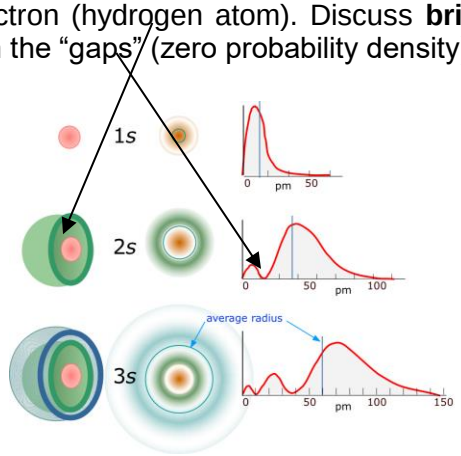
GEH1027 **2020/21 S2**
Einstein's Universe and Quantum Weirdness **Assignment 4**

Name : _____ **Group :** _____
Matric No: _____ **Date:** 19/03/2021

1) Did you watch these 2 youtube videos mentioned in class?
https://www.youtube.com/watch?v=Q1YqgPAtzho
http://www.youtube.com/watch?v=KT7xJ0tjB4A
Yes or No (cancel one) If Yes, what are these movies about (**describe in 4 lines**)?

The first video was to showcase the mystery of the double slit experiment, where electrons would show both wave and particle like properties, depending on whether they are observed.
The second video was to showcase the mystery of the Uncertainty Principle and the effect on photons, where a counter intuitive observation occurred when closing the slit to be very tiny.

2) Given the following probability density profiles, $|\psi(r)|^2$ of a wavefunction $\psi(r)$ which describes a quantum electron (hydrogen atom). Discuss **briefly** how the electron may move (trajectory) between the "gaps" (zero probability density).



Your answer:

An electron is subjected to Heisenberg's Uncertainty principle and hence it is not possible to find its exact location and momentum simultaneously. Thus the electron's trajectory cannot be found at that point

3) If a certain wave (state) function is given as $\Psi = 3i + 2$. Find Ψ^*, $\Psi^*\Psi$, $\Psi\Psi$, $|\Psi|^2$ and $|\Psi^2|$. (Note if $\Psi = a + bi$, then $|\Psi| = \sqrt{a^2 + b^2}$)

Your answer:

$\Psi^* = -3i + 2$

$\Psi^*\Psi = (-3i+2)(3i+2) = 9 + 4 = 13$

$\Psi\Psi = (3i+2)(3i+2) = -9 + 12i + 4 = 12i - 5$

$|\Psi|^2 = (\sqrt{4-9})^2 = -5$

$|\Psi^2| = (\sqrt{25-144}) = i\sqrt{119}$