Unification of quantum mechanics (QM), relativity (TR) and classical physics (CF)

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Abstract

In this paper the inconsistency of contemporary quantities of energy and momentum in QM,TR and CF are demonstrated .To correlate these quantities inevitability of installation rest momentum p_o and total momentum p_t according to TR rest and total energy concept is required. It is explained that:
-Fundamental relation in QM De Broglie equation for momentum of particle $p= h/\lambda =mv$ is incorrect and formalism of group and phase velocity of particle is tools for correction of relation $p= h/\lambda=mv$ to correct equation form $p=mv=mc.v/c = h/\lambda .v/c$ Basic outcome equations for free particle of QM Klein –Gordon and Dirac are possible to write without usage of formalism of group and phase velocity ,wave function and Dirac matrix .Rest energy of quantum harmonic oscillator is $\hbar^2\omega_o^2/c^2= m_o^2l_o^2\omega_o^2$
-Contemporary equation of total relativistic energy $E=(m_o^2v^2c^2/(1-v^2/c^2) + m_o^2c^4)^{1/2}$ represents relation for total momentum $p_t=mc=mv+ m_cc$ multiplied by c in purpose to be compatible with energy format $[kg.m^2.s^{-2}]$ .Equation of total relativistic energy has to be written as $E= m^2v^2+ m_o^2c^2= m^2c^2$ with classical limit $E= m^2c^2= m_o^2c^2/(1-v^2/c^2)= m_oc^2$ and classical limit for supplied or kinetic energy $m^2v^2=m_o^2v^2/(1-v^2/c^2)=m_ov^2$ or $1/2m_ov^2$. The rest mass or rest energy is not invariant in inertial frame with different velocities but is equal half of supplied energy $1/2\ m^2v^2$.
-Contemporary equation of total energy of photon $E=h\nu= hc/\lambda =mc.c$ represents relation for total momentum $p_t=mc=h/\lambda =mcv/c+ m_oc$ multiplied by c in purpose to be compatible with energy format $[kg.m^2.s^{-2}]$ .Equation of total energy of photon has to be written as $h^2\nu^2/c^2= h^2/\lambda^2= m^2c^2$

Energy and momentum quantity inconsistency in QM, TR and CF

Quantity of momentum p, energy E and kinetic energy E_k are fundamental quantities of contemporary physics but their relations in CF $p=m_ov$ $E_k= 1/2\ m_ov^2 = p^2/2m_o$ in TR $p=m_o.v /(1-v^2/c^2)^{1/2}$ $E_k = m_o c^2/ (1-v^2/c^2)^{1/2}- m_o c^2= m_o.v.c /(1-v^2/c^2)^{1/2}$ and in QM $p=h/\lambda$ $E= p^2/2m_o = h^2/2m_o\lambda^2$ shows inconsistencies that might lead us to unbelief if they represent the same quantities or just an effort for the same format for energy $[kg.m^2.s^{-2}]$ and momentum$[kg.m.s^{-1}]$ otherwise contentually diverse quantities . Serious contradiction arise if we apply into $E_k= p^2/2m_o$ the relativistic momentum $p=m_o.v /(1-v^2/c^2)^{1/2}$ we get $E_k = p^2/2m_o= m_ov^2 /2(1-v^2/c^2)$ but this result so as $E_k= 1/2\ m_ov^2 = p^2/2m_o$ is strictly denied by TR where $E_k=m_o.v.c /(1-v^2/c^2)^{1/2}$ .In CF at low velocity relatively to c the mass rising(or mass equivalent energy) is omitted and classical limit for relativistic momentum is $p=m_o.v /(1-v^2/c^2)^{1/2} =m_ov$. By analogy with momentum for kinetic energy we would expect at high velocities for E_k in TR at least $½m_cv^2/(1-v^2/c^2)^{1/2}$ or rather $E_k = p^2/2m_o=m_ov^2 /2(1-v^2/c^2)$. However by TR refused relation $E_k= 1/2\ m_ov^2= p^2/2m_o$ after applying by analogy to momentum of photon $p= h/\lambda$ for particle $E= p^2/2m_o = h^2/2m_o\lambda^2$ is the principal base of QM . The ratio of kinetic energy and momentum in CF $E/p=v/2$ is linear function but constant in TR $E_k/p=c$ .Moreover from basic QM and TR relation $E=h\nu = hc/\lambda =m c^2$ and $p=h/\lambda =mv$ we obtain two diverse ratio of total energy and momentum as $E/p=m c^2/mv=c^2/v$ and simultaneously $E/p = hc/\lambda / h/\lambda= h\nu/ h/\lambda = \nu\lambda =c$ .This paradox QM solves by formalism of phase and group velocities wave feature of matter .

Ground principles and relations of unification

In this paper it is proposed the statement that

- installation of internal rest energy $E_o=m_oc^2$ necessarily requires installation of internal rest momentum p_o and subsequently total momentum p_t according to rest and total energy in TR
- energy state of particles and their spatial location is firmly bind together so for particles the relations $m= m_o/(1-v^2/c^2)^{1/2}$ and $l=l_o(1-v^2/c^2)^{1/2}$ are valid
- by following these statements we can come to consistent energy and momentum quantities in QM,TR and CF .

In compliance with this premises we can write relations

$(1-v^2/c^2)= m_o^2/m^2 = l^2/l_o^2= \nu_o^2/v^2$ or $v^2/c^2= m^2-m_o^2/m^2 =l_o^2-l^2/l_o^2= (v^2- \nu_o^2) /v^2 =1- \nu_o^2/v^2$
and rewrite them into $m_o^2\, c^2/m^2(c^2-v^2) =1=l^2c^2/l_o^2(c^2-v^2)$ and calibration base for v=0 is
$m_o^2\, c^2/ m_o^2\, c^2=1= l_o^2c^2/l_o^2c^2$.
For each velocity we can write $m_o^2c^2/m^2=l^2c^2/l_o^2$ so $m_o^2l_o^2c^2/l^2=m^2c^2$ for v=0 $m_o^2l_o^2c^2/l_o^2= m_o^2c^2$.
As a constant we can write $h^2= m_o^2l_o^2c^2$ then $h^2/l_o^2= m_o^2c^2$ is bases to which we can write the changes as $h^2/l^2= m^2c^2 =h^2v^2/c^2$ and we predicate that these relations represent the quantity of energy alias total energy.

For added value to calibration base we can write
$m_o^2l_o^2c^2/l^2 - m_o^2l_o^2c^2/l_o^2= m_o^2l_o^2c^2(l_o^2- l^2/l^2\, l_o^2)= m_o^2l_o^2c^2/l^2 .(l_o^2- l^2/ l_o^2)= m_o^2l_o^2c^2/l^2.\, v^2/c^2= m_o^2c^2\, l_o^2/l_o^2(1-v^2/c^2)\, .v^2/c^2 = m_o^2c^2\, /(1-v^2/c^2).v^2/c^2 = m_o^2v^2\, /(1-v^2/c^2)= m_o^2c^2/(1-v^2/c^2) - m_o^2c^2 = m^2c^2 - m_o^2c^2 = m^2v^2 =p^2$ and we predicate that these relations represent the quantity of kinetic energy.
Subsequently for momentum we take out $p=(m^2c^2 - m_o^2c^2)^{1/2} = (m_o^2c^2/(1-v^2/c^2) - m_o^2c^2)^{1/2} = (m_o^2c^2\, v^2/(c^2-v^2))^{1/2} = m_o.v\, /(1-v^2/c^2)^{1/2} =mc/(1-v^2/c^2)^{1/2} - m_oc=mc - m_oc$

We can rewrite then kinetic energy by usage h
$h^2/ l^2- h^2/ l_o^2= h^2/ l^2\, (l_o^2- l^2/l_o^2)= h^2/ l^2.v^2/c^2= h^2/ l_o^2(1-v^2/c^2).v^2/c^2 = m_o^2l_o^2c^2/l_o^2(1-v^2/c^2).v^2/c^2 = m_o^2.v^2/(1-v^2/c^2)=m^2v^2=m^2c^2 - m_o^2c^2 =p^2$
and rewrite momentum by usage h
$p=(h^2/ l^2- h^2/ l_o^2)^{1/2}= (h^2/ l^2.v^2/c^2)^{1/2}= h/l.v/c= h/ l- h/ l_o= m_ol_oc/l_o(1-v^2/c^2)^{1/2}\, v/c= mc.v/c= mv= m_o.v\, /(1-v^2/c^2)^{1/2}$

For total value using added value and rest value we can write
$m^2c^2 = m^2v^2 + m_o^2c^2 = m^2c^2.v^2/c^2 + m_o^2c^2 = m_o^2l_o^2c^2/l_o^2(1-v^2/c^2).v^2/c^2 + m_o^2c^2 = m_o^2c^2/(1-v^2/c^2) = p_t^2= p^2 + p_o^2= p_t^2\, v^2/c^2+ p_o^2$ and $h^2/l^2= h^2/ l^2.v^2/c^2+ h^2/l_o^2= p_t^2= p_t^2\, v^2/c^2+ p_o^2$

For p then it is valid
$p_t=mc=mv+ m_oc = m_o.v\, /(1-v^2/c^2)^{1/2} + m_oc$
$h /l= h/ l.v/c+ h/l_o= p_t= p_t\, v/c+ p_o= p + p_o$
so that $h/ l.v/c= m_o.v\, /(1-v^2/c^2)^{1/2} =mv$

For frequencies we can write
$m^2c^2 =m_o^2l_o^2c^2/l_o^2(1-v^2/c^2)=h^2/l^2= \hbar^2k^2= m_o^2l_o^2\nu_o^2/(1-v^2/c^2)= m_o^2l_o^2v^2= h^2v^2/c^2= \hbar^2\omega^2/c^2 = p_t^2$
$mc=h/l= h\nu/c = p_t$
$m^2v^2= h^2/l^2.\, v^2/c^2 =h^2v^2/c^2.\, v^2/c^2 = p^2$
$mv= h/l.\, v/c =h\nu.\, v/c^2= p$

I.QM

De Broglie introduced postulate that equations for energy and momentum of photon $E=h\nu$ and $p= h/\lambda$ can be transferred to particles by relation $h/\lambda= m_o.v /(1-v^2/c^2)^{1/2}$ assigning them a wave length $\lambda=h/mv$ and energy $E= h\nu$. From this postulate and validity of $E=h\nu =mc^2$ and $p=h/\lambda=mv$ De Broglie came to two different ratios of energy to momentum $E/p=h\nu/ h/\lambda = hc/\lambda / h/\lambda= \lambda\nu = c$ and concurrently $E/p=m c^2/mv =c^2/v$. This paradox De Broglie worked out by phase velocity $w=c^2/v = \lambda\nu$ and group velocity of particle. Consequently phase velocity is always higher than velocity c when at low velocity v phase velocity approach to infinity and at velocity near c phase velocity approach to c .As we show below this is in fact the property of ratio of total momentum to momentum p_t/p . Entire taking – over De Broglie formalism wave property of matter by QM faces to wave function or wave probability of particle propagation .

In this paper it is predicated that the installation of internal rest energy of particle $E_o=m_oc^2$ can not exit without internal motion and therefore necessarily requires installation of inertial rest momentum p_o at real size of particle l_o that can be perceived as rotation of particle resembling QM spin. Consequently the changing in total energy by adding kinetic energy to rest energy is connected with changing of total momentum by adding the momentum p=mv to rest momentum. Relation $p=h/\lambda$ stands for total momentum of photon connected with its concrete total energy and at two concrete energies transferred momentum is $h/\lambda_o - h/\lambda_1$ .So we see that the relation $h/\lambda= m_o.v /(1-v^2/c^2)^{1/2}$ is incorrect because for photon $h/\lambda= p_t$ stands for total momentum while $mv=p$ stands for momentum alias added momentum just as in TR kinetic energy is added energy to whole relativistic energy alias total energy. So for particle part of h/l is internal rest momentum h/l_o at velocity $v=0$ and the correct writing is any of the form $p= h/l.v/c = h\nu/c.v/c= h/l-h/l_o= m_ol_oc/l_o(1-v^2/c^2)^{1/2} .v/c= mc.v/c= mv= m_ov /(1-v^2/c^2)^{1/2} = mc/(1-v^2/c^2)^{1/2} -m_oc=mc-m_oc$. As $h/l=h/ l_o(1-v^2/c^2)^{1/2} = m_ol_oc/l_o(1-v^2/c^2)^{1/2} =mc= p_t$ and $p=mv=mcv/c= m_o.v /(1-v^2/c^2)^{1/2}$ writing $h/l=mv$ or $mc=mv$ is incorrect and for correct writing $mv=h/l .v/c$ we get right relation $mc=h/l$ .Thus we receive symmetry $p_t/p=mc/mv=hl/(hl.v/c)=c/v$.

Then if we use relations $m^2c^2 = h^2/ l^2= h^2v^2/c^2$ a $m^2v^2= h^2/l^2.v^2/c^2 =h^2v^2/c^2 .v^2/c^2 = p^2$ without need for wave function, dispersion relation of phase and group velocities we can write Klein-Gordon equation as $h^2/ l^2- h^2v^2/c^2=0$ so $h^2/l^2 -(h^2v^2/c^2 .v^2/c^2 +m_o^2c^2)=0$ so $h^2/l^2 -h^2v^2/c^2.v^2/c^2= =m_o^2c^2$ so $p_t^2-p^2 = E- p^2=m_o^2c^2$ where l, ν,m are real proper value of particle . If in QM we received relation $h^2/l^2 -h^2v^2/c^2 =m_o^2c^2$ or $\hbar^2k^2 - \hbar^2\omega^2/c^2 = m_o^2c^2$ then in QM we have to implement the reparation by the help of wave function and dispersion relation in order that $k^2= \omega^2/c^2. v^2/c^2$ so $\omega =k.c^2/v$. Otherwise said we have to repair one term $\hbar^2k^2$ or $\hbar^2\omega^2/c^2$ from total energy into added energy that means also from total momentum to momentum Than if we incorrectly hold like energy $\hbar\omega$ and $\hbar k$ we do not hold for total momentum but for momentum the ratio of such energy and momentum is just $\omega/k.=c^2/v$. Klein-Gordon equation we can equivalently write in relations $h^2/l^2 -(h^2v^2/c^2.v^2/c^2 +m_o^2c^2)=0$ or $(h^2/l^2.v^2/c^2+m_o^2c^2) - h^2v^2/c^2=0$ or formally as supplying negative energy $(h^2/l^2- m_c^2c^2) -h^2v^2/c^2.v^2/c^2 =0$ or for added values $h^2/l^2 v^2/c^2-h^2v^2/c^2.v^2/c^2 =0$. Then these relations we can write in shortcut form as $- +\hbar^2k^2 - + \hbar^2\omega^2/c^2 - o + m_o^2c^2=0$ according to our request on express total or adding energy or if we want make the reparation to k or ω .

As it is valid relation $(m^2c^2 - m_o^2c^2)^{1/2} = mc - m_oc$ so $(p_t^2-p_o^2)^{1/2} =p_t-p_o$ so $p_t^2-p_o^2=(p_t-p_o)^2$ consequently we can write Dirac equation $- +\hbar k - + \hbar\omega/c – o + m_oc=0$ .We see that Diracs effort for an equation with terms linear at change energy with time as also is $E=\hbar\omega$ ends in equation for momentum so as relation $E=\hbar\omega$ stands for total momentum as we present in par III. At transition from Klein-Gordon equation expressing energy to Dirac equation expressing momentum we don't have mixed terms so we don't need Diracs matrix and if we take k and ω as proper value of particle we don't need the wave function as well .

II. TR

Following the relation of unification in this paper we declare that for total energy in QM, TR, CF the relations $h^2/l^2= m^2c^2 = m^2v^2 + m_o^2c^2 = p^2 + m_o^2c^2 = h^2/ l^2.v^2/c^2+ h^2/ l_o^2$ are valid and that by relations $h^2/ l^2.v^2/c^2= m_o^2v^2 /(1-v^2/c^2)= m_o^2c^2/(1-v^2/c^2) - m_o^2c^2$ we come to kinetic energy . Contemporary equation of total relativistic energy $E=(m_o^2v^2c^2/(1-v^2/c^2) + m_o^2c^4)^{1/2}$ represents relation for total momentum $p_t=mc=mv+ m_oc$ multiplied by c .The square of contemporary total relativistic energy $E^2=m_o^2v^2c^2/(1-v^2/c^2) + m_o^2c^4$ is transforming by way of classical kinetic energy $E^2- E_o^2 = p^2c^2= m^2v^2c^2= m^2c^4 v^2/c^2=E^2v^2/c^2$ so $E_{k1}^2/ E_{k2}^2= v_1^2/ v_2^2$ that is equal E_{k1}/ E_{k2} in Newtonian limit of CF . And contemporary total relativistic energy is transforming by way of classical momentum $E_k =p.c=mvc= E/ c^2 .vc=E.v/c$ so $E_{k1}/ E_{k2}= v_1/ v_2$ that is equal classical limit p_1/p_2 in CF .The term $m_o^2v^2 /(1-v^2/c^2)$ is binding element of unification of energy and momentum in QM,TR and CF so that for low velocities v comparing to c the classical limit of kinetic energy in CF is $m_o^2v^2/(1-v^2/c^2)= m_ov^2$.The quantities $m_o^2v^2/(1-v^2/c^2)$ and $m_o^2c^2/(1-v^2/c^2)$ are the same quantities shifted by constant $m^2c^2 =m_o^2.v^2/(1-v^2/c^2)+ m_o^2c^2$ and their development and function graph is the same Relativistic relation $E=E^2=m^2c^2 =m^2v^2+ m_o^2c^2$ already reflects total energy without requirement on right part to be multiplied by c^2 with subsequent square root as we exercise it in TR in purpose to be compatible with energy format $[kg.m^2.s^{-2}]$ .So relativity writing $m^2c^2 -m^2 c^2v^2/c^2=m_o^2c^2$ or $E - p^2 = m_o^2c^2$ is equivalent to one of possible writing of K-G equation $\hbar^2\omega^2/c^2- \hbar^2k^2. v^2/c^2 = m_o^2c^2$ where all terms in both equation stands for total , added , rest energy or squared momentum and writing $mc - mcv/c=m_oc$ is equivalent to Dirac equation for instance in one of possible writing $\hbar\omega/c- \hbar k. v/c - m_oc =0$ where all terms in both equation stand for total , added and rest momentum. The equation for total momentum is $p_t =mv+ m_oc$ and after multiplying by c we get present relativistic incorrectly assign as energy $E=p_t c=mc.c=mvc+ m_oc^2$ cause no mixed term exist we can also write it in square $E^2 = p_t^2 c^2 =m_o^2v^2c^2+ m_o^2c^4$. So internal rest energy of the same amount of matter is $E=m_o^2c^2$ Afterwards merely in classical limit we can write $E=m_oc^2=m_ov^2+ m_oc^2$ so relation $E=m_oc^2$ is accurate for v=0 and if we just add amount of particles and don't change their moving energetic state or for low velocities we can write $E=m c^2$ .We cant use equation $E=m c^2$ connecting to relation $m= m_o/(1-v^2/c^2)^{1/2}$ as relation of changing the energetic state of the same amount of matter if we want that this relation would be compared contentually to quantity of classical kinetic energy. Generally we have to write $E=m^2c^2$ since this term comes from relativity so primary is connected with velocity change and if we want to talk about contentually the same quantity as kinetic energy and we want to compare them.

Thus we see that in TR ratio $E/p=m c^2/mv =c^2/v$ stands for ratio of total momentum multiplied by c to momentum and if we do the ratio of total momentum multiplied by c to total momentum we get mc.c/mc=c and that is the base of QM where E/p stands for ration of two same total momentum multiplied by c $E/p= h\nu/ h/\lambda= hc/\lambda / h/\lambda= \lambda.\nu = c$ .The ratio of total momentum to momentum is $mc/mv=c/v$ and $hl/(hl.v/c)= (h\nu/c)/(h\nu/c .c/v)= c/v$ and for real energy $m^2c^2/mv=mc^2/v = m_o/(1-v^2/c^2)^{1/2} c^2/v$ and the same in QM $(h^2/l^2)/(h/l.v/c)= h/l.c/v= m_ol_oc/l_o(1-v^2/c^2)^{1/2} c/v = m_o/(1-v^2/c^2)^{1/2} c^2/v$.

Then kinetic energy we can write $E_k = m_o^2v^2 /(1-v^2/c^2)= m_o^2 c^2v^2/c^2 (1-v^2/c^2)= m_o.c/(1-v^2/c^2)^{1/2} .v/c .m_o.v./(1-v^2/c^2)^{1/2} = p_i.p_e = p_{kt}^2$ so as the same increase of internal and external momentum and so as half of internal and external supplied energy $1/2 E_{ki} +1/2 E_{ke} = =1/2m^2c^2v^2/c^2 +1/2m^2v^2$ where $1/2 E_{ke} =1/2m^2v^2=1/2 m_ov^2$ is what we observe in CF .The energy then we can write $E = E_t = m^2c^2 = m^2v^2+ m_o^2c^2 = m_o^2v^2/(1-v^2/c^2) + m_o^2c^2 = =1/2 m_o^2 c^2v^2/c^2(1-v^2/c^2) + 1/2m_o^2 c^2v^2/c^2(1-v^2/c^2) + m_o^2c^2 = 1/2p_i^2 v^2/c^2 + 1/2p_e^2+ m_o^2c^2$. So the rest energy so as the rest mass are not invariants and depend on velocity of inertial frame as $E_o=1/2 m^2c^2 v^2/c^2 + m_o^2c^2 =1/2 m^2c^2+1/2 m_o^2c^2$ what we see like increasing in mass . If we rewrite the term for internal energy in total energy equation by way of frequency we get $E=1/2m^2c^2v^2/c^2 +1/2m^2v^2+ m_o^2c^2=1/2m_o^2l_o^2c^2/l_o^2(1-v^2/c^2) v^2/c^2+1/2m^2v^2 + m_o^2c^2 = 1/2m_o^2l_o^2 \omega^2/(1-v^2/c^2) v^2/c^2+1/2m^2v^2 + m_o^2c^2 = 1/2 m_o^2l_o^2\omega^2 +1/2m^2v^2 + 1/2m_o^2c^2$.

This way we come to equation for Hamiltonian linear harmonic oscillator in CF $2m_oH=1/2m^2v^2+1/2\ m_o^2l_o^2\omega^2 + 1/2m_o^2c^2$ and its zero energy is $1/2\ m_o^2l_o^2\omega_o^2 +1/2\ m_o^2c^2 = m_o^2l_o^2\omega_o^2 = m_o^2c^2l_o^2/l_o^2 = m_o^2c^2=h^2/l_o^2 = h^2\omega_o^2/c^2$ and its zero momentum is $h\omega_o/c$.
While TR identify entire kinetic energy as $E^2= m^2v^2c^2$ instead of $E= m^2v^2$ and dedicate it to entire external momentum $p^2c^2 = m^2v^2c^2$ instead $E=1/2m^2v^2=1/2\ p^2$ this leads to statement on invariant rest mass and energy in TR .

III. Photon energy

Contemporary relation of photon energy $E=h\ \nu$ is based on Milikan revelation that kinetic energy of electrons $½m_ov^2$ flying up at photoelectric effect out of atoms reflects linear functionality in frequency of photon strike on atoms. But at least the same fair conclusion we can do if we say that though we observe linear changing in frequency of incident photons their energies is changing quadratically and this quadratic change is equal to quadratic change of electrons energies .Similarly in CF we observe linear changing in velocities of objects but their energies are quadratic .From relation $E=h\nu=h.c/\lambda$ we can make deduction that λ and ν are fully alternative just as in photon momentum relation $p= h./\lambda = h\nu/c$ and as the development of momentum and energy is the same so they differs just in constant we can doubt if such energy and momentum are diverse quantities or just the same format quantities like in CF . We may ask if these quantities physical depends just on ν or just on λ or on both parameters and we can conclude that shorter λ has effect at spatial localization matter increase and higher frequencies has effect at shorter time action. If we declare that energy of photon is linear the same way on frequency $E=h\nu$ as on wave length $E=h.c/\lambda$ and if we admit influence of both parameters simultaneously then inverse proportionality of $\nu=c/\lambda$ bring out quadratic changing in energy. We are entitled to say that relations $E=h\nu$ and $E=h.c/\lambda$ stands both for total momentum and represents only part of energy by given parameter so total energy is product of both so$E=h^2c\nu/\lambda$ so $E=h^2c\nu/\lambda=h^2\nu^2=h^2c^2/\lambda^2 =m_o^2\ \lambda_o^2c^2c^2/\lambda_o^2(1-v^2/c^2) = m^2c^4$ and added energy is $m^2c^4 - m_o^2c^4 = m_o^2\ c^4\ \lambda_o^2/\ \lambda^2- m_o^2\ c^4\ \lambda_o^2/\ \lambda_o^2= m_o^2\ c^4\ \lambda_o^2/\ \lambda^2\ .(\ \lambda^2- \lambda^2/\lambda_o^2)= m^2\ c^4v^2/c^2= m^2c^2v^2$ so we get square of present relativistic kinetic energy that as we insist is momentum multiplied by c and real kinetic energy is p^2 . So for product of momentum relation $p_t = h./\lambda = h\nu/c$ we get $p_t^2 = h^2\nu/c\lambda = h^2\nu^2/\ c^2 = h^2/\lambda^2 = m^2c^2$ and added value is $h^2/\lambda^2- h^2/\lambda_o^2= m_o^2\ c^2\ \lambda_o^2/\ \lambda^2- m_o^2\ c^2\lambda_o^2/\ \lambda_o^2= m^2\ c^2v^2/c^2= m^2v^2 =p^2$ what is the real kinetic energy with classical limit $m_c^2\ v^2/(1- v^2/c^2)= m_o\ v^2$. Then explanation of pfotoelectric effect like difference in energy $E-E_o=h\ \omega-h\ \omega_o$ where E_o is the binding energy has to be identify with difference in total momentum of photon equal to momentum change of electron $mc- m_oc=mv$ so with force impart electron necessary escape velocity out of atom passed from photon on electron . Then explanation of pfotoelectric effect by difference in energy has to be identify with difference of total energies of photon equal to kinetic energy of electron $h^2\nu^2/\ c^2-h^2\nu_o^2/c^2= = h^2/\lambda^2- h^2/\lambda_o^2= m^2v^2$ and the half of it $1/2\ m_o\ v^2$ is seen in CF .

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