Source: [[KBPhysicsMasterIndex]]

1 | Quantum Mechanics

What is quantum mechanics? Quantum => in small/discrete steps

The Quantum of US Currency => $0.01

1.1 | Puzzle of the Blackbody Radiation

("black" => opaque): from solid materials, liquids

The radiation from hot, solid materials looks samey (bright yellow) unlike every gas, however, had a spectral emission (think - neon lights.)

But!

Pasted image 20210303111558.png

The light spectrum did depend on temperature, so what happened? Why is everything hot?

Max Plank => trying to model incoming light source from rays as basically all absorbed and not bounced back.

Pasted image 20210303111810.png

Max Plank's Model 1 in this manner matched well with observations at long wavelengths (red hot). But, it predicted infinite brightness (it will just "keep bouncing") as wavelength => 0, which is wrong. This is the "ultraviolet catastrophie."

So, he made it better.

Max Plank's Model 2 is just Model 1, but an additional assumption that when Energy Transfers from e^- to EMWave, δE must be some constant * frequency of light.

So, to synthesize high frequencies, this cop out had the effect of supressing the infinite growth as δE would grow bigger and bigger to the point where all your energy would not go into the EMWave but to this transferring factor.

Which is like… Kind of a cop out. But it did fit medium frequencies better.

Einstein => Light != "wave"; instead, light are photon particles moving through space.

Impontant Knowledges::

Energy of each photon is equal to the plank constant (h) times the frequency (f). $E = h * f$.

Pasted image 20210308100848.png

Pasted image 20210308101013.png

$\lambda * f = c$

$E_{photon} = h \times f$

Instead of Hertz, however, the frequency of F could better be represented with ω, a unit of $\frac{radians}{sec}$ that is derived as $2\pi f(\frac{radians}{s})$

So to calculate energy with ω, simply use $\bar{h} = \frac{h}{2\pi}$ and so $E = \bar{h}\omega$

Pasted image 20210308111422.png

1.2 | **Heisenberg Uncertainty**

$\Delta E \times \Delta t = \bar{h}$ => "uncertainty of energy times uncertanity in time is the reduced plank's contstant"

Pasted image 20210308111709.png

Lifetime of the upper level => Δt

(Mean) lifetime of the "upper" energy level => Δt. So, $\Delta E = \frac{\bar{h}}{\Delta t}$.

If Δt is small, ΔE is large.

As long as the units of two deltas end up as $J \times s$, they would be related by the same way with $\bar{h}$

This ΔP has an actual effect on our vision

THIS IS IMPORTANT, TOO! $\Delta \vec{p} \times \Delta \vec{x} \approx \bar{h}$.

Pasted image 20210308112755.png

Pasted image 20210308112058.png

Pasted image 20210308112111.png

Meaning, in the subatomic world, everything exists based on differening upper-energy-state-time based uncertainties.

"Diffraction through an apreture"

We could see a similar pattern in passing photons through a llit. $Slitlarge, \Delta P_x small\ Slitsmall, \Delta P_x large$.

Pasted image 20210308112427.png

This limits the width of the lens of a camera because of the uncertanity in momentum.

Pasted image 20210308113318.png

Pasted image 20210308113628.png

Taking the angle, and dividing it by 3000, which is $\frac{1}{60}$ degrees.

Even though Plank's constant is a tiny number, it effects how sharply you eyes could see b/c of this uncertainty.

There are three "flavor"s of Leptons, each with two variations — creating six different leptons.

Lepton => "small", but they are not actually that small as what their original namer had suggested.

1.3 | **Famous Leptions**

- The Electron
  - Dirac's equations predicted the existance of a certain "positiron" which would be the oppostite of an electron. After self-determination (the "equation was too perfect to be wrong"), he set out hard to try to prove it.
-