ISSN No:-2456-2165

Theoretical Modification on Kinetic Energy and Conservation Law of Energy in Pair Production phenomena

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Abstract:- The objective of this work is to find the error in kinetic energy of particle-antiparticle and law of conservation of energy in Pair-production Phenomena, theoretically. When photon of suitable energy incidence or enter on nucleus field of heavy nucleus, whose energy are suitable or sufficient for pair production phenomena. The energy of incidence photon or photon goes to produce particle-antiparticle in nucleus field and these particle-antiparticle goes on several phenomena with coulomb force in nucleus field. This several phenomena cause the change in kinetic energy of particle-antiparticle which causes change in law of conservation, before and after pair-production. In this work, we are introducing the role of potential energy (Coulomb force) between the pair production constituent and charge particle produce by nucleus (Proton into Neutron, Neutron into Proton), which play important role to change the speed of particle-antiparticle, from point of formation (within nucleus field) and away from the point of formation (out of nucleus field). Since, Pair-production produce Particle-antiparticle having positive and negative charge, and also inside the nucleus there is existence of proton (positive charge), pion (positve, negative and neutral charge). The presence of these charge causes attraction and repulsion of the particle-antiparticle in nucleus field and effect the speed of particle-antiparticle after formation.

In this paper, we have developed a mathematical model or relation that the velocity of Particle-antiparticle at formation point or on nucleus field is less than the velocity of particle-antiparticle away from point of formation or out of nucleus field that mean velocity of Particle-antiparticle is inversely proportional to the distance of particle-antiparticle from nucleus or nucleus field.

Keywords:- *Pair-Production, Pion, Particle-Antiparticle, Photon, Nucleus Field etc.*

I. INTRODUCTION

The theoretical life time of Yukawa meson 10^{-8}s and nuclear force ranges of 10^{-13}cm [1] which is the exchanging time of proton into neutron and neutron into proton as shown in Figure 1 [2].

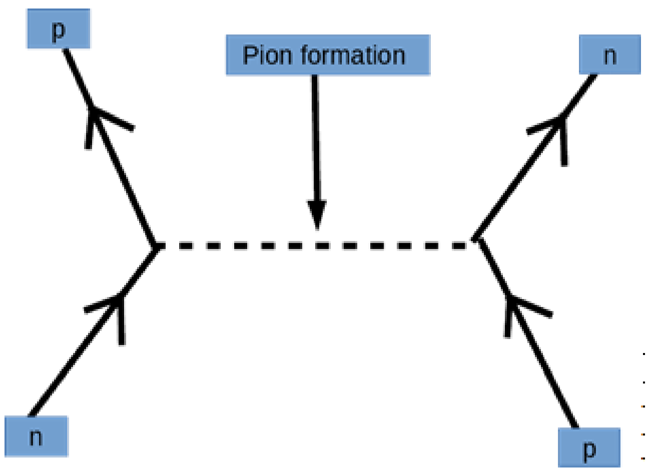

Fig 1:- Exchange of nucleon.

Internal bremsstrahlung spectrum were made, first by Knipp and Uhlenbeck and by Bloch for allowed transitions with a vector interaction of nucleon (proton and neutron), in two step transition as

$$n \rightarrow p+e^{-} +\bar{\upsilon} \rightarrow p+e^{-} +\bar{\upsilon} +\gamma$$

Feynman Gell-Mann theory measure the beta decay of the pion directly and also by Berkeley (Yp62), CERN (So63) and Dubna (Ch63) recently as

$$\pi^{-} \rightarrow \pi^{o}+e^{-}+v$$

In recent experiments at Brookhaven (Sc62) and CERN (Be63, Yo63), it was proved that there are two kinds of neutrino in nature. One has masses, m<250eV call neutrino and another has mass, m<3.5MeV call muon neutrino [3].

The dominant interaction mechanisms include the atomic photo-effect, coherent (Rayleigh) and incoherent (Compton) scattering, and, in the photon energy region above 1 MeV, electron–positron pair (and triplet) production. Systematic tabulations of the probabilities, or cross sections, for these processes, and their totals in the form of mass attenuation coefficients m/r, extending to photon energies above 1MeV, have been developed at NBS/NIST [4-8].

II. REVIEW

Yukawa theory of nuclear forces has led to many successes and, owing to the present state of quantum theory, to some difficulties. Bhabha suggest nucleons interact not only by means of mesons but also by other types of particles. The potential inside a nucleus will now be rather smooth, certainly much smoother as a result there will be only small forces acting upon a nucleon inside a nucleus. Gauss shown that strong spin-orbit coupling results under certain conditions immediately from the vector-meson theory of Yukawa. Teller suggested, probably be brought about by the non-linear interaction terms in the field equation, which prevent the Yukawa field to increase above a certain value. Finally the cross-section for elastic collision of very fast nucleons will decrease more rapidly with increasing energy than one would expect from the Yukawa potential and the corresponding tensor potential [9]. Heisenberg considered the interaction of Platzwechse between the neutron and the proton to be of importance to tho nuclear structure. Recently Fermi treated the problem of Beta-disintegration on the hypothesis of neutrino. According to this theory, the neutron and. the proton can interact by ernitting and absorbing a pair of neutrino and electron. They following the way of transition of a heavy particle from neutron state to proton state is not always accompanied by the emission of light particles, but also transformed from proton state into neutron state [10].

Hideki Yukawa proposed a fundamental theory of nuclear forces involving the exchange of massive charged particles between neutrons and protons and called the exchanged particles heavy quanta. The meson theory has turned out to be an important paradigm for the theory of elementary particles, as seminal as Ernest O. Lawrence's cyclotron has been for its experimental practice [11]. The range of the nuclear force is short, only a few femtometer (1fm =10^{-15} m), beyond which it decreases rapidly and is due exchange of particles lighter than nucleons known as mesons. Scattering experiments at higher energies (more than 200 MeV) provide evidence that the nucleon-nucleon interaction turns repulsive at short inter-nucleon distances when smaller than 0.5 fm, but it rapidly decreases to insignificance at distances beyond about 2.5 fm [12].

Gamow-Teller β decays of very light, light, and medium-heavy nuclei [13] and determination GT -matrix elements from beta-decay and charge exchange reactions has led to a series of discoveries concerning the structure of the nucleus and the properties of spin-isospin transitions in nuclei. The weak-interaction decays bring invaluable complements on well-resolved transitions and allow to investigate nuclei far from stability [14]. $e^{+}e^{-}$ pair production in heavy ion collisions at high energies and there pair production can be studied in so called ultra-peripheral collisions, where the ions do not come close enough to interact strongly with each other. Bethe-Heitler process of production $e^{+}e^{-}$ pairs in photon-nucleus collisions was Bethe and Maximon, and recovered by summing over a class of Feynman diagrams to infinite order. The short interaction time in ultraperipheral heavy ion pair production can be well understood in the frame of QED perturbation theory [15].

Electron–positron pair production by photons was prediction of the positron by Dirac. Photons of energies above $2m_{e}c^{2}$ (1.022 MeV) can interact with the Coulomb field of an atomic nucleus to be transformed into an electron–positron pair, the probability increasing with increasing photon energy, up to a plateau at high energies, and increasing with increasing atomic number approximately as the square of the nuclear charge (proton number). Recently (1979–2001), Sud and collaborators have developed some new approaches including using distorted wave Born approximation (DWBA) theory to compute pair production cross sections in the intermediate energy region (5.0–10.0 MeV) on a firmer theoretical basis [16]. In pair production, the photon is converted into an electron-positron pair in the Coulomb field of the nucleus if photon energy is $2m_{0}c^{2}$. If photon has greater than 2moc2 then remain energy goes for kinetic energy of pair-production particle [17].

Positron is produce from β^{+} nuclear decay when high energy photon interacts with nucleus or orbital electron electric field. In Pair production, production of $e^{-}e^{+}$ pair + complete absorption of incident photon by absorber atom and follow the law of conservation of energy, charge, momentum [18]. Yukawa in 1935, in an attempt to remove the difficulties of Heisenberg-Majorana theory of exchange forces modified the theory known as Yukawa meson field theory. According to the meson theory of nuclear forces, all nucleons consist of identical cores surrounded by a cloud of one or more mesons. Meson may be neutral or may have a positive or negative charge, formation of posiitve and negative meson inside the nucleus may be $n \,\square\, p+\pi^{-}$ or $p+\pi^{-} \,\square\, n$ or $p \,\square\, n+\pi^{\square}$ or $n+\pi^{\square} \,\square\, p$ etc. The formation of these meson play an important role stability to the nucleus of an atom [19].

The nucleus in turn has been broken down into its component protons and neutrons. M ore recently it has become apparent that the proton and the neutron are also composite particles; they are made up of the smaller entities called quarks. In the case of the leptons, experiments have probed to within 10^{-16} centimeter and found nothing to contradict the assumption that leptons are pointlike and structureless. The quarks in a proton or a neutron are thought to be held together by a new long-range fundamental force called the color force, which acts on the quarks because they bear a new kind of charge called color. The weak force is also distinguished by its exceedingly short range; its effects extend only to a distance of about 10^{-16} centimeter, or roughly a thousandth of the diameter of a proton [20].

III. METHODOLOGY

Let E_γ is the energy carried by a photon whose energy is suitable for pair production and such energy is given by

$E_\gamma = hf_\gamma$ ………………………..(1)

where, h=plank constant and f_γ=frequency of incidence photon.

When E_γ energy photon incidence or collide with heavy nucleus the E_γ energy convert into masses having opposite charge, same masses and conserved energy of phenomena. This phenomena is called pair production. According to this phenomena, energy and momentum are conserved before and after collision with nucleus or interaction with nucleus field.

Since the pair production medium but in our cases we consider the medium as coulomb field (field due to charge at nucleus). When photon of E_γ enter in such field, E_γ energy goes to numbers of phenomena and finally produce particle-antiparticle in nucleus field. As according to pair production, the charge of particle-antiparticle are opposite then we have to suitable cases

Cases I: If the direction of the production of particle-antiparticle are in same then goes annihilation. Here, direction indicate angle between them after formation is zero. In this situation again they converted into energy or formed energy and the processes of formation of energy is called annihilation.

Case II: If the direction of the production of particle-antiparticle is not same i.e. not goes on annihilation after the formation of particle-antiparticle.

Since the nucleus is positive charge particle as contain positive charge particle proton and neutral particle neutron, which is heavier than that of particle-antiparticle formation during pair production, in term of mass and volume.

Several experiment show that the shape of nucleus is spherical so the volume of the nucleus is given as

$$V_N = \frac{4}{3}\pi R_N^3 \text{.....................................}(2)$$

Where V_N= Volume of nucleus and R_N = Radius of nucleus. This is the probable volume of nucleus where the pair production take place, when photon of energy E_γ enter in it. This is the volume or space through which particle-antiparticle goes to passes through number of phenomena and finally escape.

The charge of particle is negative and antiparticle is positive.

The number of phenomena introduce in this research are given below:

Considering no change in the position of nucleus when hit by suitable energy of photon which causes the pair production. Nucleus is the mixture of proton, neutron, pion.

Attraction of surface proton with particle:

Let q_{pN} charge of proton and q_p charge of creation particle during pair production, from energy of incidence photon having energy E_γ . Then force (F_1) of attraction between them is given by coulomb charge is

$$F_1 = \sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}\times q_p}{4\pi\epsilon r_{ij}^2}$$

$$F_1 = \sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}q_p}{4\pi\epsilon r_{ij}^2} \text{...................................}(3)$$

Here j is the position of particle after the formation from pair production which is variable, i is the position of proton on nucleus and r_{ij} is the distance between q_{pNi} and q_p position at any instant.

Repulsion of antiparticle by surface proton:

Let q_{pN} charge of proton and q_p charge of creation antiparticle during pair production, from energy of incidence photon having energy E_γ. Then force (F_2) of attraction between them is given by coulomb charge is

$$F_2 = \sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}\times q_p}{4\pi\epsilon r_{ik}^2}$$

$$F_2 = \sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}q_p}{4\pi\epsilon r_{ik}^2} \text{................................}(4)$$

Here k is the position of antiparticle after the formation from pair production, which is variable, i is the position of proton on nucleus and r_{ik} is the distance between q_{pNi} and q_p position at any instant.

Attraction of antiparticle with surface negative Pion:

As nucleus are stable due to Yukawa theory of pion means the formation of proton into neutron and vice-versa, during this pion are produce which have charge (positive and negative) and neutral. This process is spontaneous indicate that numbers of production of pion bases on atomic number of atom.

When proton (p) change into neutron inside the nucleus, then π^+ produce having positive charge as shown below:

$$p \,\square\, \pi^{\square} + n \text{....................}(5)$$

Let q_π charge of positive pion and q_p charge of creation antiparticle during pair production, from energy of incidence photon having energy E_γ. Then, force (F_3) of attraction between them is given by coulomb charge is,

$$F_3=\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}\times q_p}{4\pi\epsilon r_{ik}^2}$$

$$F_3=\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}q_p}{4\pi\epsilon r_{ik}^2}\text{.................................}(6)$$

Here k is the position of antiparticle after the formation from pair production, which is variable, i is the position after proton form π^+ on nucleus and r_{ik} is the distance between $q_{i\pi}$ and q_p position at any instant.

Attraction of particle with surface positive Pion:

As nucleus are stable due to Yukawa theory of pion means the formation of proton into neutron and vice-versa, during this pion are produce which have charge (positive and negative) and neutral. This process is spontaneous indicate that numbers of production of pion bases on atomic number of atom.

When proton (p) change into neutron inside the nucleus, then π^- produce having negative charge as shown below:

$$n\square\ \pi+p\text{.................................}(7)$$

Let q_π charge of negative pion and q_p charge of creation antiparticle during pair production, from energy of incidence photon having energy E_γ. Then, force (F_4) of attraction between them is given by coulomb charge is,

$$F_4=\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}\times q_p}{4\pi\epsilon r_{il}^2}$$

$$F_4=\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}q_p}{4\pi\epsilon r_{il}^2}\text{...}(8)$$

Here *l* is the position of antiparticle after the formation from pair production, which is variable, i is the position after proton form π^- on nucleus and r_{il} is the distance between $q_{i\pi}$ and q_p position at any instant.

Attraction between particle-antiparticle at point of formation:

At the formation of pair-production at the point of creation both particle get attracted due to charge and attraction goes to decrease as they apart from formation point and resultant force at incidence direction is

$$F_R=\frac{q_q\cos\theta\times q_q\sin\theta}{4\pi\epsilon r^2}$$

$$F_R=\frac{q_q^2\cos\theta\sin\theta}{4\pi\epsilon r^2}\text{....................}(9)$$

Now, total resultant force acing to resist the pair-production particle escaping from nucleus volume V is given as

$$F=F_1+F_2+F_3+F_4+F_R\text{..................................}(10)$$

On putting the value of F_1 from (3), F_2 from (4), F_3 from (6), F_4 from (8), and F_R from (9) in (10) then (10) become,

$$F=\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}q_p}{4\pi\epsilon r_{ij}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}q_p}{4\pi\epsilon r_{ik}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}q_p}{4\pi\epsilon r_{ik}^2}$$

$$+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}q_p}{4\pi\epsilon r_{il}^2}+\frac{q_q^2\cos\theta\sin\theta}{4\pi\epsilon r^2}\text{..................}(11)$$

This equation (11) is the resultant force acing on particle-antiparticle formed during pair production and try to bound particle-antiparticle in nucleus field created by proton, neutron, and pion etc.

If F is the force that attracted charge and decreases the velocity v of a charge particles, as charge particle closure to nucleus. In other wards the attraction to charge particle goes to decrease as the charge particle goes far away from the nucleus or nucleus field.

According to Bohr's model of hydrogen atom the electron exist in orbit or around nucleus due to balance of centripetal and electrostaticc force i.e.

Centripetal force = Electrostatic force or coulomb force

$$\frac{m_e v^2}{r_o}=\frac{1}{4\pi\epsilon_o}\frac{e^2}{r_o^2}\text{..........................}(12)$$

This relation show that the electron revolved around the nucleus because centripetal force equal to coulomb force. This relation show if equation (12) is dis-balance electron don't exist on the orbit. In our case, we used the case of dis-balance equation and the cases of dis balance equation is given as

$$\frac{m_e v^2}{r_o}>\frac{1}{4\pi\epsilon_o}\frac{e^2}{r_o^2}.$$

This show electron of orbit goes away from the nucleus.

$$v^2>\frac{1}{4\pi m_e\epsilon_o}\frac{e^2}{r_o}$$

$$v^2>\frac{K}{r_o}\text{..........................}(13)$$

ISSN No:-2456-2165

In general

$$v^2 > \frac{K}{r_m} \text{..................................(14)}$$

This relation show that velocity of electron goes on increasing as distance between electron and nucleus increases.

Then for a cases, we applied such situation and can extend pair production relation. Since in pair production the particle-antiparticle are not revolving around the nucleus instead of these they goes away from nucleus or nucleus field. Show we applied a condition

$$F < \frac{m_e v^2}{r_m} \text{ ....(15)}$$

Let v_p is the velocity of particle and mp is the mass of particle, formation take place on pair production then (15) become

$$F < \frac{m_e v_p^2}{r_m} \text{ ....(16)}$$

This relation show that the pair-production particle is not bounded by nucleus or nucleus field.

Now for particle which is created during pair-production, we have relation from equation (11) and (16) is given by,

$$\frac{m_p v_p^2}{r_m} > \sum_{i=1}^{n}\sum_{j} \frac{q_{pNi} q_p}{4\pi\epsilon r_{ij}^2} + \sum_{i=1}^{n}\sum_{k} \frac{q_{pNi} q_p}{4\pi\epsilon r_{ik}^2}$$

$$+ \; + \sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi} q_p}{4\pi\epsilon r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi} q_p}{4\pi\epsilon r_{il}^2} + \frac{q_q^2 \cos\theta \sin\theta}{4\pi\epsilon r^2}$$

$$v_p^2 > \frac{r_m}{m_p}\left[\sum_{i=1}^{n}\sum_{j} \frac{q_{pNi} q_p}{4\pi\epsilon r_{ij}^2} + \sum_{i=1}^{n}\sum_{k} \frac{q_{pNi} q_p}{4\pi\epsilon r_{ik}^2}\right] +$$

$$\frac{r_m}{m_p}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi} q_p}{4\pi\epsilon r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi} q_p}{4\pi\epsilon r_{il}^2} + \frac{q_q^2 \cos\theta \sin\theta}{4\pi\epsilon r^2}\right]$$

$$v_p^2 > \frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{pNi}}{r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi}}{r_{il}^2} + \sum_{i=1}^{n}\sum_{j} \frac{q_{pNi}}{r_{ij}^2}\right]$$

$$+ \; \frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi}}{r_{ik}^2} + \frac{q_q \cos\theta \sin\theta}{r^2}\right] \text{........(17)}$$

$$v_p^2 = A\frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{pNi}}{r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi}}{r_{il}^2} + \sum_{i=1}^{n}\sum_{j} \frac{q_{pNi}}{r_{ij}^2}\right]$$

$$+ \; A\frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi}}{r_{ik}^2} + \frac{q_q \cos\theta \sin\theta}{r^2}\right] \text{........(18)}$$

m_p mass of particle formed during pair production and A is dimensionless constant for particle charge of pair production.

Similarly for anti-particle we have,

$$v_n^2 > \frac{r_m}{m_n}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{pNi}}{r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi}}{r_{il}^2} + \sum_{i=1}^{n}\sum_{j} \frac{q_{pNi}}{r_{ij}^2}\right]$$

$$+ \; \frac{r_m}{m_n}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi}}{r_{ik}^2} + \frac{q_q \cos\theta \sin\theta}{r^2}\right] \text{............(19)}$$

$$v_n^2 = B\frac{r_m}{m_n}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{pNi}}{r_{ik}^2} + \sum_{i=1}^{n}\sum_{l} \frac{q_{i\pi}}{r_{il}^2} + \sum_{i=1}^{n}\sum_{j} \frac{q_{pNi}}{r_{ij}^2}\right]$$

$$+ \; B\frac{r_m}{m_n}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k} \frac{q_{i\pi}}{r_{ik}^2} + \frac{q_q \cos\theta \sin\theta}{r^2}\right] \text{.......(20)}$$

where v_n is velocity of antiparticle and m_n is corresponding mass and B is dimensionless constant for antiparticle charge of pair production.

From equation (17) and (19), we can say that the velocity of particle-antiparticle is greater to escape the attraction of nucleus or nucleus field after pair production.

Also from (17) and (19) we have, velocity is inversely proportional to distance of nucleus and particle-antiparticle, during pair production. This means as the distance separation of particle-antiparticle increases velocity by square and hence we can say that velocity of particle-antiparticle goes on increase after certain time of pair.

In case of opposite charge we have only consider attraction

Energy Conservation in Pair production:

The conservation of energy in pair-production

ISSN No:-2456-2165

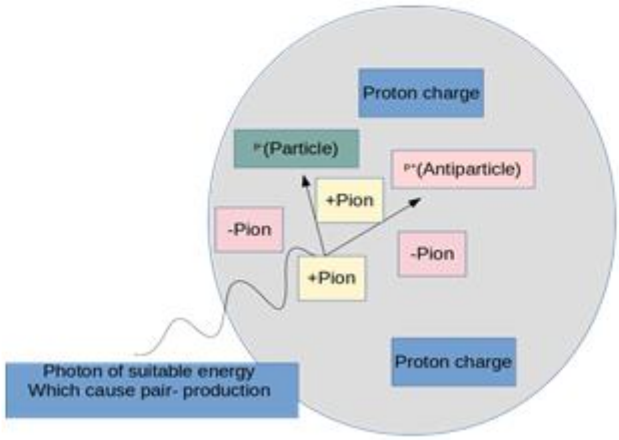

Fig 2:- Pair-production Phenomena in Nucleus field.

$hf = 2m_0c^2 + K.E_P + K.E_n$ ……………………….(21)

This is the equation for energy conservation on pair production.

Here $2m_0c^2$= rest energy of particle.

$K.E_p$= Kinetic energy of the particle created ion pair-production after production.
$K.E_n$= Kinetic energy of the antiparticle created ion pair-production after production.
hf= Energy of photon whose energy is suitable for pair-production.

After the photon enter in the field of nucleus, production or formation of particles take place. Let the kinetic energy of the positive charge particle having mass m_p moving with velocity v_p and negative charge particle m_n moving with velocity v_n are respectively given as

$$K.E_p=\frac{1}{2}m_pA\frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}}{r_{ik}^2}+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}}{r_{il}^2}\right]+\frac{1}{2}m_pA\frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}}{r_{ij}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}}{r_{ik}^2}\right]+\frac{1}{2}m_pA\frac{r_m}{m_p}\frac{q_p}{4\pi\epsilon}\left[\frac{q_q\cos\theta\sin\theta}{r^2}\right]$$

$$K.E_p=\frac{Ar_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}}{r_{ik}^2}+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}}{r_{il}^2}\right]+\frac{Ar_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}}{r_{ij}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}}{r_{ik}^2}\right]+\frac{Ar_m}{2}\frac{q_p}{4\pi\epsilon}\left[\frac{q_q\cos\theta\sin\theta}{r^2}\right] \text{..........(22)}$$

This is the net kinetic energy of particle after pair production.

Similarly, Kinetic energy of antiparticle after pair production is given as

$$K.E_n=\frac{Br_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}}{r_{ik}^2}+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}}{r_{il}^2}\right]+\frac{Br_m}{2}\frac{q_p}{4\pi\epsilon}\left[+\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}}{r_{ij}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}}{r_{ik}^2}\right]+\frac{Br_m}{2}\frac{q_p}{4\pi\epsilon}\left[\frac{q_q\cos\theta\sin\theta}{r^2}\right] \text{.......(23)}$$

On putting the value of Kinetic energy of particle from (22) and kinetic energy of antiparticle from (23) in (21) we get,

$$hf=2m_oc^2+\frac{Ar_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}}{r_{ik}^2}+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}}{r_{il}^2}\right]+\frac{Ar_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}}{r_{ij}^2}+\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}}{r_{ik}^2}+\frac{q_q\cos\theta\sin\theta}{r^2}\right]+\frac{Br_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{pNi}}{r_{ik}^2}+\sum_{i=1}^{n}\sum_{l}\frac{q_{i\pi}}{r_{il}^2}+\sum_{i=1}^{n}\sum_{j}\frac{q_{pNi}}{r_{ij}^2}\right]+\frac{Br_m}{2}\frac{q_p}{4\pi\epsilon}\left[\sum_{i=1}^{n}\sum_{k}\frac{q_{i\pi}}{r_{ik}^2}+\frac{q_q\cos\theta\sin\theta}{r^2}\right] \text{......(24)}$$

This is the equation of conservation of energy in pair production. After the text edit has been completed, the paper is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your paper. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your paper; use the scroll down window on the left of the MS Word Formatting toolbar.

IV RESULT AND DISCUSSION

In this research work, we have calculated the conservation of energy during the phenomena of pair production (before and after formation of particle-antiparticle). Here we develop some modification in kinetic energy of particle-antiparticle at formation point and after formation (within field of nucleus and out of nucleus field). In this cases, the major role of coulomb force of attraction and repulsion are taken in consideration, and with the help of this we calculated velocity of the particle-antiparticle after formation about point (nucleus field) and away from the point, where particle-antiparticle formed. In addition we also consider the coulomb attraction of Particle-Antiparticle, Proton-Particle, Proton-Negative Pion, Negative Pion-Antiparticle, Positive Pion-Negative Pion and repulsion of Proton-Antiparticle, Proton-Positive Pion, Particle-Negative

Pion. The resultant of attraction and repulsion coulomb force play an important role on speed of the particle-antiparticle. The speed, measure the kinetic energy of particle-antiparticle and play important role in conservation of energy in pair production.

V CONCLUSION

Hence, from (24) we can say that there are several coulomb force (attraction and repulsion) in nucleus field where pair-production take place and these play the vital role for the conservation of energy of pair-production phenomena. Some of the coulomb force which we have taken on account are Particle-Antiparticle, Proton-Particle, Negative Pion-Antiparticle, Proton-Antiparticle, Particle-Negative Pion and so on.

ACKNOWLEDGMENT

We would like to thanks all member of Innovative Ghar Nepal and Hypersales Pvt. Ltd to providing us research space and peaceful environment during our research work.

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