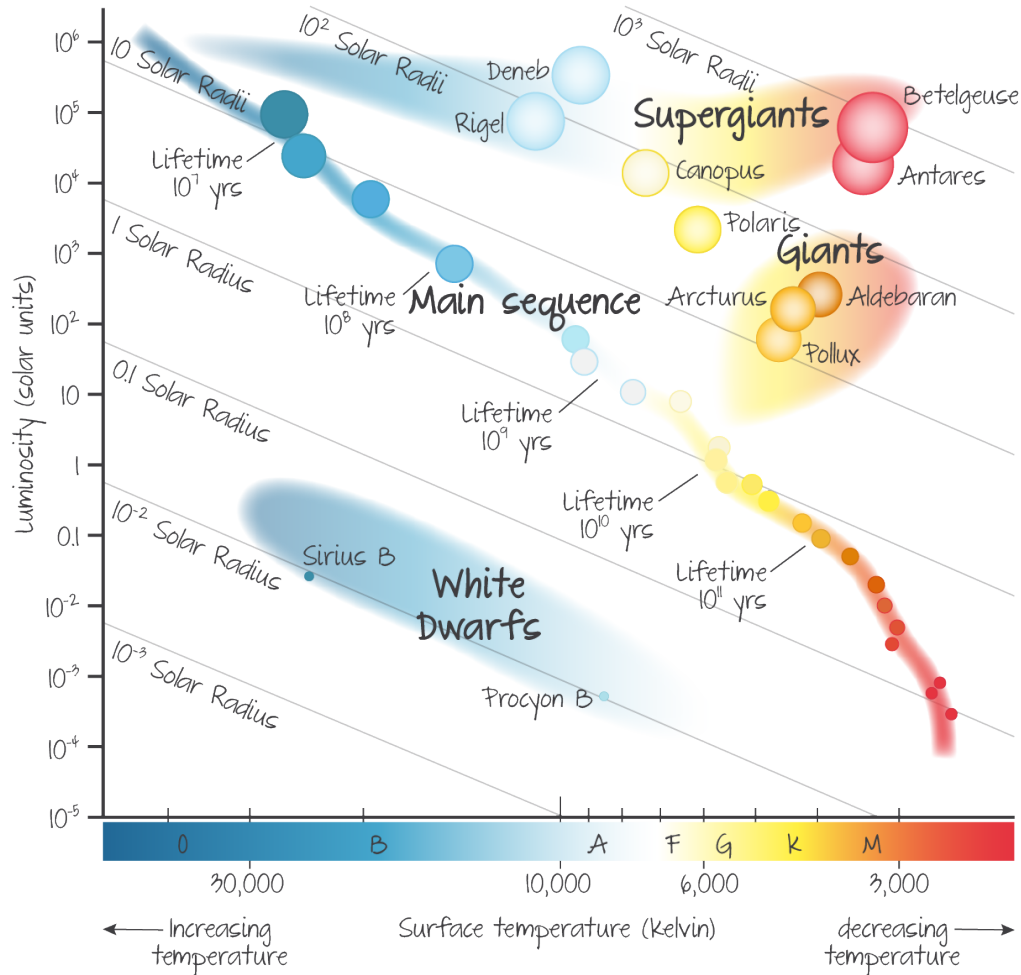


# H-R Diagrams and Stellar Spectra

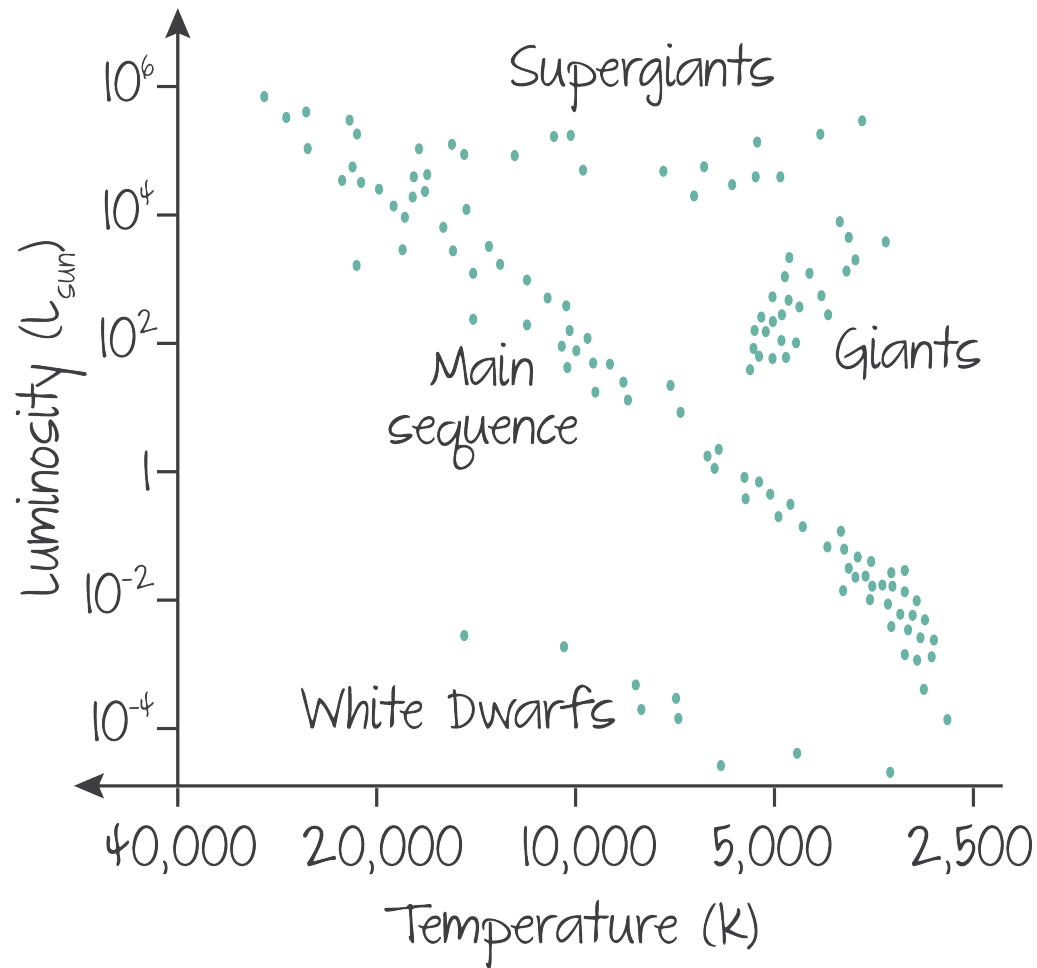
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IB PHYSICS | ASTROPHYSICS

# H-R Diagrams



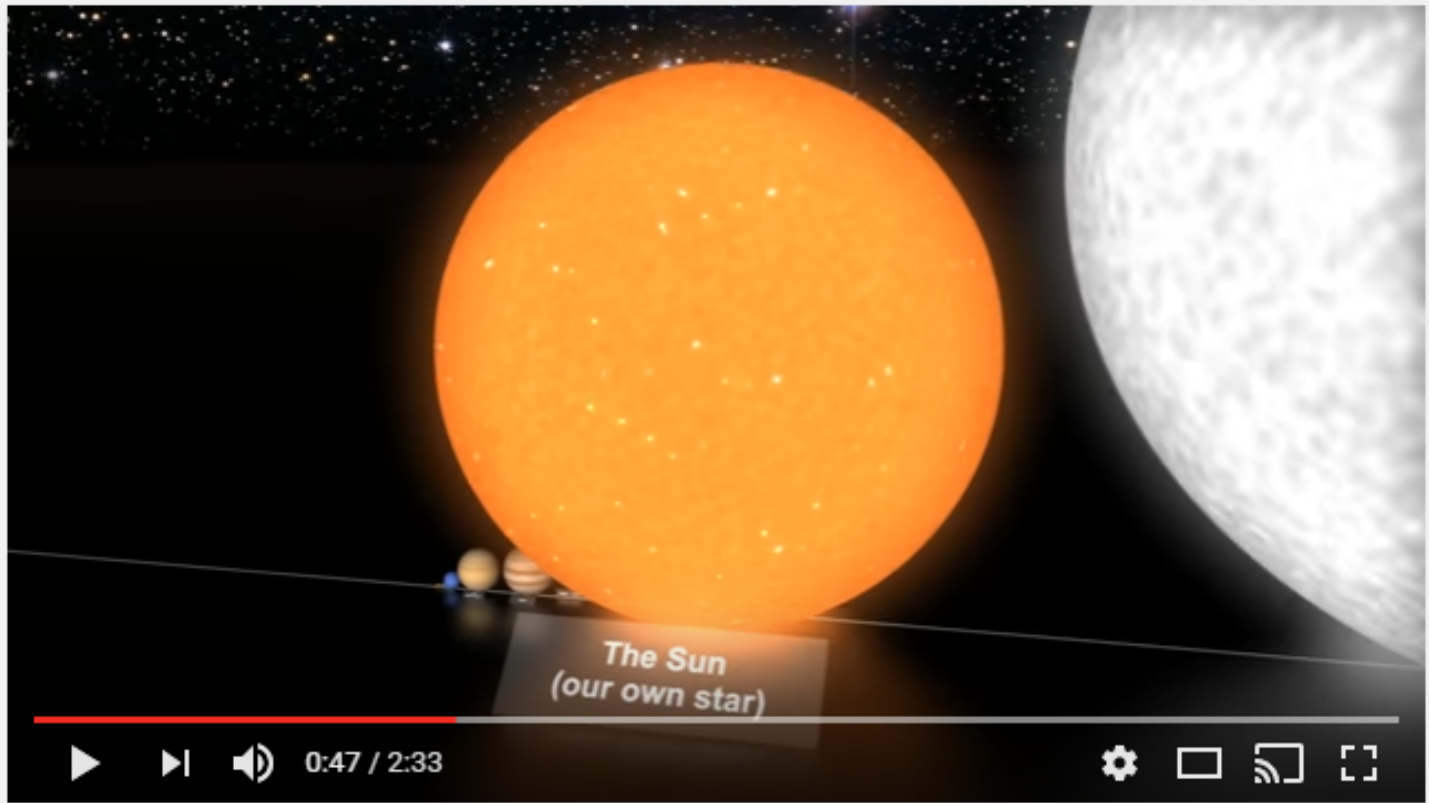
# H-R Diagrams



# H-R Diagrams



# Sizes of Stars



Star Size Comparison HD

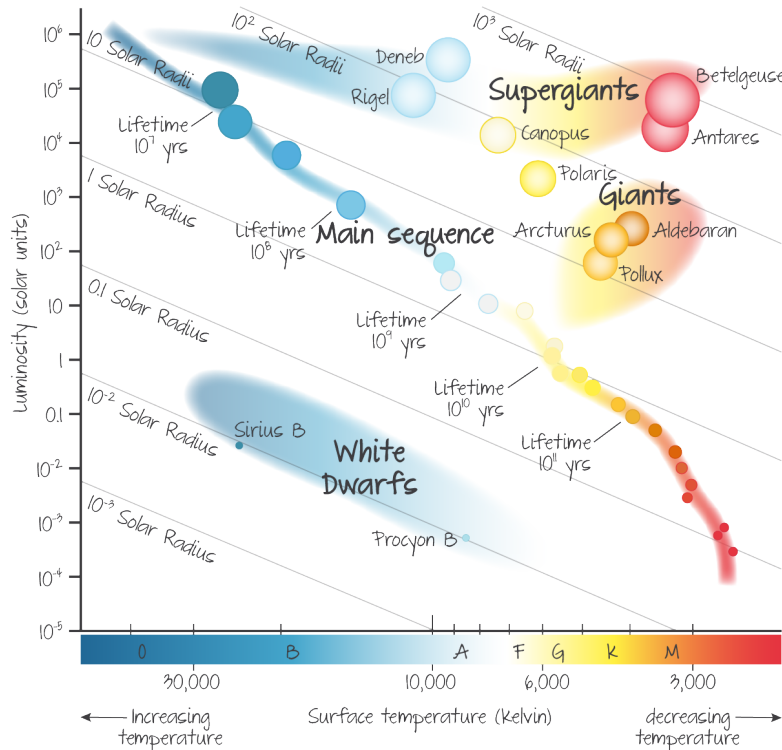
# IB Physics Data Booklet

Sub-topic D.1 – Stellar quantities	Sub-topic D.2 – Stellar characteristics and stellar evolution
$d \text{ (parsec)} = \frac{1}{p \text{ (arc-second)}}$ $L = \sigma AT^4$ $b = \frac{L}{4\pi d^2}$	$\lambda_{\text{max}} T = 2.9 \times 10^{-3} \text{ m K}$ $L \propto M^{3.5}$
Sub-topic D.3 – Cosmology	Sub-topic D.5 – Further cosmology (HL only)
$z = \frac{\Delta\lambda}{\lambda_0} \approx \frac{v}{c}$ $z = \frac{R}{R_0} - 1$ $v = H_0 d$ $T \approx \frac{1}{H_0}$	$v = \sqrt{\frac{4\pi G\rho}{3}} r$ $\rho_c = \frac{3H^2}{8\pi G}$

# H-R Diagram for Calculating Distance

The maximum wavelength of a distant star is measured to be 600 nm, suggesting that it has a temperature of  $\sim 4800$  K. If this star has a brightness of  $1.0 \times 10^{-12} \text{ W m}^{-2}$ , what is its distance from Earth?

$$L_{\text{sun}} = 3.84 \times 10^{24} \text{ W}$$

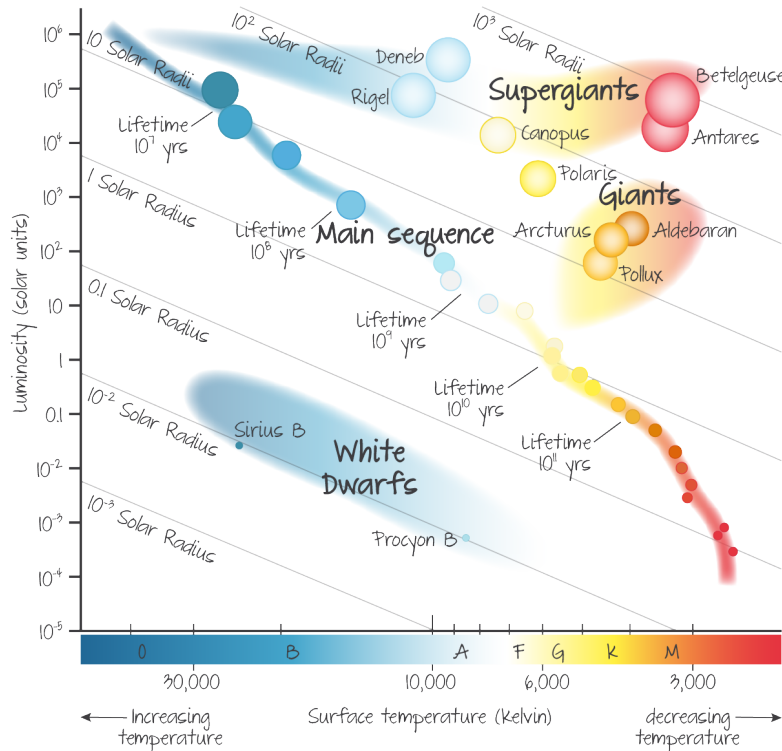




# Try This

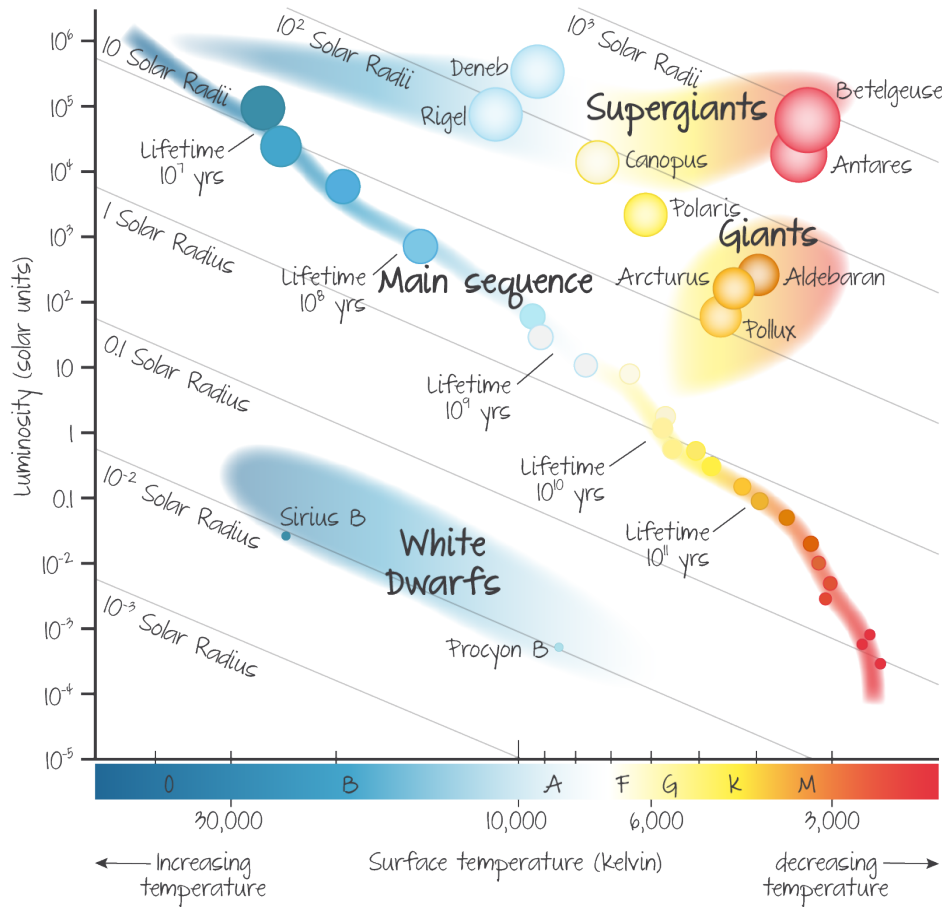
The maximum wavelength of a distant star is measured to be 400 nm. If this star has a brightness of  $0.5 \times 10^{-12} \text{ W m}^{-2}$ , what is its distance from Earth?

$$L_{\text{sun}} = 3.84 \times 10^{24} \text{ W}$$



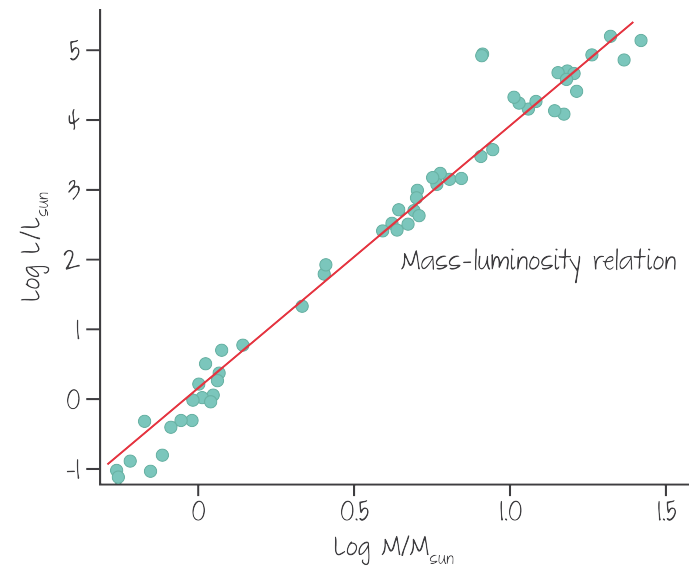


# Mass-Luminosity Relationship



For stars on the main sequence, there is a relationship between luminosity and mass

$$L \propto M^{3.5}$$

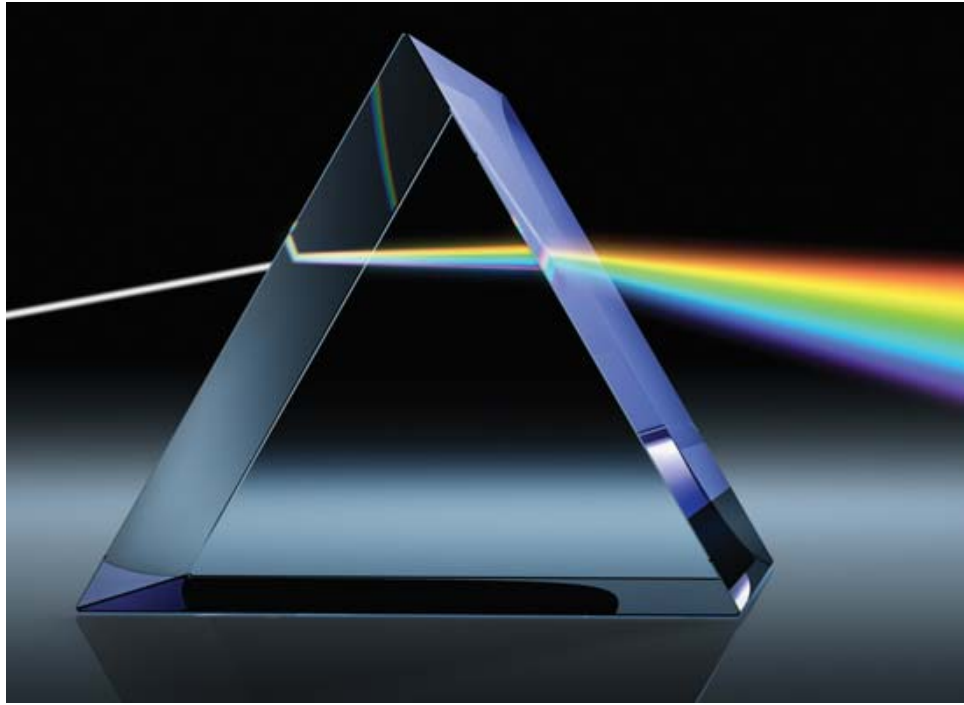


# IB Physics Data Booklet

Sub-topic D.1 – Stellar quantities	Sub-topic D.2 – Stellar characteristics and stellar evolution
$d \text{ (parsec)} = \frac{1}{p \text{ (arc-second)}}$ $L = \sigma AT^4$ $b = \frac{L}{4\pi d^2}$	$\lambda_{\max} T = 2.9 \times 10^{-3} \text{ m K}$ $L \propto M^{3.5}$
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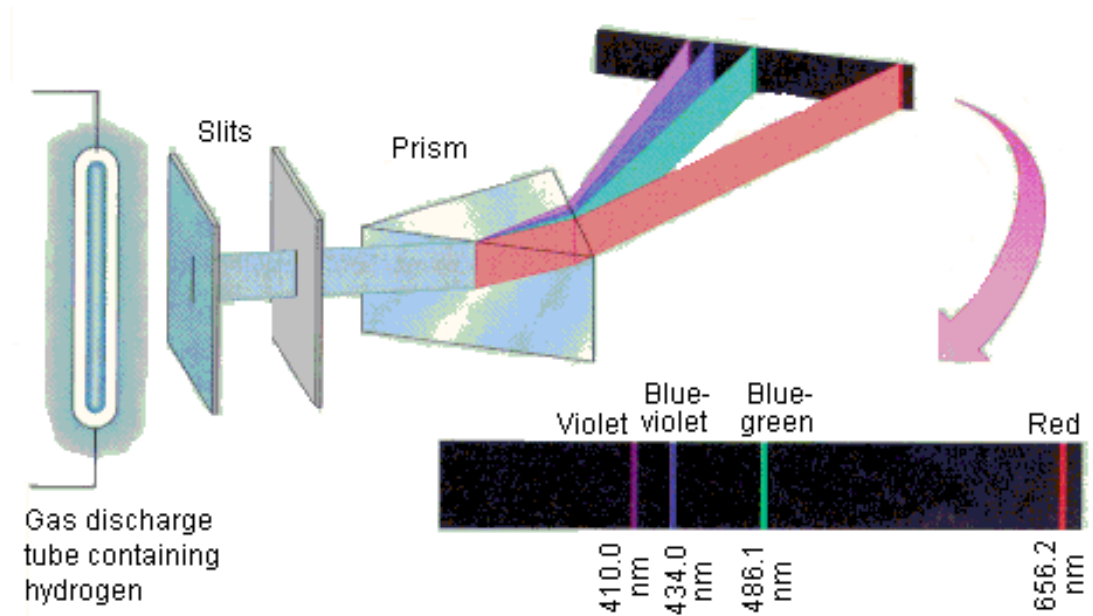
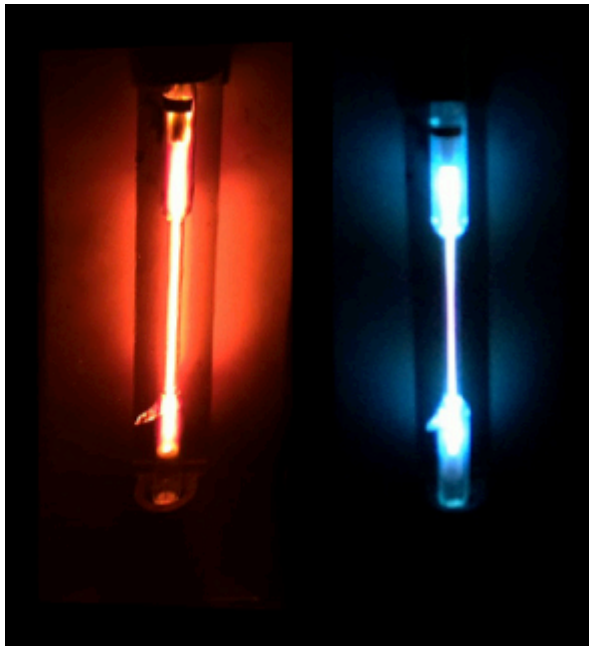
# Continuous Spectrum

When white light from the sun passes through a prism, the light is dispersed into its component colors in a continuous spectrum



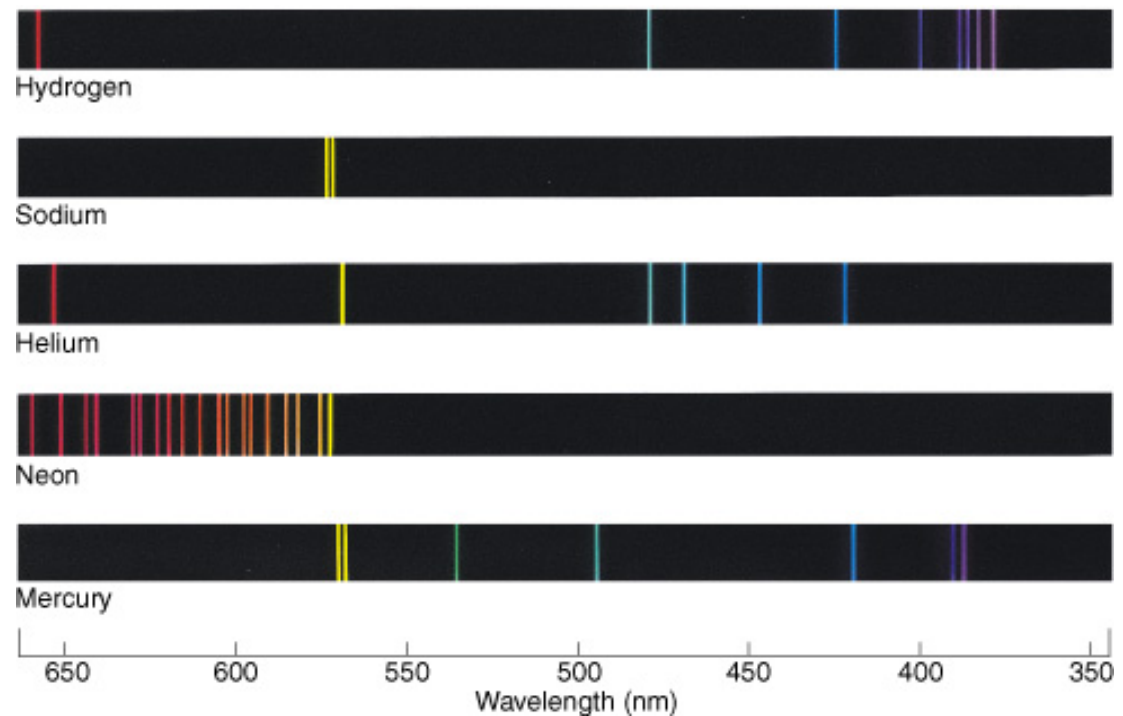
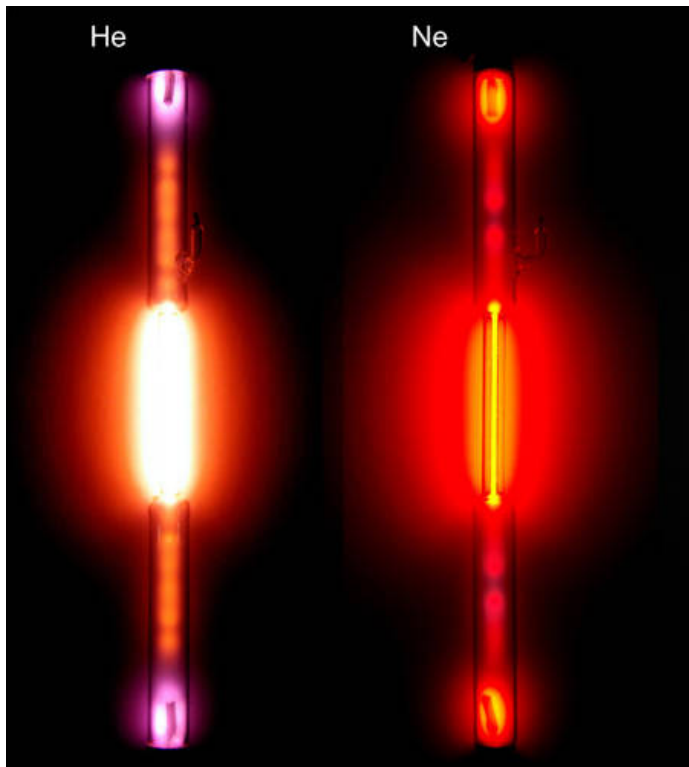
# Emission Spectrum

If an electric current is passed through an element in the form of a low-pressure gas, it will produce its own unique emission spectrum



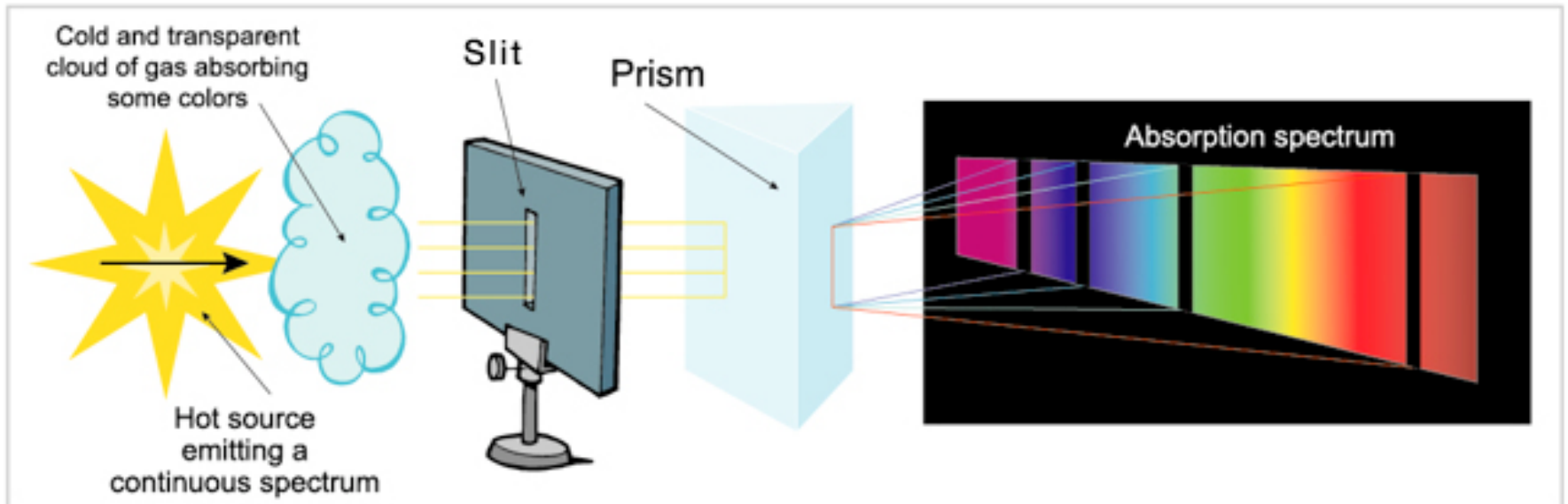
# Emission Spectrum

These spectra can be used to identify elements like a fingerprint

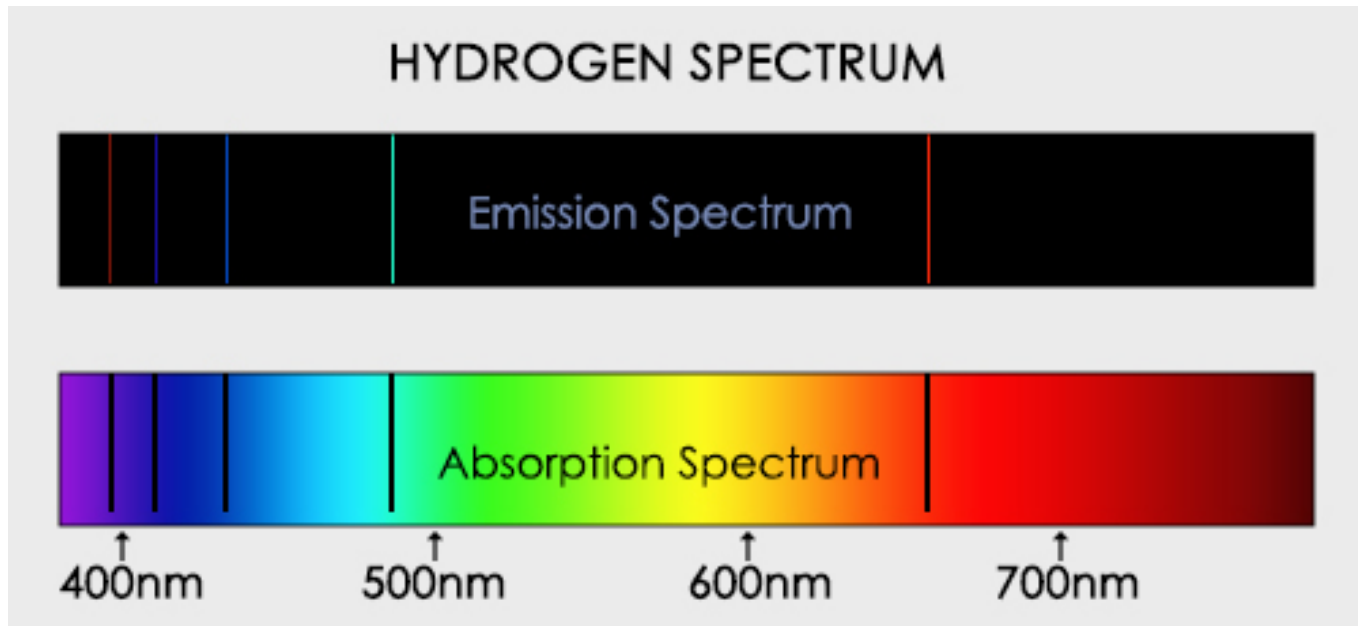


# Absorption Spectrum

If white light is passed through a sample of gaseous atoms or molecules, it is found that the light of certain wavelengths is missing



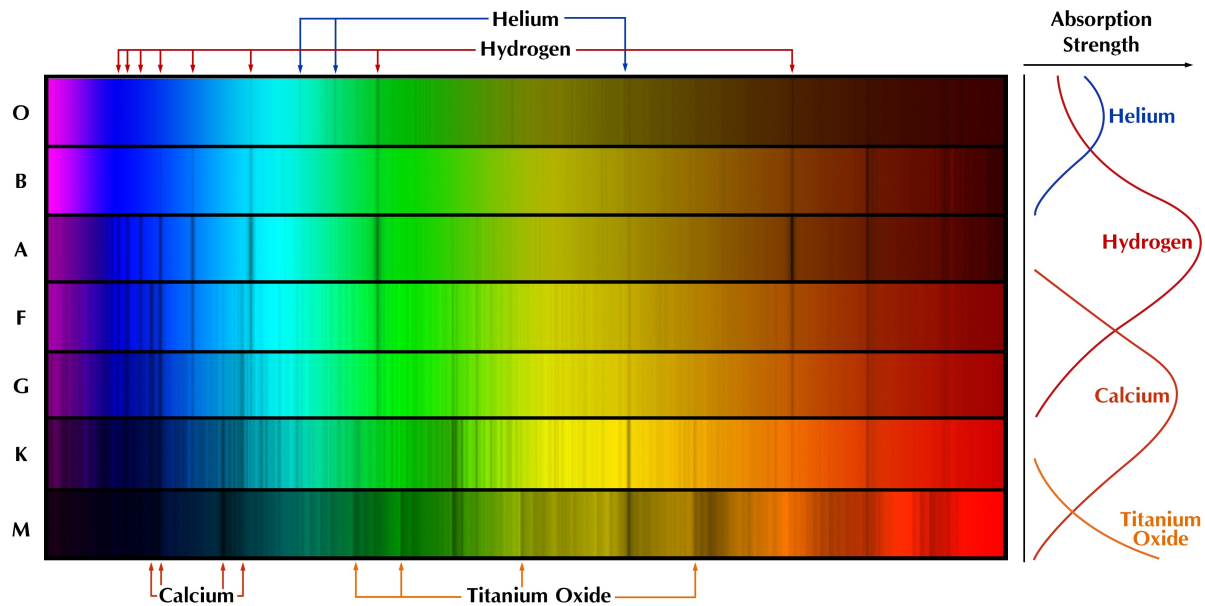
# Absorption Spectrum





# Stellar Spectra

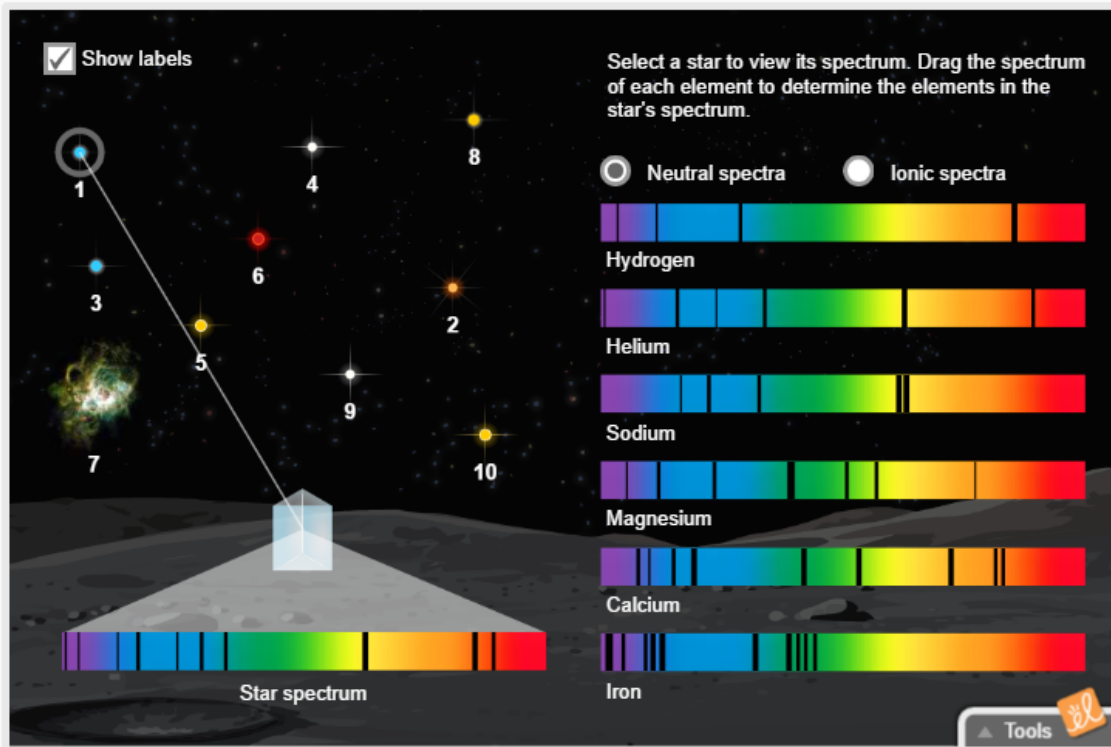
Studying the Spectra of Stars can help determine what the stars are made of



Are these Emission Spectra or Absorption Spectra?

# Stellar Spectra | Try it out

Compare the spectra of the stars with the known absorption spectra of different elements to determine the composition of the stars



N → Neutral Spectra    I → Ionic Spectra

1	2	3	4	5	6	7	8	9	10

↑  
Redshifted