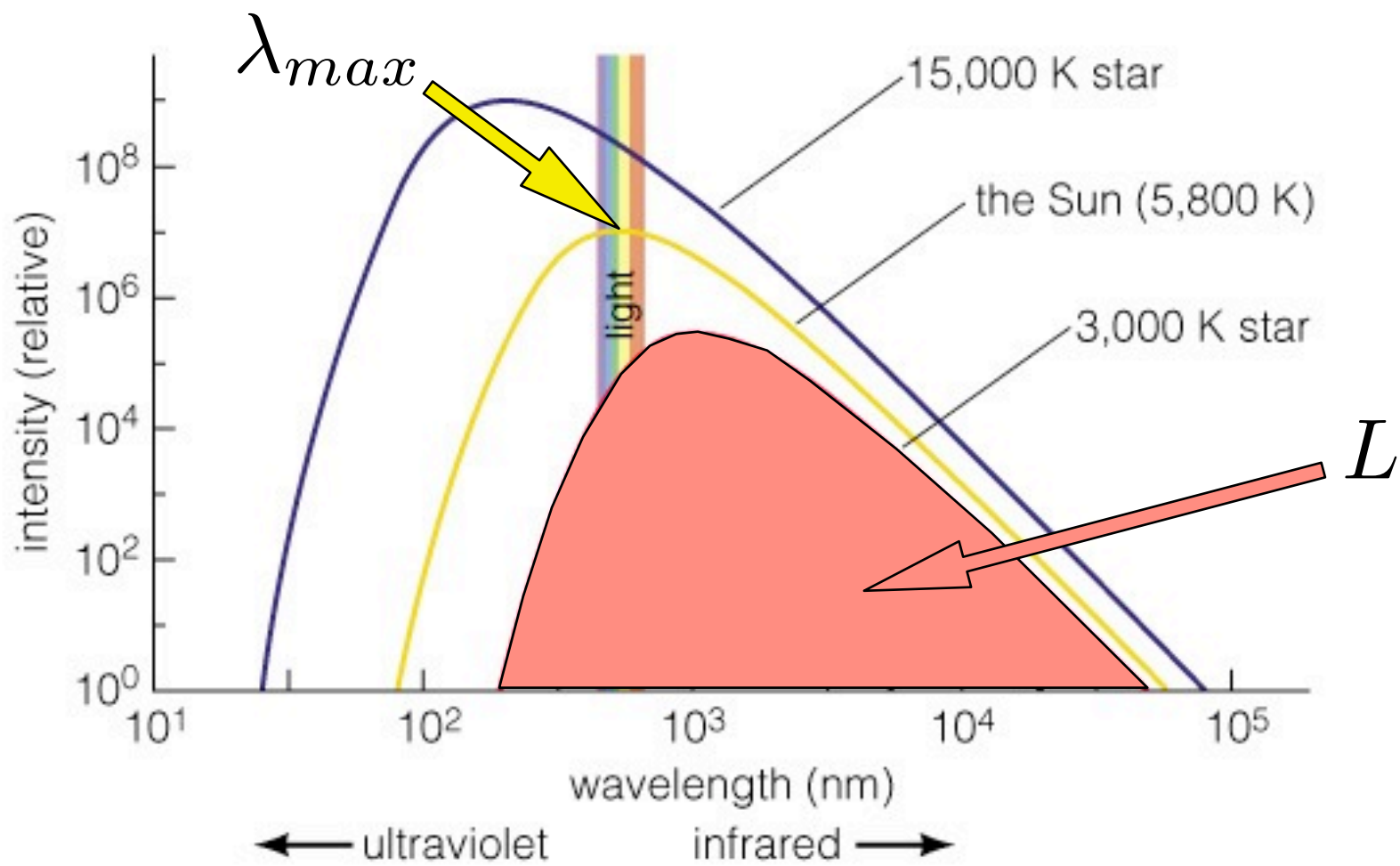
Stars

Their life & times

"Galaxies are made of stars"
- R. Schommer (1989, private communication)

Thermal Radiation

1. Wien's Law: $\lambda_{max} = \frac{2.9}{T} \frac{\text{mm}}{\text{K}}$
2. Stefan-Boltzmann: $L = 4\pi R^2 \sigma_{SB} T^4$

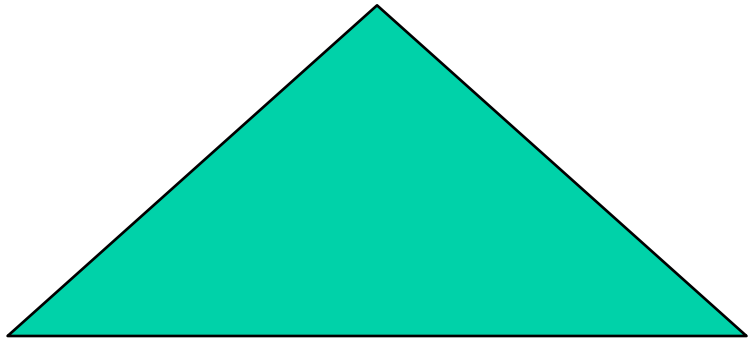


- To a crude first approximation, stars are thermal radiators (blackbodies)
- In detail, their spectra depend on
  - surface temperature
  - surface gravity (gas pressure)
  - chemical composition

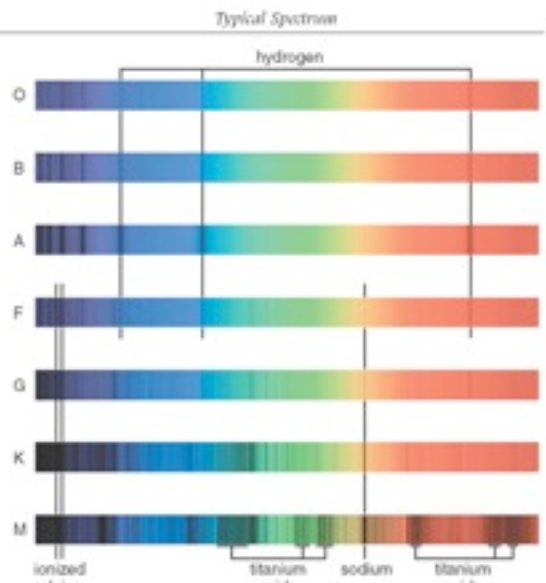
Spectral Types are a sequence in Temperature

Hot ⟷ Cool

O B A F G K M



...F8 F9 G0 G1 G2 ... G8 G9 K0 K1...



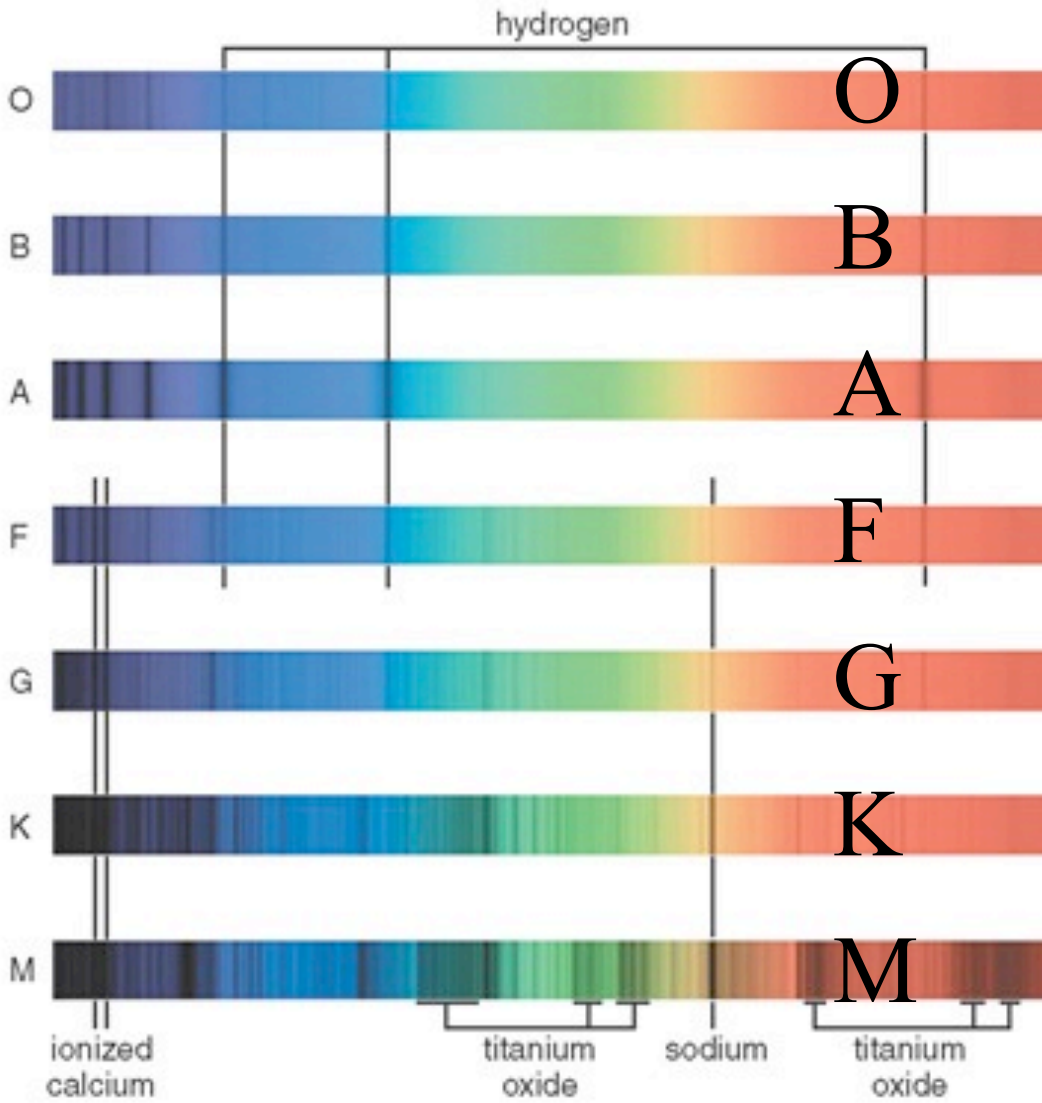
The Sun is type G2

1 *The Spectral Sequence*

OBAFGKM

Example(s)	*Temperature Range*	*Key Absorption Line Features*	*Brightest Wavelength (color)*
Stars of Orion's Belt	> 30,000 K	Lines of ionized helium, weak hydrogen lines	< 97 nm (ultraviolet)*
Rigel	30,000 K–10,000 K	Lines of neutral helium, moderate hydrogen lines	97–290 nm (ultraviolet)*
Sirius	10,000 K–7,500 K	Very strong hydrogen lines	290–390 nm (violet)*
Polaris	7,500 K–6,000 K	Moderate hydrogen lines, moderate lines of ionized calcium	390–480 nm (blue)*
Sun, Alpha Centauri A	6,000 K–5,000 K	Weak hydrogen lines, strong lines of ionized calcium	480–580 nm (yellow)
Arcturus	5,000 K–3,500 K	Lines of neutral and singly ionized metals, some molecules	580–830 nm (red)
Betelgeuse, Proxima Centauri	6 3,500 K	Molecular lines strong	7 830 nm (infrared)

Typical Spectrum



ove 6,000 K look more or less white to the human eye because they emit plenty of radiation at all visible wavelengths.