Physics III: Chapter 33 Lecture Notes

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January 25, 2025

Maxwell's Equations

Maxwell's Equations are a set of equations that govern electromagnetism.

Gauss' Law

$$\oint \vec{E} \cdot d\vec{A} = \frac{q}{\epsilon_0}$$

Gauss' Law states that

Gauss' Law (for magnetism)

$$\oint \vec{B} \cdot d\vec{A} = 0$$

Other Important Equations

Practice Problem 1

Your eyes are the most sensitive to the green-yellow region of the visible light spectrum. If the wavelength of this color is 555nm, calculate the frequency of this light.

Strategy

Before we get started on solving the problem, we should first define our variables. From the prompt, we can gather the following:

- First, let's think about what this problem is asking us for. It is asking us to find the frequency of the light-wave using the wavelength. Shouldn't be too difficult.
- One equation that we notice could be really useful in this situation is the equation

  $$v = f\lambda.$$

  We already have the wavelength $\lambda = 555nm$, so this equation could be a good starting point.

- Since light travels at the speed of, well, light, we can infer that $v = c$. Looking back at the equation $v = f\lambda$, we can rewrite it as $c = f\lambda$. We conveniently have two of the three values in the equation. So, now we pretty much have everything we need to solve the problem, so let's do that

Solution

Now that we've examined the problem, we have a decent amount of information to actually solve it. I recommend rearranging your equations symbolically, so that's what we'll do here.

- Using a little algebra magic, we can rearrange the equation from earlier to get us what we're looking for–the frequency f, by dividing both sides by λ, we get

$$f = \frac{c}{\lambda}.$$

- So, by plugging in our values, we get a final solution of

$$f = \frac{3 \times 10^8}{555 \times 10^{-9}} = 5.41 \times 10^{14} Hz.$$