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!

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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.

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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). $E = h * f$.

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$\lambda * f = c$

$E_{photon} = h \times f$

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 $E = \bar{h}\omega$

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1.2 | **Heisenberg Uncertainty**

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

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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 $J \times s$ $\Delta \vec{p} \times \Delta \vec{x} \approx \bar{h}$.