

Black Body Radiation

Wolter:
Spectral shifts
brighter left

N/

me

Black Body Radiation is temperature based production of light. The thermal energy makes the atoms and electrons vibrate causing light from the waves they create in electromagnetic fields.

Use the graphs found in **Black Body Radiation Data** on Schoology to draw some conclusions about some stars based on their light. There is an example at the top to help you read the graphs, and you'll need a calculator to do the math.

1. Use the Star Black Body Spectrums from the data document to find the wavelength of the peak (or λ_{PEAK})

Star Name	Peak Wavelength (nm)	Surface Temp (K)	Spectral Type
7 Alnitak	80 nm	36,225 K	O7
6 Lambda Taurus	115 nm	25,200 K	B4
1 Betelgeuse	950 nm	3085.58 K	M2
2 Aldebaran	640 nm	4528.12 K	K4
3 Gamma Taurus	580 nm	5269.09 K	G9
5 Theta Taurus	290 nm	9993.1 K	A1
4 Arneb	385 nm	7527.3 K	A9

2. From the Peak wavelength we can calculate what the temperature of the star is by using the following equation:

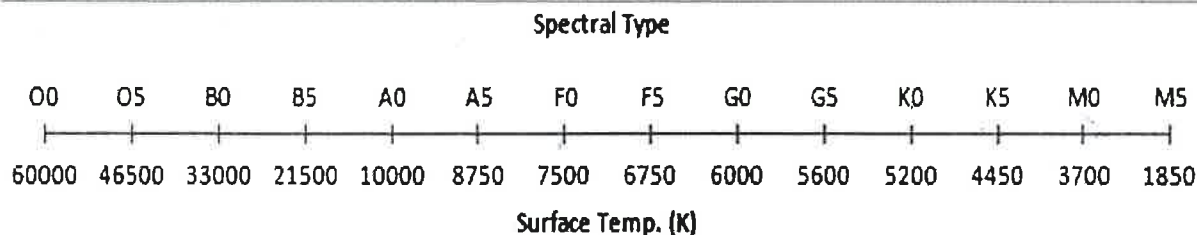
$$(\lambda_{\text{PEAK}})(\text{Temperature}) = 2,898,000 \text{ nm K}$$

where λ_{PEAK} is in nm, and Temp is in Kelvin. **Rearrange the equation so that Temperature is by itself.**

$$T = \frac{2898000}{\lambda_{\text{peak}}}$$

3. Calculate the Surface Temperature of each star in Kelvin using the equation, and record the temperatures in the table above.

4. Use the graph below to estimate the spectral type of each star based on its temperature (K). Each letter counts up from zero to 9, going from left to right.



5. Rank the stars by temperature from hot to cold.

1. Betelgeuse
2. Aldebaran
3. Gamma Taurus
4. Arneb
5. Theta Taurus
6. Lambda Taurus
7. Alnitak

6. Given what you found today which star should be the brightest (as in most light produced) and which should be the least bright.

Brightest = Alnitak
Dimmest = Betelgeuse

7. If a star is moving quickly away from Earth, should it be red-shifted or blue-shifted?

Red shifted

8. Given what you decide for #7, how should that affect the estimated temperature of the star? (You would use a similar process as in #1-3 to estimate the temperature)

lower temp is expected, lower freq. wavelengths, less energy

9. In the space below, draw a rough sketch of the black body spectra of Betelgeuse, Aldebaran, and Arneb all on one set of axes. (Think about peak wavelength, height, shape, and size)

