

IntroCosmo24

Homework problems #1

Due October 24, 2024

1. Using Mathematica derive from the Planck's formula the Stefan-Boltzmann law and the Wien's law.

2. Use the Wien's law to calculate the frequency and energy of photons that are most efficiently emitted from the surface of the Sun. The effective temperature of the Sun's photosphere is 5800K. Assuming that all photons emitted by the Sun have this frequency calculate how many photons the Sun emits per second. The luminosity of the Sun is $L_{\odot} = 3.82 \cdot 10^{26} \text{W}$.

3. Using the Stefan-Boltzmann law estimate how much energy/sec you are radiating away. Assume that your temperature is normal $36.6\text{C} \approx 310\text{K}$ and your surface area can be approximated by a cylinder of height (your height) and radius = your chest circumference/ 2π . Comments are welcome.

4. Ionization energy of an hydrogen atom is 13.6 eV. What is the wavelength of a photon that could ionize an hydrogen atom from its ground state? Comments are welcome.