April 25th 2016

Review Session

Bohr's Postulate:

- angular momentum is quantized
- $L = n\hbar$ ← lowest possible is $n=1$ ∴ $L=\hbar$

$E_i - E_f = hf$

$r_n = (\text{const})n^2$, $E_n = (\text{const})\ 1/n^2$

↑ radius

Ripiber's Equation:

$$\frac{1}{\lambda} = R_H\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$$

Electric Fields:

- Stark effect
  - ↳ book about Aryan vs. Jewish physics

Blackbody Radiation

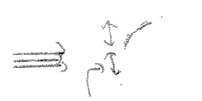
Q28 on old exam

$I = \sigma T^4$ ∴ $I = \frac{P}{A}$

$P = eA\sigma T^4$

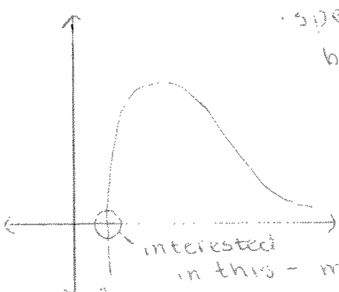
↑ e always 1 for blackbody

↳ $I = \frac{\text{total } P \text{ emitted}}{\text{area of star}}$



$\lambda_{max} T = \text{const.}$

x-ray Question



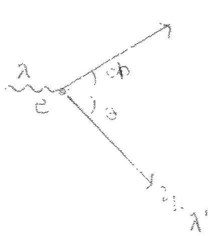
- spectrum emitted by x-ray lamp

$K = eV$

$eV = h\frac{c}{\lambda_{min}}$

Compton

$E_{photon} = 0.7\,MeV$



$\theta = 2\varphi$

$K = \frac{mv^2}{2}$

$p = mv$

$\lambda' - \lambda = \frac{h}{m_e c}(1 - \cos 2\varphi)$

$E_{photon} = E_{photon'} + E_{electron}$

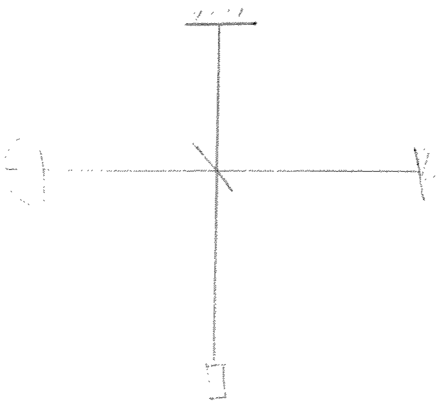
$p_{ix} = p_e \cos\varphi + p_{\lambda'} \cos 2\varphi$

$p_{iy} = \emptyset = p_e \sin\varphi + p_{\lambda'} \sin 2\varphi$

Huge capacitor Q on 2015 exam:

- Find loop with no other capacitor including capacitor of interest.

Q5 from Midterm #2



$$\lambda = \frac{2(0.382\,mm)}{1700}$$

Q2 from Midterm #2

$$1/p + 1/q = 1/f$$

$$-1/p^2 \frac{dp}{dt} + \left(-1/q^2\right)\frac{dq}{dt} = \emptyset$$

$$1/q^2 \underbrace{\frac{dq}{dt}} = -1/p^2 \underbrace{\frac{dp}{dt}}$$

$$1/q^2 \, V_q = -1/p^2 \, V_p$$

Q32 Old Final

- plot normals ~ answer is 2

Q31 Old Final

$\lambda = 548\,nm$

$$\frac{v}{\lambda} = \frac{\Delta\phi}{2\pi}$$

$$\frac{\omega}{\lambda} = \frac{2\,rad}{2\pi\,rad}$$

$$\frac{\omega}{\lambda} = \frac{1}{\pi}$$

$$\frac{d\sin\theta}{\lambda} = \frac{1}{\pi}$$

$$\sin\theta = \frac{\lambda}{d}\frac{1}{\pi}$$

$$= \frac{548\times10^{-9}}{250\times10^{-6}}\frac{1}{\pi}$$

$$= 0.04\,rad$$

<u>Carbon Question on A10</u>

$N_0 = 44$, 6.5×10^{12} ^{14}C

$A = \left| \frac{dN}{dt} \right|$ $\qquad 100 \frac{\text{decays}}{60 \text{ sec.}}$

$N = N_0 e^{-\lambda t}$

$\frac{dN}{dt} = -\lambda [N_0 e^{-\lambda t}]$

$A = \left| \frac{dN}{dt} \right| = \left| -\lambda N \right| = \lambda N$

↑

$\frac{100}{60} = \lambda (N)$

$N = \frac{100}{60} \frac{1}{\lambda}$ $\qquad T_{1/2} = 5730$ years $\qquad \lambda = \frac{\ln 2}{t_{1/2}}$

$N = N_0 \left(\frac{1}{2}\right)^{t/t_{1/2}}$

$\ln \frac{N}{N_0} = (\ln 1/2)(t/t_{1/2})$

Sarah Eisinga

Physics Review Session

Apr. 25

Bohr - quantization of angular momentum

$L = n\hbar$ ① ↳ smallest value is $\hbar$, with multiple of n

↳ energy levels can only exist here

② atom doesn't absorb on these

not postulate for quantization → ③ if absorbed or emitted $E_f - E_i = hf$

$r = \boxed{\text{const.}}\, n^2$ $n=1 \rightarrow n=10$, radius multiples by 100.

memorize constants → $E_n = \boxed{\text{const}}\, \frac{1}{n^2}$

Rydberg's Formula: ← memorize Ⓐ

$$\frac{1}{\lambda} = R_H \left[\frac{1}{n_f^2} - \frac{1}{n_i^2} \right]$$

features of atomic spectrum bohr's atom could not explain:

- hydrogen atom
- various lines have diff. intensities (strength of ~~light~~ lines)
- single lines are composed of sub lines in presence of magnetic field

Black Body Radiation

Question 28 - Practice final 2015

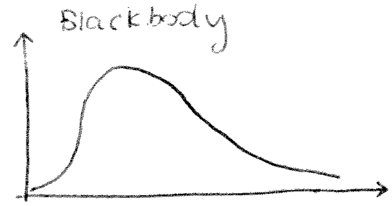
- ~~does~~ star emits same amount of energy per m^2.
- area × radius of the orbit = total power emitted from star
  ↳ per m^2

$I = \sigma T^4$, $P = eA\sigma T^4$, $I = \frac{P}{A}$

$I = \frac{\text{total power emitted}}{\text{area of star}} = \sigma T^4$ ← temperature in kelvin!

$\therefore T =$ ______

Wien's displacement law: $\lambda_{max} T = \text{const.}$
↳ to find λ.

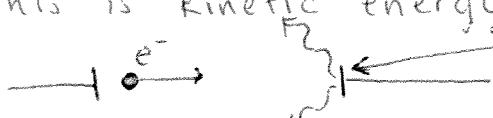


NOT the same

$\lambda_{min} \rightarrow e^-$ loose all energy to produce most intense x-ray

Applying potential, causes e^- to be emitted. require $e \cdot \Delta V$ to accelerate, this is kinetic energy.

$\boxed{e\Delta V = \frac{hc}{\lambda_{min}}}$



here e^- stops, energy emitted or absorbed pg 5

anti-colour is made by removing original colour from spectrum

Mesons - quark + antiquarks (colour & anti-colour) → need to know classification
Baryons - 3 quark (3 colours)
↳ red, blue + green

Antimatter → know concept

Cosmology: Cosmic Background Radiation
↳ black body radiation
- at 2.7 K will be at equilibrium with radiation

Cobe Results - small fluctuations of densities in early universe

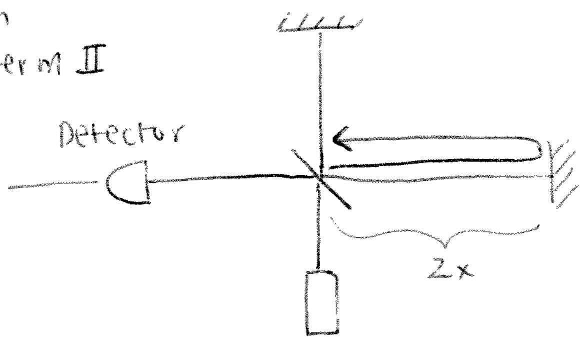
Final Exam - Practice 2015
→ find loops with no other capicators

time constant → RC

$Q(t) = Q(1 - e^{\frac{-t}{RC}})$ → to find I, Integrate
$Q(t) = Qe^{\frac{-t}{RC}}$

Michelson's Interferometer

→ Q on Midterm II



mirror displacement by 0.382 mm

$$\lambda = \frac{2(0.382\ mm)}{1700}$$

#2 Midterm 2 - antelope moving towards lens..

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f} \Rightarrow \left(-\frac{1}{p^2}\right)\left(\frac{dp}{dt}\right) + \left(\frac{-1}{q^2}\right)\left(\frac{dq}{dt}\right) = 0$$

differentiate ~~integrate~~

$$\frac{1}{q^2}\left(\frac{dq}{dt}\right) = -\frac{1}{p^2}\left(\frac{dP}{dt}\right)$$

$$\frac{1}{q^2} V_q = -\frac{1}{p^2} V_o$$

Assignment #10

$N_0 = 44 \cdot 6.5 \times 10^{10}$ $\quad$ ^{14}C

Activity $(A) = \left| \frac{dN}{dt} \right|$ $\quad$ 100 decays/60 sec.

$$N = N_0 e^{-\lambda t}$$

$$\frac{100}{60} \qquad \frac{dN}{dt} = -\lambda \left[N_0 e^{-\lambda t} \right]$$

$$A = \left| \frac{dN}{dt} \right| = \left| -\lambda N \right| = \lambda N$$

$$\therefore \frac{100}{60} = \lambda (N) \qquad N = \frac{100}{60} \cdot \frac{1}{\lambda}$$

$T_{1/2} = 5730$ yrs

$$\lambda = \frac{\ln 2}{T_{1/2}}$$

$$N = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}}$$

$$\frac{N}{N_0} = \left(\frac{1}{2}\right)^{t/T_{1/2}}$$

$$\ln \frac{N}{N_0} = \ln\left(\frac{1}{2}\right)\left(\frac{t}{T_{1/2}}\right)$$

→ sun will not end up as neutron star

$$N(t) = N(t)$$

$$N_0 e^{-\lambda t} = N_0 \left(\frac{1}{2}\right)^{t/T_{1/2}}$$

$$\ln e^{-\lambda t} = \ln\left(\frac{1}{2}\right)^{t/T_{1/2}}$$

$$-\lambda t = \frac{t}{T_{1/2}} \ln\left(\frac{1}{2}\right)$$

$$\lambda = \frac{\ln 2}{T_{1/2}}$$