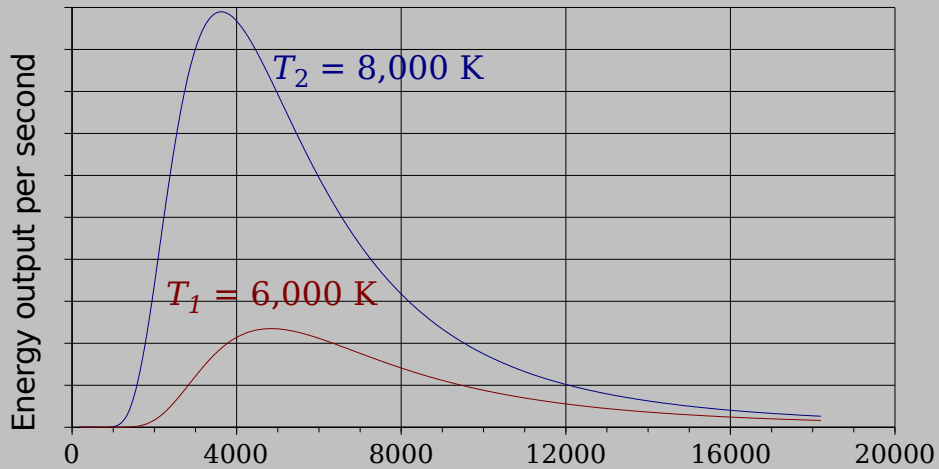


## Blackbody (Thermal) Radiation



Higher Temperature: More Energy/sec (for objects of same size)

Higher T: Peak at higher frequency = lower wavelength = bluer

*Blackbody (Thermal) Radiation* : the spectrum of light emitted by a body that radiates just because it is warm.

$$L = A \sigma T^4$$

$L$  Luminosity (in Watts) – energy output per second

$A$  Surface area (in  $\text{m}^2$ )

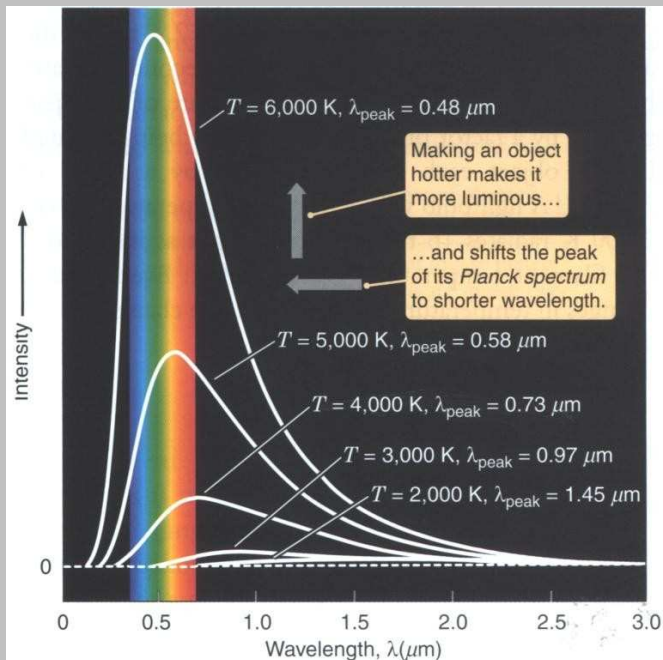
$T$  Temperature (in Kelvin)

$\sigma$  Steffan-Boltzmann constant =  $5.67 \times 10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$

For a sphere (e.g. a star):

$$L = (4\pi R^2) \sigma T^4$$

$R$  Radius of the star (in m)



You observe two stars which, to you, appear to be the same brightness. Star A is bluer in color than Star B. Which star is more *luminous* (i.e. which star is radiating more energy per second)?

- A Star A is more luminous
- B Star B is more luminous
- C They have the same luminosity
- D Not enough information**

Which puts out more energy: the Sun (temperature  $5,500 \text{ }^\circ\text{C}$ ) or an arc-welder (temperature  $20,000 \text{ }^\circ\text{C}$ )?

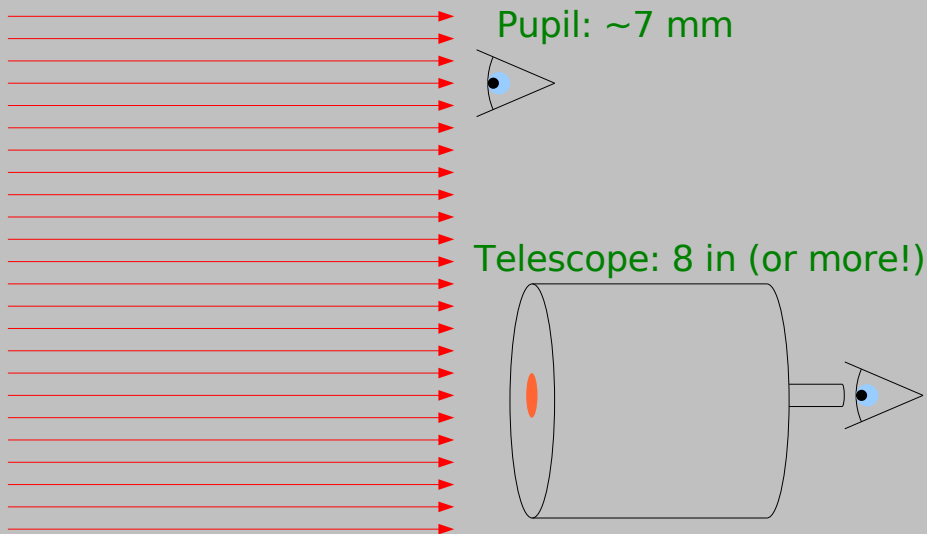
Two stars emit the same total energy per second. One star is bluer than the other. What can you say about them?

- A The bluer star is smaller than the redder star.
- B The bluer star is bigger than the redder star.
- C The bluer star is at a lower temperature than the redder star.
- D The two stars are at the same temperature

bluer = hotter (higher temperature)  
hotter = more energy *for objects of the same size*

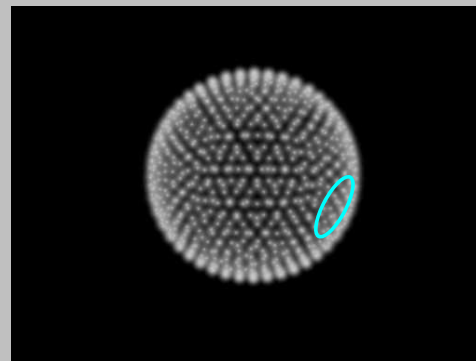
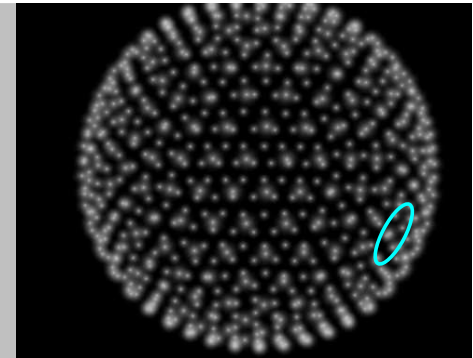


Aperture : the most important telescope parameter.



The amount of light seen by a given telescope (which is what we call *Brightness*) goes down as the distance from the source goes up:

$$B \propto \frac{1}{d^2}$$



An object that is twice as far away will appear  $\frac{1}{4}$  as bright.