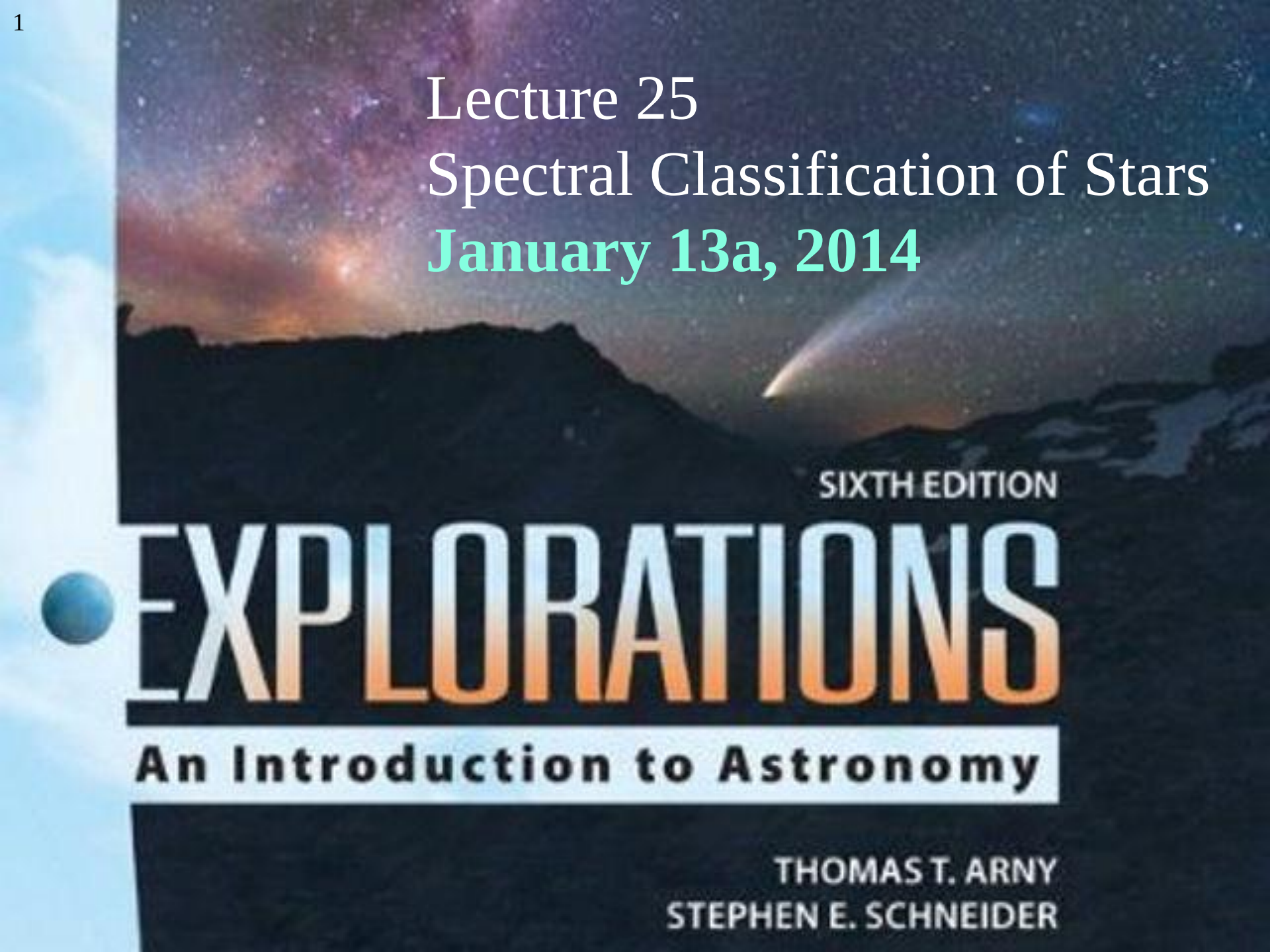
Lecture 25
Spectral Classification of Stars
January 13a, 2014

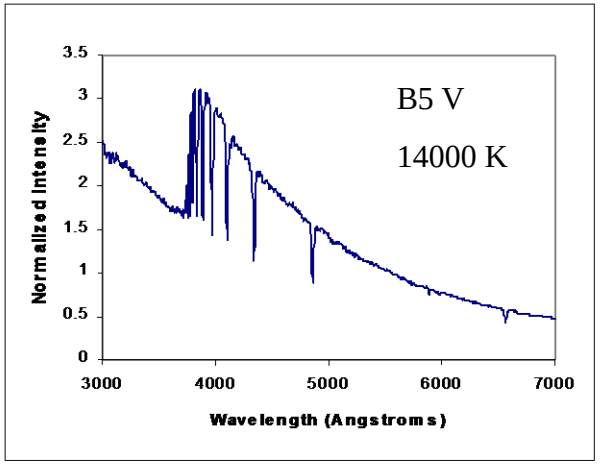


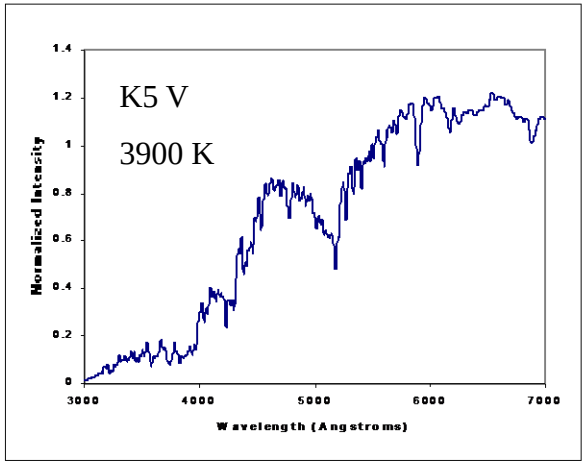
In-Class Project – Spectral Classification

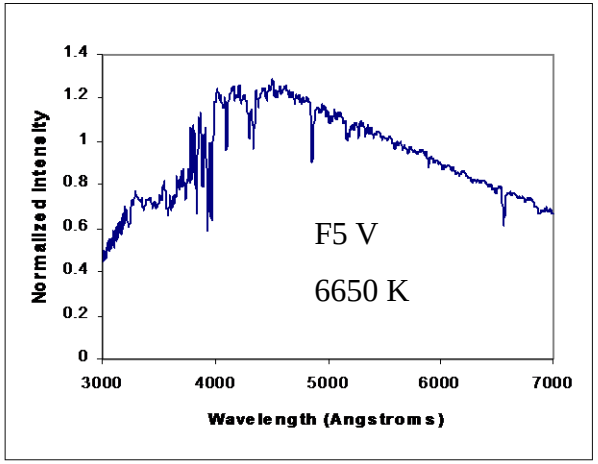
- Follow the instructions provided with the in-class activity

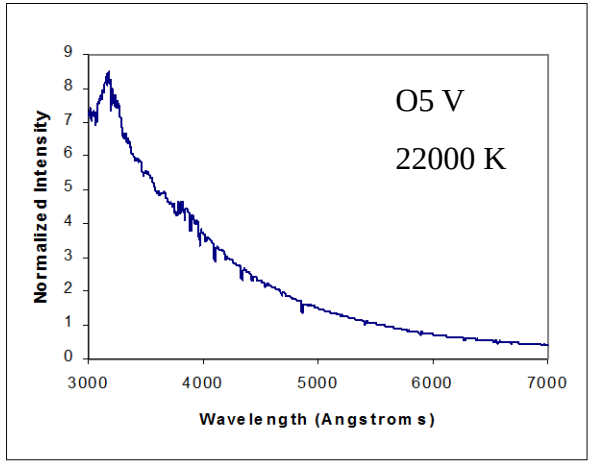
Spectra from In-class Project

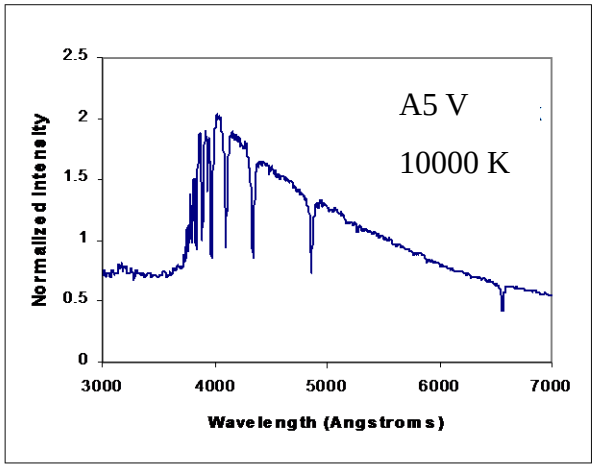
- The presence of spectral absorption lines prevents accurate estimate of temperature using Wien's Law
- Note how these actual temperatures differ from those you derived from Wien's law

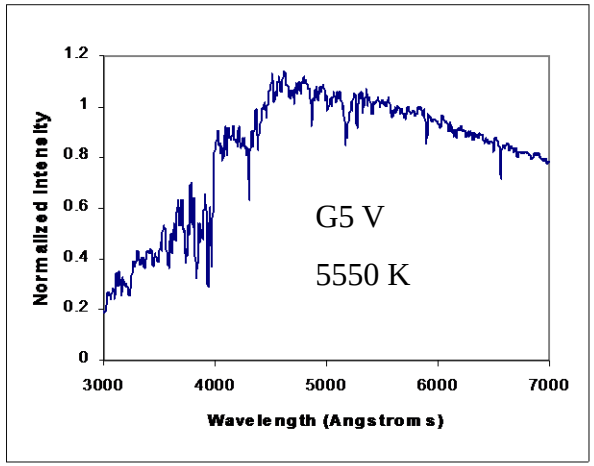












Luminosity and Brightness

- Stars were originally classified by apparent brightness.

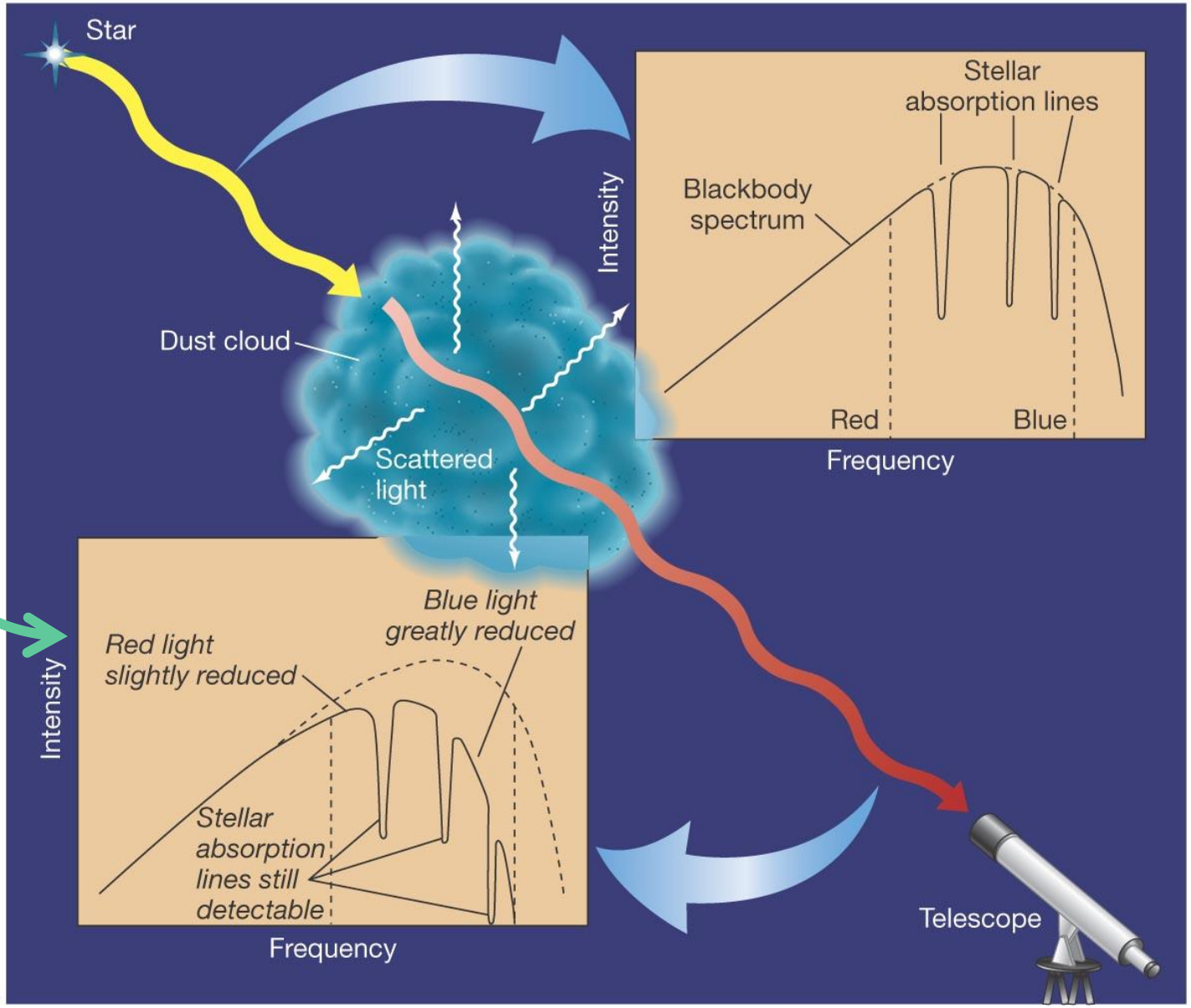
- But, apparent brightness depends on the intrinsic brightness (luminosity) and the distance!

Temperature and Color

- Stars are blackbodies
- Temperature: measured using Wien's Law
  - The hotter the star, the shorter the peak wavelength.
  - Color of star can give estimate of temperature
- But:
  - stars have absorption lines
  - may not be able to observe peak of spectrum
  - interstellar reddening can produce erroneous temperatures (pp. 446-447)

Interstellar reddening

Applying Wien's law to a reddened spectrum will yield a temperature that is too cool. Instead, use the absorption lines to determine spectral classification.



(a)

Spectral Classification

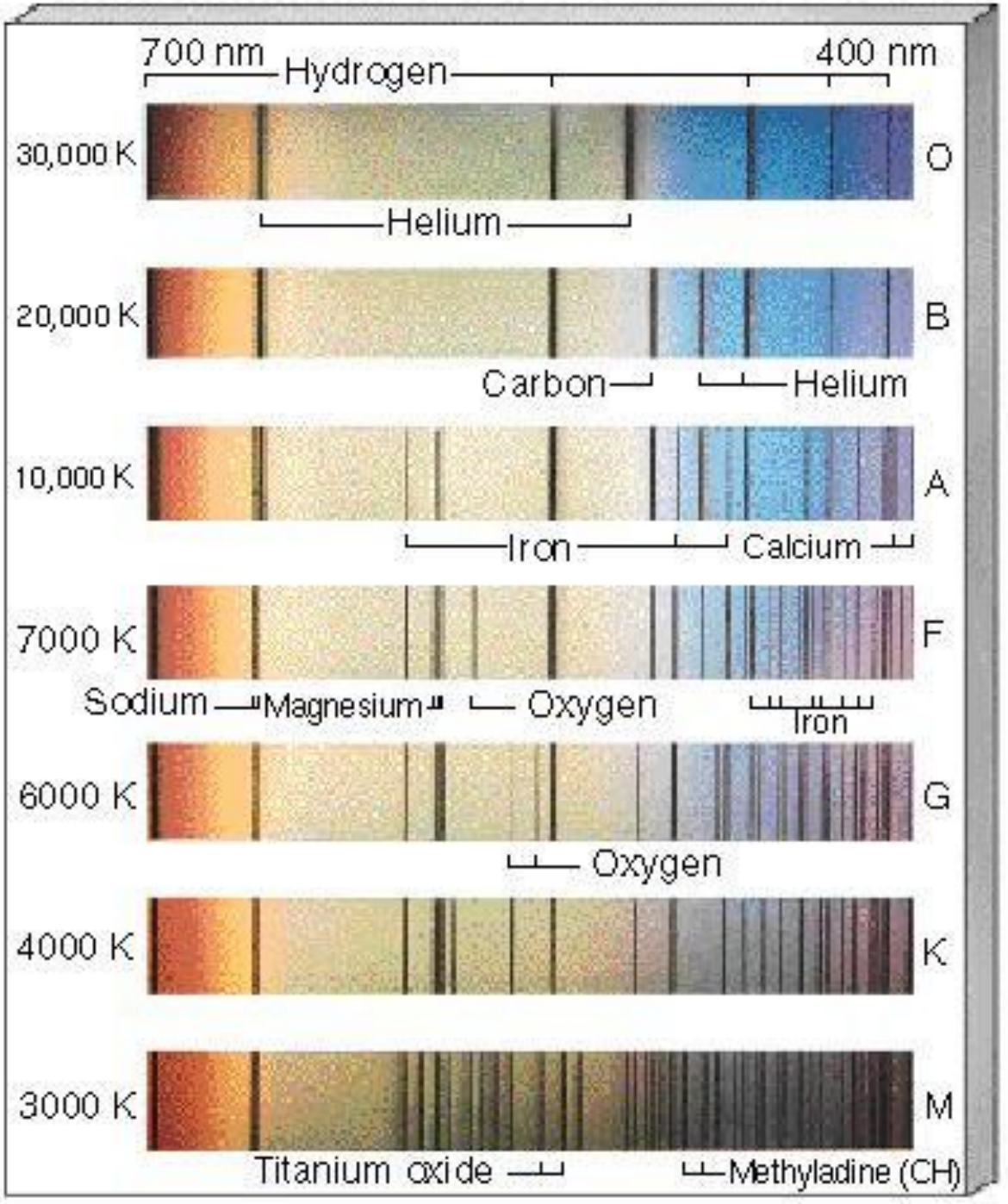
- Stellar spectroscopy used to study
  - temperature
  - compositions

Spectral Classification

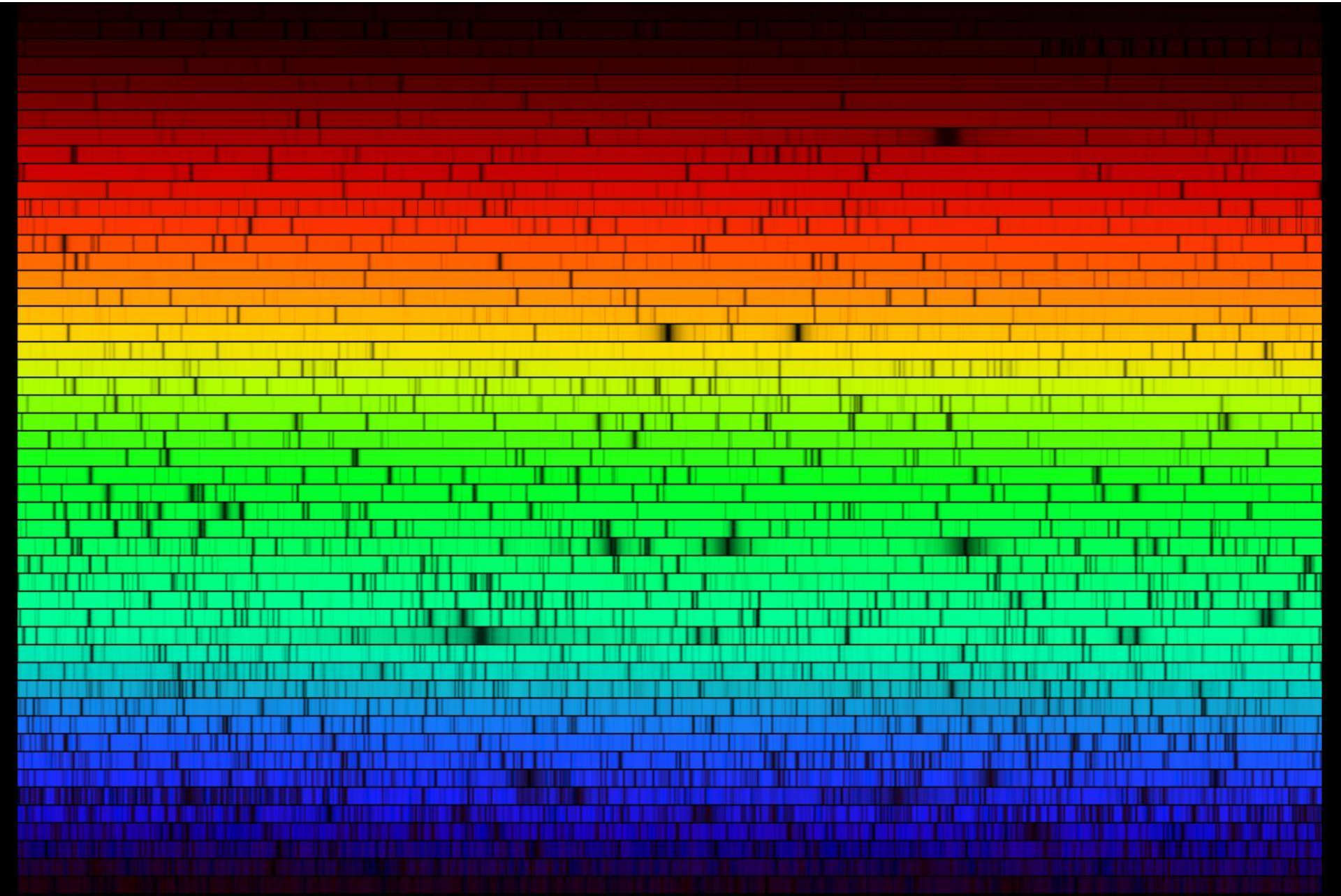
- Presence of spectral lines and their strength depend on the temperature of the star.
- As temperature increases, different jumps in energy are possible for the electrons in the different atoms.
- (Annie Jump Cannon classified thousands of stars, see p. 362)
- Stellar classifications
  - **O B A F G K M**
  - "Oh Be A Fine Girl/Guy Kiss Me"
  - Each classification is subdivided:
    - O5, … , O9, B0, B1, … , B9, A0, A1, … , A9 …

Temperature and Spectral lines

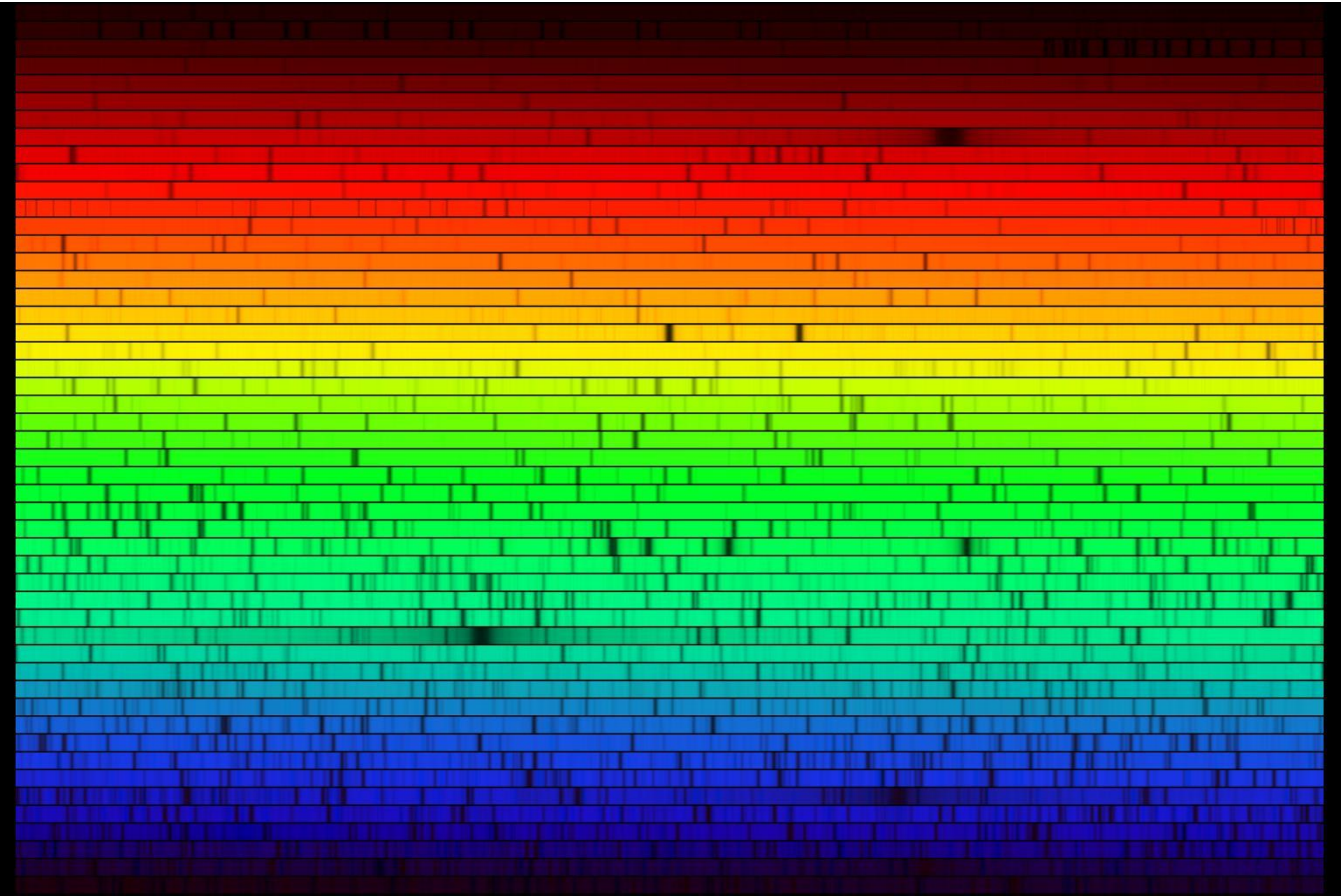
- Hottest stars have the most ion lines
- Medium (B, A, F) stars have the strongest hydrogen lines
- Cool stars show many lines from “metals” (atoms heavier than helium)



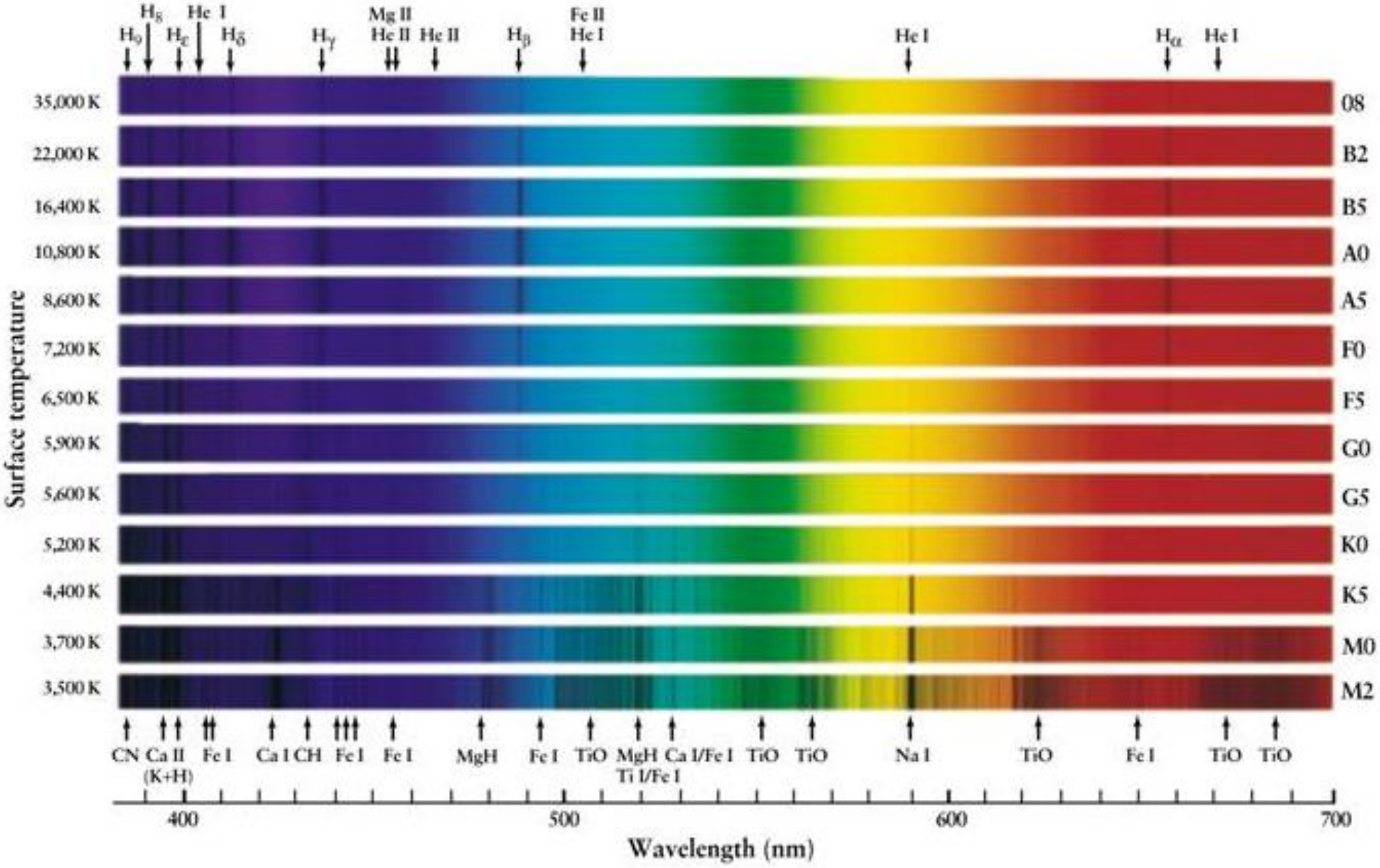
Solar Spectrum (type G2 star)



Spectrum of Procyon (type F5 star)



Stellar Classification, Temperature, and Spectral lines



Spectral Class	Temperature (K)	Absorption Lines
O	30,000	Strong He, faint H
B	20,000	Weaker He, stronger H
A	10,000	Faint He, strong H
F	7,000	Medium H, some metals
G	6,000	Fainter H, some metals
K	4,000	Strong metals, faint H
M	3,000	Very strong metals

Rank the following spectral classifications in order of increasing temperature

A. O3 < G8 < G2 < K4

B. K4 < G8 < G2 < O3

C. G2 < G8 < K4 < O3

D. G2 < O3 < K4 < G8

Rank the following spectral classifications in order of increasing temperature

A. O3 < G8 < G2 < K4

B. K4 < G8 < G2 < O3

C. G2 < G8 < K4 < O3

D. G2 < O3 < K4 < G8