Stellar Structure Assignment One: The Planck Curve
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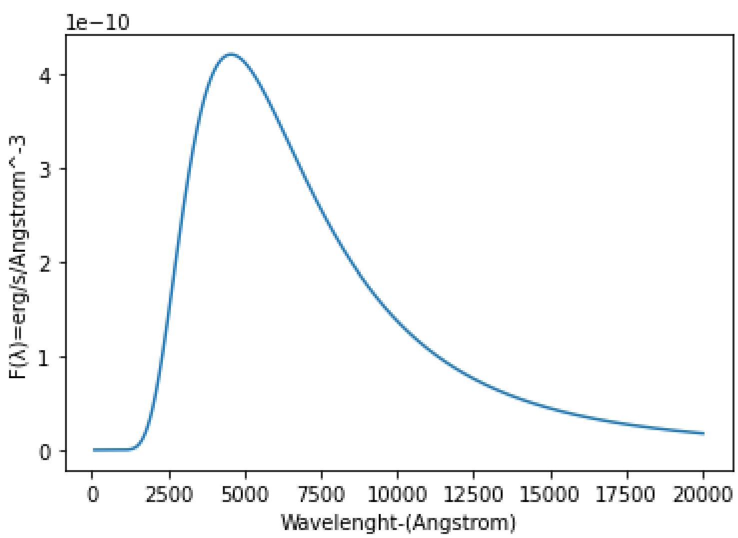
My star: 6346 Kelvin

Using Wein's Law

$\lambda_{max} T = 0.002897755\, mK$ [1]

$\lambda_{max} = 4.569807753.(10^{-7})$ ≈ 4570 Angstrom

We'll compare this to the peak result of Planck's Function plot.



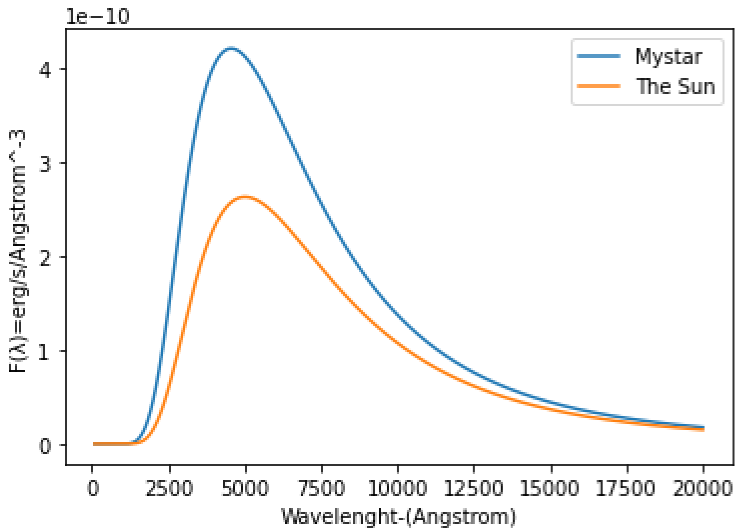
From the graph we can estimate the peak wavelength of this stars emission to be 4900 ∓ 50 Angstrom.
This lines up well with Wien's estimate of 4570 Angstrom.
Obtained using the following code:

```
import numpy as np
import matplotlib.pyplot as plt

h= 6.62606957e-27
c= 2.99792458e18
k= 1.3806488e-16
T=6346

w = np.linspace(100, 20000, 4000)

A=2*h*(c**2)
W=((w)**5)
b=h*c/(w)/k/T
B=(np.exp(b)-1)
PF=(A/W/B)

plt.xlabel('Wavelenght-(Angstrom)')
plt.ylabel('F(λ)=erg/s/Angstrom^-3')
plt.plot(w,PF)
```

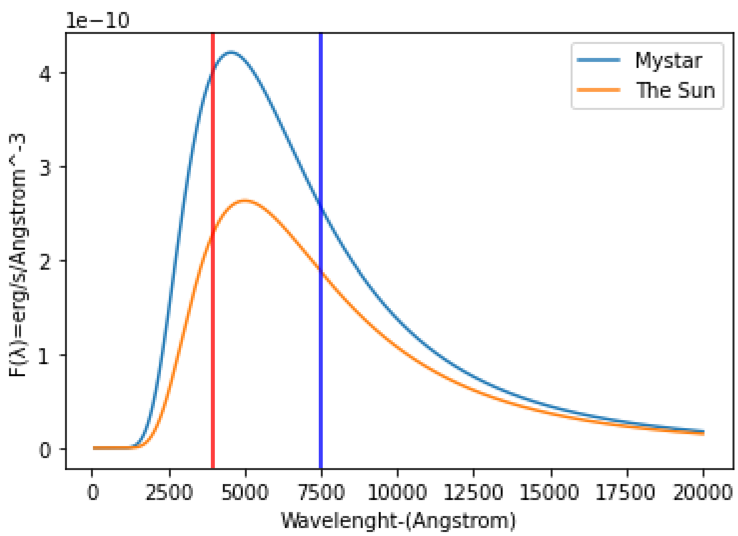
The constants h & k are planck's constant and Boltzmann constant respectively, both are converted to erg units.
h=6.626196x(10^-27) erg s
k=1.380622x(10^-16) erg k^-1

The speed of light (c) was converted to angstrom per second
c=2.997924x(10^18) A/s

Comparing the spectra of my star (6346 K) and the Sun (5778 K)



We see the sun's main emission is quite similar but more around 5000 angstrom, but the sun has a lower energy per unit time per unit area per wavelength.
These wavelengths are all within the visible spectra 4000-7500 angstrom
My Star would appear brighter and redder.



Using the following code:

```python
import numpy as np
import matplotlib.pyplot as plt

h= 6.62606957e-27 #erg s
c= 2.99792458e18 #angstrom/s
k= 1.3806488e-16 #erg/K
T1,T2=6346,5776 #K

w = np.linspace(100, 20000, 4000) #Creates our range of wavelenghts

#in the following lines I have split Planck's Function into parts
#A (the Numerator) ,W (referring to wavelenght), b (to simplify the exponent on e)
#finally B (the denominator)
A=2*h*(c**2)
W=(w**5)
b1=h*c/(w*k*T1) #Because in this graph we have two spectra I have -
b2=h*c/(w*k*T2) #split the parts of the function into parts with -
B1=(np.exp(b1)-1)#the different temperatures T1&T2
B2=(np.exp(b2)-1)
PF1=(A/W/B1) #A sperate function for each star
PF2=(A/W/B2)

plt.xlabel('Wavelenght-(Angstrom)') #our labels
plt.ylabel('F(λ)=erg/s/Angstrom^-3')
plt.plot(w,PF1,label="Mystar")
plt.plot(w,PF2,label="The Sun")
plt.legend(loc="upper right")
plt.show()
```

6) Using the Stefan-Boltzmann Equation

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

Note T is T effective

This can be rearranged to find R

$L/4\pi\sigma T^4 = R^2$ [1]

$T_{eff} = \lambda^{peak} 0.002897755$

T eff=(0.0029)/4.57(10^-7) ….wavelength in meters

T eff=6345 k

From main sequence diagram: we can say the luminosity is around 1

From this we can solve equation [1] to find the radius.

$1/4\pi(1.38x10^{-23})(6345)^4 = 3557824 = R^2$

R=1886 km