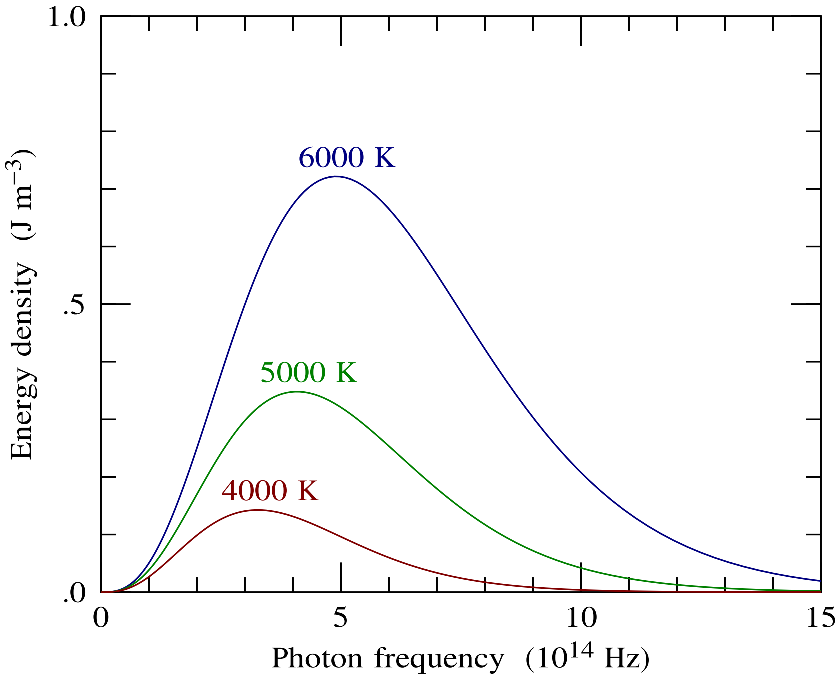
ASTR 1200-001 Gen. Astronomy: Stars & Gals Spring 2018. Project 1.
Fri Feb 2.

Scribe's name:

Names of other members of the group:

Spectra

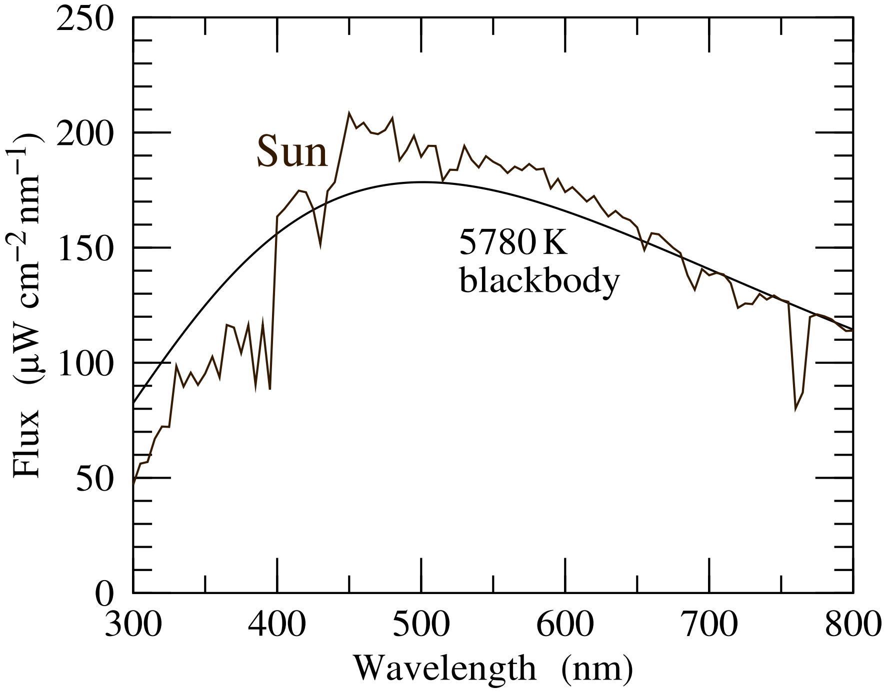


1. The above graph shows blackbody spectra at various temperatures. On the graph, mark the ranges of visible, infrared, and ultraviolet light (the human eye can see light over wavelengths 750–380 nm, corresponding to frequencies 4–8 $\times 10^{14}$ Hz). Explain, with reference to the plots of blackbody spectra, why there is a relation between the temperature of a hot dense object (like a glowing light bulb, or the Sun) and its color. [Recall that absolute temperature is a measure of the mean energy of random motions of particles.]

2. Does the human body emit a near blackbody spectrum over some parts of the electromagnetic spectrum? If so, at about what temperature? Are there other parts of the spectrum where the light given off by a human body is not at all like a blackbody? Explain.

3. A black sheet of paper is black because it absorbs all the visible light that falls on it. What happens to the energy in the light? Does the black paper radiate at all?

4. What does it mean for a material to be **transparent**? To be **opaque**? Can a material be transparent at some wavelengths, and opaque at others? Give an example.



5. The Sun's visible spectrum shown above (from Kurucz, Furenlid, Brault, & Testerman 1984 "Solar Flux Atlas from 296 to 1300 nm") can be characterized as a near blackbody (shown as a smooth line) with many superposed absorption lines. The most prominent absorption lines are the lines labeled A–K by Fraunhofer (1814):

Line	Absorber	Wavelength (nm)
A	Earth atmospheric O_2	760
B	Earth atmospheric O_2	687
C	Hα	656
D	Na	589
E	Fe	527
F	Hβ	486
G	Fe & Ca	431
H	Ca	397
K	Ca	393

Mark on the plot the positions of the H (hydrogen) absorption lines. Which of the H lines is the pink one, which the cyan (blue-green) one? Mark on the plot the infrared and ultraviolet parts of the spectrum (the human eye can see wavelengths 380–750 nm).

6. At sunrise and sunset, the Sun looks red. This is because small particles in the atmosphere preferentially scatter:
   A. red light more than blue light, or
   B. blue light more than red light?
   Where does the scattered light go?

7. What are the physical causes underlying the fact that images of the Sun look more interesting in ultraviolet and x-rays? [To answer this question, you should have read pages 479–481 of Cosmic Perspective.]