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Calculation in Hydrogen atom isotope (^{2}H, or D) model and hypothesis

Dr. Ziadan Jassim Khalaf

Asst. prof of physical chem.

Chem. Dept. Swansea, university of wales (UK)1990.

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Abstract: **Recalculate hydrogen atom isotope (deuterium, D) features using, Boher radius, Density, de Broglie wave length and energies approaches.**

Keywords: **hydrogen atom isotope, Boher radius, Density.**

1. INTRODUCTION

The simple unit in chemistry is the hydrogen atom and its isotope (^{2}H) consist one proton, one neutron and one electron. According to previous studies, we need to recalculate and define the characteristic of this system, to fine more knowledge and information for that. [1-4]

Calculation

A. Bohr radius of hydrogen atom =0.529 A˚, this means the distance between Proton, P (condense region contain neutron) and electron, e [1].

Suppose the neuron lie in the position at some where between proton and electron in hydrogen isotope(^{2}H) as in following diagram.

Now if the distance between neutron and the proton is equal to X.

.e ———n---X--- p

|——0.529——|

Fig.1: proton, electron and neutron representation diagram

Let the proton hold in stationary state (fixed position), we can say:-nm X = em (0.529 – X), crowbar

if introduce mass of electron which is equal to 9.10939 x 10^{-28}g and the mass of neutron which is equal to 1.67493 x 10^{-24} g in this relation as:-

X = 0.529 em / (nm + em) = 0529 (0.000910939 x 10^{-24}) / (0.000910939 x 10^{-24} + 1.67493 x 10^{-24})

X = 0.0002876232 A˚

This represent the distance between the neutron and proton. Their for, 0.529 A˚ - 0.0002876232A˚ = 0.5287124 A˚

this represent the distance between electron and neutron.

B-Density of atomic particles.

1A˚ =10^{-10} m, R◦H = 0.529 A˚

If we calculate the volume of hydrogen atom according to Bohr radius. [1]

The volume of sphere particle , $V= 4/3\ \pi r^3 = 4/3(22/7)(0.529x10^{-10})^3 = = 0.620340868 \times 10^{-30} m^3$.

The density = mass/ volume, ($\rho = m /V$)

$\rho e = 9.10939 \times 10^{-31} / 0.620340868 \times 10^{-30}$ = 0.001468449×10^3 kg/m^3

$\rho p = 1.67265 \times 10^{-27} / 0.620340868 \times 10^{-30}$ = 2.696×10^3 kg/m^3

$\rho n = 1.681759 \times 10^{-27} / 0.620340868 \times 10^{-30}$ = 2.711024×10^3 kg/m^3

$\rho n = 2711.024$ kg/m^3 = $\rho e + \rho p = 2697.46845$ kg/m^3

C-de Broglie hypothesis [1]

$\lambda = h / p = h / mc$

$h = 6.6 \times 10^{-34}$ j.s , $c = 3 \times 10^8$ m/.s^2 .

$\lambda e = 6.6 \times 10^{-34} / 9.10939 \times 10^{-31} \times 3 \times 10^8 = 0.2415095 \times 10^{-11} m^{-1}$

$\lambda p = 6.6 \times 10^{-34} / 1.67265 \times 10^{-27} \times 3 \times 10^8 = 1.31527815 \times 10^{-15} m^{-1}$

$\lambda n = 6.6 \times 10^{-34} / 1.67495 \times 10^{-27} \times 3 \times 10^8 = 1.3153 \times 10^{-15}$ m^{-1}

$\lambda e + \lambda p = \lambda n$, $1.3153 \times 10^{-15} \approx 1.3153 \times 10^{-15}$

the atomic nucleus, $n \rightarrow p + e^- + \upsilon^- e$ (neutrino). , (beta decay).

D- zero point energy (vibration) [2]

$\Delta E = (\nu + 1/2)h\upsilon$ …….(1) $\Delta E = 1/2 m V^2$ ……(2) $(\nu + 1/2)h\upsilon = 1/2\ mV^2$ ….(3)

For $\nu = 0$ …….(a) , (ν- vibration quantum number).

$h\upsilon_\circ = m V^2$ ……(4)

If V = ω angular speed and $V^2 = \omega^2$.

$.\omega = 2\pi\upsilon$ ……..(5)

$.\tau = 1/\upsilon$ ……..…….(6)

$.\tau = 2\pi \sqrt{L/g}$ ……..…(7)

$.\upsilon = 1 / 2\pi \sqrt{g / L}$……(8) From eq (5) , in to eq(8) we obtain,

$.\omega = \sqrt{g / L}$ ……(9) . , so $\omega^2 = g / L$ ……(10)

($.\omega^2 = aN / R$, aN –normal acceleration. [4]

.g –gravity and L-length of pendulum.

If we use L =R ……(11), (R-Bohr radius). $h\upsilon_\circ = me\ g / R$……,(12)

substituted me =9.10939×10^{-31}kg ,R =0.529×10^{-10} m and g =9.8 m /s^2. into eq (12).

$h\upsilon_\circ = 9.10939 \times 10^{-31} \times 9.8 / 0.529 \times 10^{-10} = 168.756 \times 10^{-21}$ Their for $\upsilon_\circ = 168.756 \times 10^{-21} / 6.6 \times 10^{-34} = 25.569 \times 10^{13}$ m.

$.\lambda e = C / \upsilon_\circ = 3 \times 10^8 / 25.569 \times 10^{13} = 1.1733 \times 10^{-6}\ m^{-1} = 0.11733 \times 10^{-7} m^{-1}$

For $\nu = 1$ …….(b)

$3h\upsilon = me\ g / R$, $\upsilon = me\ .g / 3R\ h$

= $9.10939 \times 10^{-31} \times 9.8/3\ (6.6 \times 10^{-34} \times 0.529 \times 10^{-10})$

= 0.8523×10^{14}m .

$\lambda e = c / \upsilon = 3 \times 10^8 / 0.8523 \times 10^{14}$ m

= $3.5199 \times 10^{-6}\ m^{-1} = 0.35199 \times 10^{-7} m^{-1}$

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E. Energy Calculation [3,4] (Quantum)

En = n^2 h^2 / 8me L^2 ……. (Particle in a box) (L = a)

For hydrogen atom (^{2}H) isotope.

mn=1.67493 x 10^{-27}kg

E n = $(1)^2$ (6.6 x 10^{-34})^2 / 8 x1.67493 x 10^{-27} x (0.5287 x 10^{-10})^2 =11.63 x10^{-27}.

.υn = E/ h = 11.63 x10^{-27} /6.6 x 10^{-34} = 1.762 x10^7

.λn = C / υ = 3 x 10^8 /1.762 x10^7 = 1.703 x10 m^{-1}.

For electrón, me =9.1093 x10^{-31}kg

Ee =$(1)^2$ $(6.6x10^{-34})^2$ / 8 x 9.109 x10^{-31} $(0.529\ 10^{-10})^2$ =2.136 x10^{-17}J υe =E/h =2.136 x10^{-17} /6.6 x10^{-34} =0.324 x 10^{17}

λe =C/υ = 3x10^8 /0.324 x 10^{17} = 9.26 x10^{-9} m^{-1}

and for protón , m p =1.6726 x10^{-27}kg

Ep = $(1)^2$$(6.6\ x10^{-34})^2$ / 8 x1 .6726x10^{-27} $(0.529\ x10^{-10})^2$ = 11.633 x 10^{-27}

.υp = E/h =11.633 x 10^{-27} /6.6 x10^{-34} =1.7626 x 10^7

.λp =3 x10^8 /1.7626 x 10^7=1.702 x 10 m^{-1}

***F*- Scientific facts**

Electrón spin (-1/2, +1/2) .

Proton spin (- 1/2 , +1/2).

Two pairs of spinning motion make **flip nodal.**

Electron spin – 1 / 2(↑) — **flip** — electron spin +1 /2.(↓)

Proton spin + 1 / 2(↓) — **nodal** — proton spin – 1 / 2.(↑)

The position of flip nodal between two pairs of electron-proton

Spinning is form neutral position between electron charge (-) and proton charge (+) and neutral (zero). is the charge of neutron. Because the mass of neutron is nearly equal to masses summation of proton and electron.

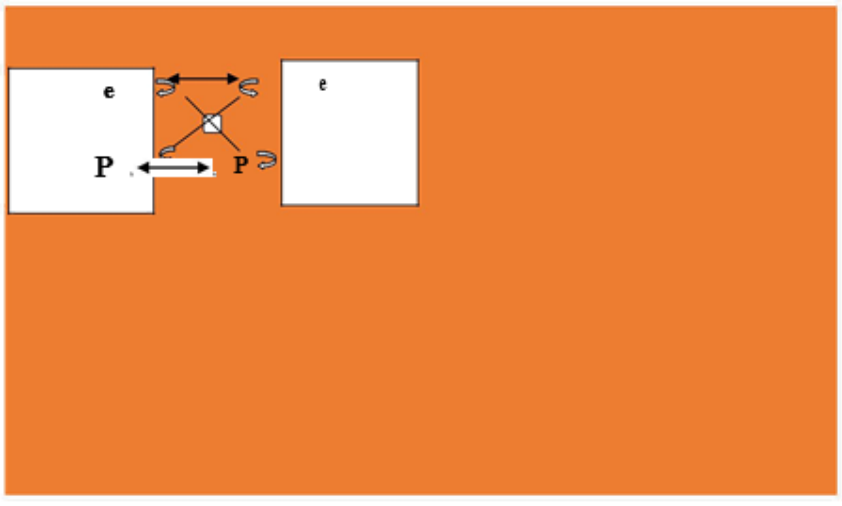

Fig.2 electron-proton flipping diagram. (e-electron ,p-proton).

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* **The energies for three hypothesis** (**De Broglie**, B , **Particle in a box** ,E, **Zero-point energy**, D(a) and region of **vibration**, D(d));

were calculated **as** following.

EB = hc / λ = 6.6 x 10^{-34} x 3 x 10^{8} / 0.24151 x 10^{-11} = 8.2 x 10^{-16} J.

EE = h c / λ = 6.6 x 10 $^{-34}$ x 3 x 10^{8} / 0.203 x 10^{-9}= 0.98 x 10^{-15} J.

ED = h c / λ = 6.6 x 10^{-34} x 3 10^{8} / 1.1733 x 10^{-6}= 0.16875 x 10^{-18} J**…(a).**

ED = h c / λ = 6.6 x 10^{-34} x 3 x 10^{8} / 0.35199x10^{-7}= 5.6252x 10^{-18}J… **(b)**

EB – represent the kinetic energy of free electron (moving outside nucleus, H^{+}). EE – represent the kinetic energy of restricted electron to effect of nucleus.

ED - represent the kinetic energy of electron in frozen region (flipping nodal **)(a).** ED – represent the kinetic energy of electron in region of vibration **(b).**

Table.1 show energías for hydrogen isotope particles

Variables,J	de Broglie(C)	Spectroscopy. J(Vibración)(D)	Quantum (E)
Ee	8.182 x 10^{-16}	a. 0.16876 x 10^{-18} b. 5.63 x10^{-18}	2.136 x 10^{-17}
En	15 x 10^{-11}		11.63 x10^{-27}
Ep	15 x 10^{-11}		11.633 x10^{-27}

2. CONCLUSION

If we are compare the density of neutron (**ρn 2.2711024 x10^{3}** kg/m^{3}) with the

summation density of proton(**ρp =2.696 x10^{3}**kg/m^{3}) plus electron

(**ρe= 0.0014685** x10^{3}kg/m^{3}) give the difference (**13.6** kg/m^{3}) and this difference may be belong to beta decay, ($p + e^{-} + \nu^{-}e = n$), (neutrino, $\nu^{-}e$).(6)

Also by compare the summation of wave length of electron (λe) with wave length of proton (λp) give nearly equal to wave length of neuron (λn) ,

(λp + λe ≈ λn =1.3153 x10^{-34} m^{-1}).

This mean there is a case look like form of hybrid. And the neutron is main particle in atom.

The kinetic energy , EB > EE & ED(b) > ED(a) .(table. 1)

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