Quantum Physics, Preparation for Friday, Jan. 26

Study Q4 from *Six Ideas*

I'm hoping Q4 seems straightforward, even though it was revolutionary. The bottom line is that light arrives in tiny quanta called photons, even though it behaves like a wave in many other respects.

If Q4 isn't enough reading for your to digest for Friday, look ahead to Sections Q5.1 and Q5.2.

Presentations

Miles: Short presentation on the rare condition of tetrachromacy

Rebecca and Hexi (who will coordinate and divide the historical material): Experimental apparatus that discovered the photoelectric effect, a significant paper (possibly in translation) from circa 1900, and the hypothesis of quanta and h, Planck's constant

Presentation from Ren and Miles: a problem from Q4 of their choice

For Problem Set 4

Some Problems with Intensity

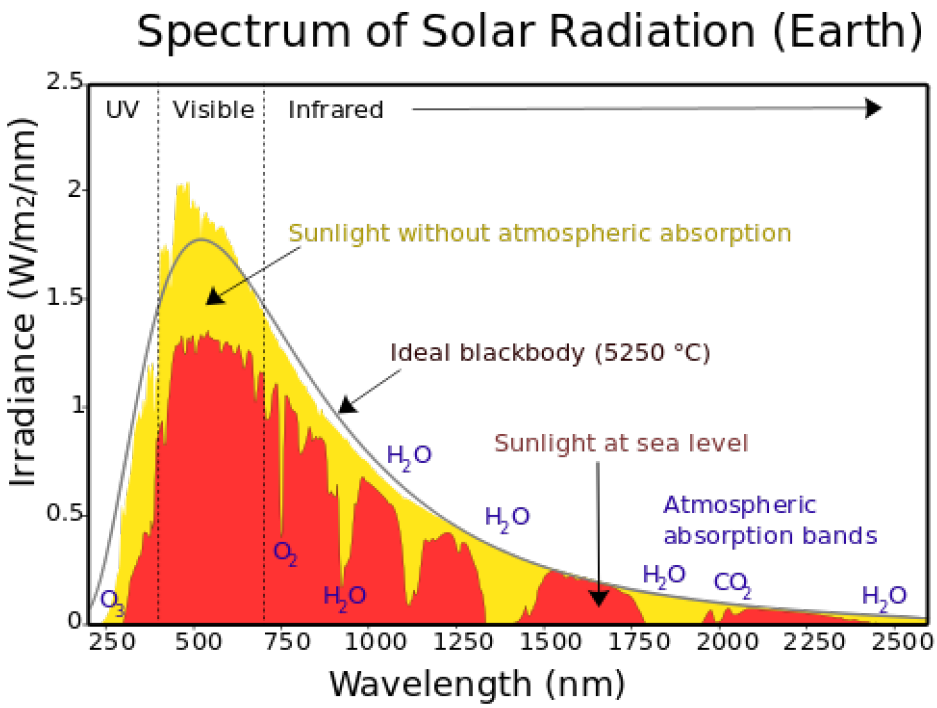
1. Q4B.9 A basic intensity problem (this should have been categorized as a two-minute problem)

2. On the next page in red is the intensity of sunlight reaching the Earth at sea level. In yellow is the sunlight reaching the upper atmosphere. The function drops sharply below about 400nm. As you can see, thankfully, there is no ultraviolet catastrophe.

Lightly trace a nice even grid over the graph. Make the horizontal spacing of your grid lines 50nm, and the vertical spacing 0.1 $\mathrm{W/m^2/nm}$.

(a) How much $\mathrm{W/m^2}$ does each square in your grid represent?

(b) Count the number of grid squares in the visible range. Use the idealized blackbody spectrum at 5250° (light black line) for the counting. Using your answer from (a) and the count you just made, how many $\mathrm{W/m^2}$ does the Sun deposit on Earth in the visible range?



By the way, a good 1 square meter solar panel can produce 200-300W on a sunny day. A real solar panel is far from 100% efficient in converting sunlight to electricity.

A Couple of Very Similar Photoelectric Effect Problems

3. Q4M.2 The work function for Cesium

4. Q4M.4 The work function for Lead

A Very Rich Problem

5. Q4R.3 The last photons emerging from a collapsing black hole