RADIATION AS PARTICLES

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Supplementary Material for

PHY 3305 (Modern Physics)

Harris, Ch. 3.1-3.5

TABLE OF CONTENTS

REVIEW

- Correct form of velocity transform
- Had to question momentum
- Chose to preserve conservation of momentum
  - changed definition of momentum
- Had to change definition of total energy as well
  - $E^2 = (mc^2)^2 + (pc)^2$
  - $p = \gamma mu$
- We discussed the implications of p=0

BLACKBODY SPECTRUM

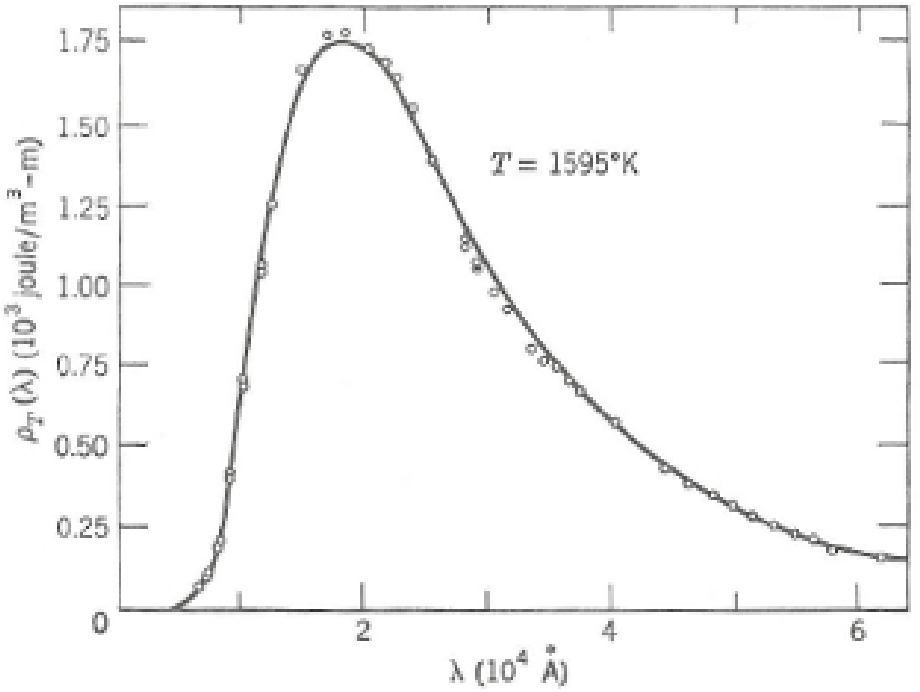


FIGURE I–11

Planck's energy density prediction (solid line) compared to the experimental results (circles) for the energy density of a blackbody. The data were reported by Coblentz in 1916 and apply to a temperature of 1595°K. The author remarked in his paper that after drawing the spectral energy curves resulting from his measurements, "owing to eye fatigue it was impossible for months thereafter to give attention to the reduction of the data." The data, when finally reduced, led to a value for Planck's constant of 6.57×10^{-34} joule-sec.

"AN ACT OF DESPERATION"

" . . . a theoretical interpretation [of the blackbody spectrum] had to be found at any cost, no matter how high."
(Max Planck, in a letter to R.W. Wood)

BALL ON A POND

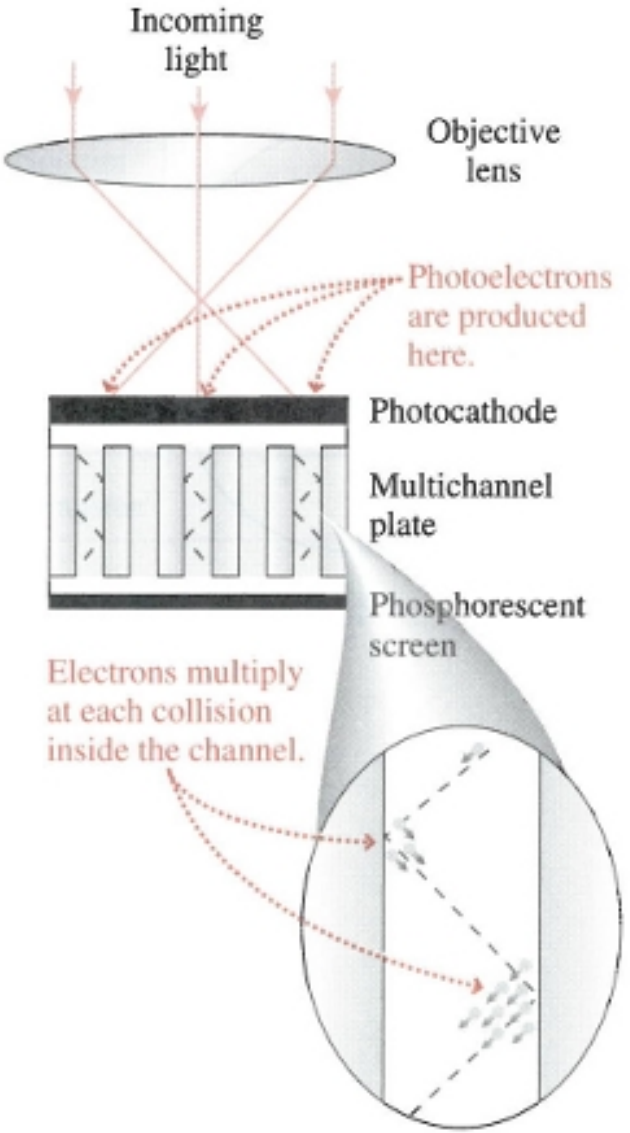
PHOTOELECTRIC EFFECT

/home/sekula/Documents/Notebooks/ModernPhysics/photoelectric_en.jar

http://phet.colorado.edu/simulations/sims.php?sim=Photoelectric_Effect

BALL STUCK IN A TREE

Figure 3.5 In a night vision device, a light image becomes an image of free electrons, amplified in a multichannel plate and then revealed on a screen.



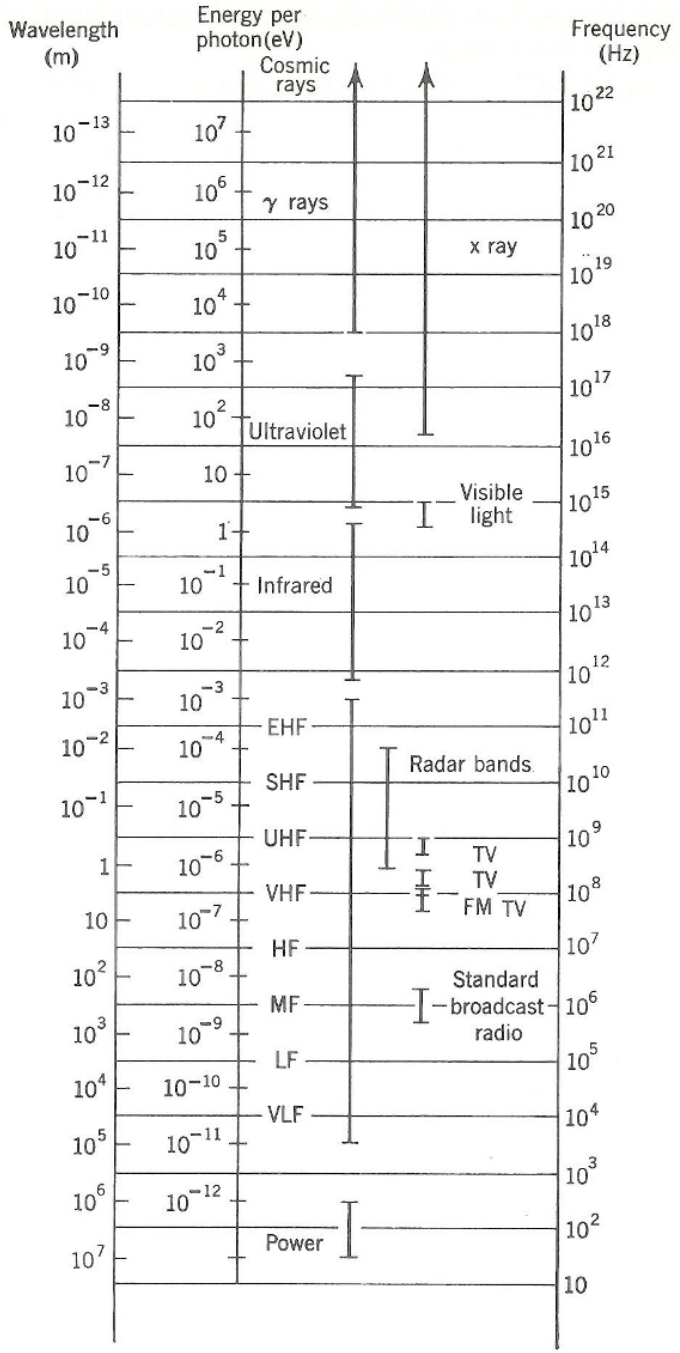
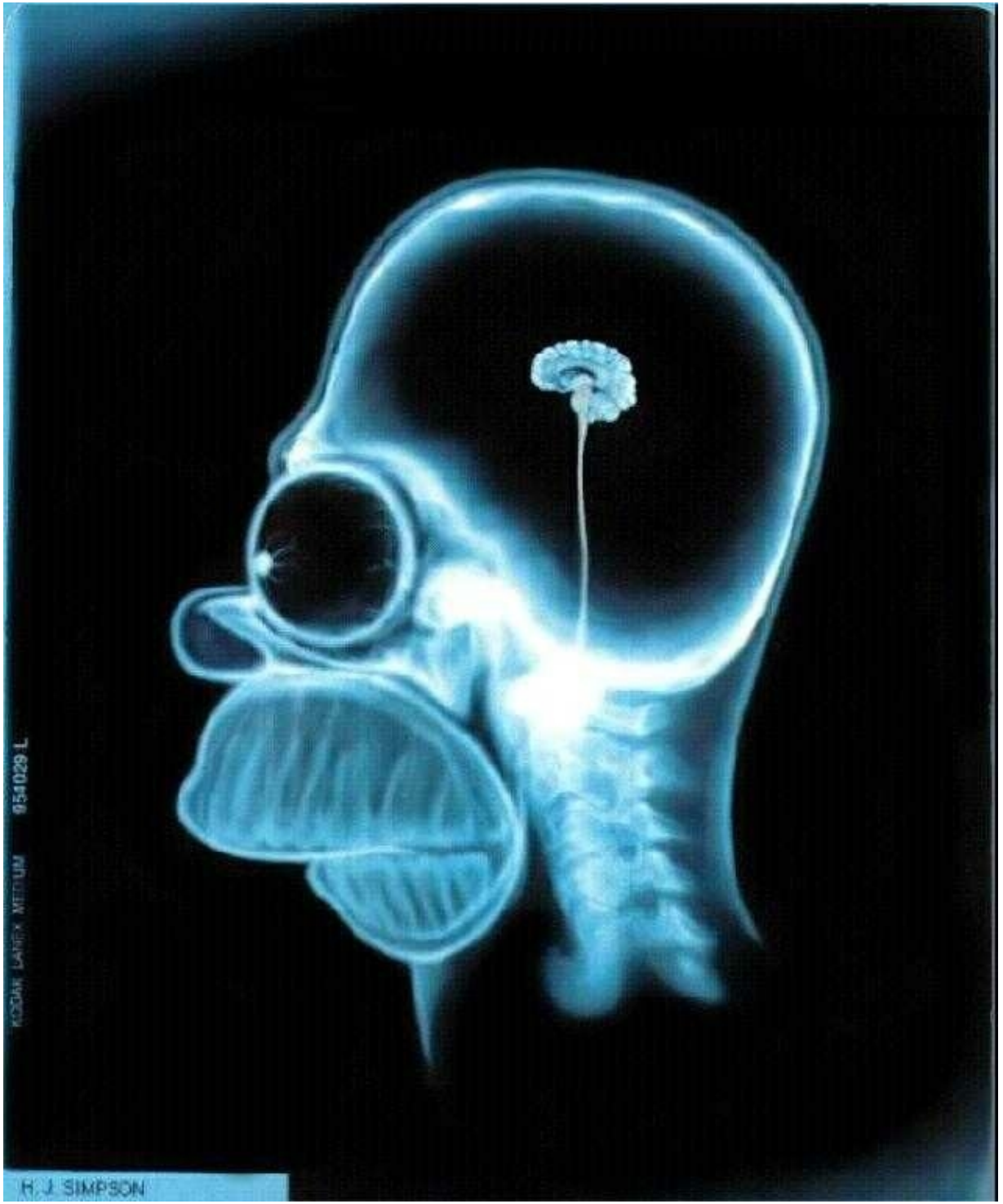


FIGURE 2-4

The electromagnetic spectrum, showing wavelength, frequency, and energy per photon on a logarithmic scale.


R. J. SIMPSON

NEXT TIME

- So which is it?
  - Is radiation a wave or a particle?
- Duality: radiation as a two-manifestation phenomenon
- If radiation has a dual nature, does matter?
  - Harris Ch. 3.6, 4.1-4.2