**Assignment 6: Non-existence of electron in the Atomic Nucleus**

let us assume that electrons exist in the nucleus. As the radius of the nucleus in approximately 10-14 m. If electron is to exist inside the nucleus, then uncertainty in the position of the electron is given by

∆x= 10-14 m

According to uncertainty principle,

∆x∆px =h/2∏

Thus ∆px=h/2∏∆x

Or ∆px =6.62 x10-34/2 x 3.14 x 10-14

∆px=1.05 x 10-20 kg m/ sec

If this is p the uncertainty in the momentum of electron, then the momentum of electron should be at least of this order, that is p=1.05\*10-20 kg m/sec.

An electron having this much high momentum must have a velocity comparable to the velocity of light. Thus, its energy should be calculated by the following relativistic formula

E= √( m²c⁴ + p²c²)

E = √((9.1\*10-31)2 (3\*108)4 + (1.05\*10-20)2(3\*108)2)

= √((6707.61\*10-30) +(9.92\*10-24))

= √((0.006707\*10-24) +(9.92\*10-24))

= √(9.9267\*10-24)

E= 3.15\*10-12 J

Or E=3.15\*10-12/1.6\*10-19 eV

E= 19.6\* 106 eV

Or E= 19.6 MeV

Therefore, if the electron exists in the nucleus, it should have an energy of the order of 19.6 MeV. However, it is observed that beta-particles (electrons) ejected from the nucleus during b –decay have energies of approximately 3 Me V, which is quite different from the calculated value of 19.6 MeV. Second reason that electron can not exist inside the nucleus is that experimental results show that no electron or particle in the atom possess energy greater than 4 MeV.

Therefore, it is confirmed that electrons do not exist inside the nucleus.