Einstein's Incomplete derivation of $\Delta L=\Delta mc^2$ (or $\Delta E=\Delta mc^2$) , its critical analysis; and applications of Generalized form $\Delta E =Ac^2\Delta m$.

or

Some hidden aspects of Einstein's Sep 1905 paper

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Theme of discussion

Einstein's Sep. 1905 paper [1] in which $\Delta L=\Delta mc^2$ (light energy –mass equation) is derived, is not completely studied; and is only valid under HANDPICKED or SUPER -SPECIAL CONDITIONS. Here the origin of $\Delta E=\Delta mc^2$ is completely speculative in nature without mathematical derivation. This derivation   (under general conditions) contradicts the LAW OF CONSERVATION OF MATTER. In simple words it implies that when candle burns its mass must increase. Apparently Einstein may had been aware of limitations and complexities of his derivation; hence he only took SUPER SPECIAL VALUES OF PARAMETERS. Thus Einstein derived $\Delta L=\Delta mc^2$ and speculated from it $\Delta E=\Delta mc^2$. The same derivation also gives L α Δmc^2 or   L =A Δmc^2, where A is coefficient of proportionality. Thus Generalized Mass Energy inter conversion equation is derived in other way as $\Delta E =Ac^2\Delta m$, where A is coefficient of proportionality. There are numerous values of constants of proportionality in the existing physics.   Then applications of $\Delta E =Ac^2\Delta m$ are given to justify its validity.

Points to be probed by the learned reviewers.

Part A

(i) **Author has concluded that Einstein's Sep. 1905 paper involve many parameters and Einstein has taken special values of parameters to derive L=Δmc^2. Thus Einstein's mathematical derivation of L=Δmc^2 is true under SUPER SPECIAL or HAND PICKED conditions only.**

Is it correct? If not then how and why?

(ii) **Author has concluded that Einstein's Sep. 1905 derivation leads to conclusions that L α Δmc^2**

Is it correct? If not then how and why?

(iii) **Author has concluded that Einstein had speculated E =Δmc^2 from L=Δmc^2 without mathematical derivation.**

Is it correct? If not then why and how and why?

(vi) **Author has concluded that Einstein derived mass energy inter-conversion equation for 'light energy' then generalized it for every energy (stating the mass of body is measure of its energy content).**

Is it correct? If not then what is correct?

(v) **Author has concluded that Einstein's Sep 1905 derivation also predicts that decrease in mass is more than L/c^2. Hence energy emitted can be different from L/c^2. Thus corresponding to mass 'm', the numerous values of energy (L) are possible.**

Is it correct? If not then how and why ?

(vi) **Einstein should have objected when applications of E =Δmc^2 were extended to nuclear binding energy and other phenomena, as originally L =Δmc^2 was derived to light energy mass inter conversion process.**

He should have objected. If not then how and why?

Part B

VIOLATION OF LAW OF CONSERVATION OF ENERGY/MATTER.

(vii) **Author has concluded that Einstein's Sep. 1905 derivation also predicts that 'when light energy is emitted then mass increases.' It is contradiction of mass and energy.**

Is it correct? If not then how and why ?

(viii) **Author has concluded that under general conditions (energy of light waves is 0.50001L and 0.49999L, wavelengths of each is 5000Å) the recoil velocity of body is 5×10^{-32} m/s.**

Is it correct ? If not then what is correct value?

(ix) Author has deduced generalized mass energy equation $\Delta E = Ac^2\Delta m$ by method of proportionality and integration. Many equations are derived by this method.

Is it correct? If not then what is correct?

Part C

(x) Should $E = \Delta mc^2$ be used to explain the origin of mass of universe 10^{55} kg ?

Is it correct? If not then why?

(xi) Author has given various application of the generalized equation in chemical reactions, nuclear reactions, astrophysical and cosmological reactions and various other phenomena.

Are these correct ? If not then please explain equation wise what is correct equation?

(xii) So far no pre-big bang origin of the universe is described, author has initiated it for first time.

 Is it logical? If not then how and why ? What should be correct ?

Section I

In science an equation is derived for GENERAL SYSTEMS and then results are justified for all cases including special cases.

Einstein derived $L = \Delta mc^2$ for SUPER SPECIAL CASES and IMPOSED results for GENERAL (all) CASES, without mathematically validating the same for general cases.

If Einstein's derivation is studied for GENERAL CASES then the limitations become transparent.

What Einstein actually did in Sep. 1905 paper [1] in which L $=\Delta mc^2$ was derived and E $=\Delta mc^2$ was speculated?

In Einstein's derivation basic equation is

$$\ell^* = \ell \frac{\left[1 - \frac{v}{c}\cos\phi\right]}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad\qquad (1)$$

where ℓ is light energy emitted by body in frame (x,y,z) and ℓ^* is light energy measured in system (ξ, η, ζ), and v is velocity with which the frame or system (ξ, η, ζ) is moving.

Let E_0 and H_0 are energies in coordinate system (x, y, z) and system (ξ, η, ζ) before emission of light energy, further E_1 and H_1 are the energies of body in the both systems after it emits light energy.

Table I. Energies emitted before and after emission by body in Einstein's Sep. 1905 derivation.

Sr No	System (x,y,z)	System((ξ, η, ζ)
1	Before Emission E_0	Before Emission H_0
2	After Emission H_1	Before Emission H_2

Thus Einstein wrote various equations as Energy of body in system (x,y,z)

$$E_0 = E_1 + 0.5L + 0.5L = E_1 + L \qquad (2)$$

Energy of body in system (ξ, η, ζ)

$$H_0 = H_1 + 0.5 \, \beta \, L \{1 - \frac{v}{c}\cos\phi + (1 + \frac{v}{c}\cos\phi \,\} \qquad (3)$$

where $\beta = \dfrac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}}$ $\qquad (4)$

$$H_0 = H_1 + \beta L \qquad (5)$$

Or, $(H_0 - E_0) - (H_1 - E_1) = L\,[\beta - 1] \qquad (6)$

Einstein calculated, kinetic energy of body before emission of light energy, K_0 ($\dfrac{M_b v^2}{2}$)

and kinetic energy of body after emission of light energy, K ($\dfrac{M_a v^2}{2}$) as

$$K_0 - K = L \,\{\frac{1}{\sqrt{1 - \dfrac{v^2}{c^2}}} - 1\} \qquad (7)$$

Einstein considered the velocity in classical region thus applying binomial theorem,

$$K_0 - K = L \left(1 + \frac{v^2}{2c^2} + 3\frac{v^4}{8c^4} + \ldots\ldots\ldots\ldots - 1\right) \qquad (8)$$

Further Einstein quoted [1]
Neglecting magnitudes of fourth and higher orders, we may place.

$$K_0 - K = L\, \frac{v^2}{2c^2} \qquad (9)$$

$$\frac{M_b v^2}{2} - \frac{M_a v^2}{2} = L\, \frac{v^2}{2c^2} \qquad (10)$$

or $L = (M_b - M_a)\, c^2 = \Delta m c^2$ (11)

or Mass of body after emission (M_a) = Mass of body before emission (M_b) $- \dfrac{L}{c^2}$. (12)

Now replacing L (light energy) by E (energy-content or every energy) Einstein wrote:

or $E = (M_b - M_a)\, c^2 = \Delta m c^2$ (13)

or Mass of body after emission (M_a) = Mass of body before emission (M_b) $- \dfrac{E}{c^2}$ (14)

Typical comments regarding classical region of velocity (not given by Einstein).

Einstein's derivation also offers the most mysterious situation in science. It is explained below. The

$$M_{motion} = \frac{M_{rest}}{\sqrt{1 - \dfrac{v^2}{c^2}}} \qquad (15)$$

Let the velocity is in classical region i.e. 10m/s (36m/hr i.e. ordinary speed of vehicle) , we find that no mass of object increases when its move with this velocity or higher velocity, the speed of aeroplane is over 400km/hr.

$M_{motion} = M_{rest} [1 + v^2/2c^2 + 3v^4/8c^4 + \ldots\ldots\ldots] \qquad (16)$

If v = 10m/s (36km/hr)

$M_{motion} = M_{rest} [1 + 5.55 \times 10^{-16} + 4.629 \times 10^{-31} + \ldots\ldots\ldots..] \qquad (17)$

Here even term 5.55×10^{-16} is regarded as negligible, and 4.629×10^{-31} is further negligible thus

$M_{motion} = M_{rest} \qquad (18)$

Thus term 5.55×10^{-18} can be neglected only then both masses are equal when body is at rest. Similarly the orbital velocity of the earth is 30km/s or 3,0000m/s i.e. v/c = 10^{-4}.

$M_{motion} = M_{rest} [1 + v^2/2c^2 + 3v^4/8c^4 + \ldots\ldots\ldots]$

$\qquad = M_{rest} [1 + 5 \times 10^{-9} + 3.75 \times 10^{-17} + \ldots\ldots\ldots..] \qquad (19)$

The mass of earth remain same 5.98×10^{24} kg always. Thus here also the term $v^2/2c^2$ **(5×10^{-9})** is neglected compared to unity. If it is not neglected then mass of earth will be increase per second (1 year = 3.14×10^7 s) and increase by significant amount.

Thus

M_{motion} [mass of earth in motion] = M_{rest} [mass of earth at rest]   (20)

Thus in classical region of velocity (v<<c) , the terms of the order of v^2/c^2 are neglected.

Einstein's similar case i.e. eq.(8)

$$K_0 - K = L\left(1 + \frac{v^2}{2c^2} + 3\frac{v^4}{8c^4} + ... - 1\right)$$ (8)

Now consider the same case when velocity is 10m/s or 36km/hr , then eq. (8) . Under this conditions eq.(8) becomes

$$\frac{M_b v^2}{2} - \frac{M_a v^2}{2} = L[1 + 5.55 \times 10^{-16} + 4.629 \times 10^{-31} + ...-1]$$ (21)

The rest masses and relativistic masses are equal as in eq.(8) if the term 5.55×10^{-16} is neglected. Thus neglecting last two terms in eq.(21) , we get

$M_b - M_a = 0$ (light energy is continuously emitted)

Mass of body before emission = Mass of body after emission   (22)

Thus above deduction is not justified as energy is emitted out of NOTHING, which is violation of Law of Conservation of Energy.

By using eq.(1) in classical region and retaining terms up to second order of v^2/c^2 [this term is neglected when $M_{motion} = M_{rest}$] . Einstein has simply brought term c^2 in the equations.

Part I

The following arguments can be given that Einstein's derivation is true under SUPER SPECIAL or HANDPICKED conditions

1. Einstein [1] has put condition on state of the body: Let there be a **stationary body** in the system (x, y, z), and let its energy--referred to the system (x, y, z) be E_0. Let the energy of the body relative to the system (ξ, η, ζ) moving as above with the velocity v, be H_0.

Einstein also assumed that the body also remains stationary after emission of light energy.

But practically this condition (Light emitting body is stationary) is NOT obeyed in many cases.
(i) The nuclear fission is caused by the thermal neutrons which has velocity 2185m/s. The uranium atom also moves as it is split up in barium and krypton, and EMIT energy.

(ii) When a gamma ray photon of energy at least 1.02MeV, moves near the field of nucleus it is split up in electron and positron pair [2]. The gamma ray photon is in motion

and so is the position of electron and positron pair.

(iii) Similarly the particle and antiparticle moves towards each other for annihilation. The particle and antiparticle collide then annihilation takes place. In nuclear fusion the atoms are in motion.
THESE PHENOMENA WERE NOT DISCOVERED IN EINSTEIN'S TIME.

(iii) When a paper burns then it is also sets in motion and energy in various forms is emitted. Chemical reactions were discovered in Einstein's time.

EINSTEIN NEVER DISCUSSED THIS PHENOMENON IN HIS WORKS.
So Einstein's condition that body is STATIONARY, emits light energy and its mass decreases, is not justified.

1(a) Other conditions on Einstein's derivation.

Einstein's Sep. 1905 derivation [1] of $\Delta L = \Delta mc^2$ is true under SUPER SPECIAL CONDITIONS OR HANDPICKED CONDITIONS only. It is justified below. In the derivation of $\Delta L = \Delta mc^2$ there are FOUR variables e.g.

(a) Number of waves emitted,

(b) l magnitude of light energy,

(c) Angle ϕ at which light energy is emitted and

(d) Uniform velocity, v

These variables have numerous values.

Einstein has taken SUPER SPECIAL or HANDPICKED VALUES of parameters. Thus for complete analysis the derivation can be repeated with all possible values of parameters. In all cases the law of conservation of momentum is obeyed (which is discussed in next sub-section).

(A) The body can emit large number of light waves but Einstein has taken only **TWO light waves emitted by luminous body.**

Why one or n   light energy waves are neglected ?

(B) The energy of two emitted light waves may have different magnitude **but Einstein has taken two light waves of EQUAL magnitudes (0.5L each).**

Why other magnitudes (0.5001L and 0.4999L) are neglected by Einstein ?

(C) Body may emit large number of light waves of different magnitudes of energy making DIFFERENT ANGLES **(other than 0º and 180º as assumed by Einstein).**

Why other angles are neglected by Einstein ?

(D) Einstein has taken velocity in classical region (v<<c and applied binomial theorem) has not at all used velocity in relativistic region. If velocity is regarded as in relativistic region (v is comparable with c), then equation for relativistic variation of mass with velocity i.e.

$$M_{rel} = \frac{M_{rest}}{\sqrt{1 - \dfrac{v^2}{c^2}}} \qquad\qquad (15)$$

is taken in account. It must be noted that before Einstein's work this equation was given by Lorentz [3-4] and firstly confirmed by Kaufman [5] and afterwards more convincingly by Bucherer [6]. Einstein on June 19, 1948 wrote a letter to Lincoln Barnett [7] and advocated abandoning relativistic mass and suggested that is better to use the expression for the momentum and energy of a body in motion, instead of relativistic mass.

It is strange suggestion as Einstein has used relativistic mass in his work including in the expression of relativistic kinetic energy [8] from which rest mass energy is derived [9-10].

(a) Why the relativistic values of v are not considered?

(b) Why the case v = 0 is not discussed?

The law or phenomena of inter-conversion of mass and energy holds good in ALL CASES FOR ALL BODIES and energies under all conditions. But Einstein has taken special values of parameters [11-24] to derive equation $L = \Delta mc^2$ i.e. to confirm that conversion factor between mass and energy is c^2. Then from $L = \Delta mc^2$ Einstein speculated $E = \Delta mc^2$, however from the derivation of $L = \Delta mc^2$, $L \, \alpha \, \Delta mc^2$ or $L = A \, \Delta mc^2$ is equally possible.

Einstein has considered body emits light energy, but simultaneously body may also EMIT HEAT energy which is not taken in account in Einstein's derivation. A burning body emits heat, sound and LIGHT ENERGIES simultaneously. For proper description of heat energy-mass inter-conversion we need equation equivalent to eq.(1). Similar is the case of other energies.

Further Einstein has considered that body sends plane light waves (in visible region). But energy can also be emitted in the invisible region and Einstein did not mention at all about HEAT and SOUND ENERGIES (emitted along with light energy). Thus energies other than light energy are also emitted but NEGLECTED by Einstein in the derivation. So energies are NOT taken in account completely.

Table II   The values of various parameters considered by Einstein and neglected   by Einstein in the derivation of Light Energy Mass equation $L = \Delta mc^2$.

OR

Values of parameters Einstein considered,

and

Values of parameters Einstein did not consider?

Sr No	Parameters	Einstein considered	Einstein neglected (No reason was given by Einstein why parameters are neglected).
1	No. of light waves	Two Light Waves	One, three, four or n waves
2	Energy of light wave	Equal 0.5L and 0.5L each	Energies of the order of 0.50001L and 0.49999L are also possible. There are numerous such possibilities, which need to be probed.
3	Angle	0° and 180°	The angles can be 0° and 180.05° or 0.9999° and 180° are also possible. There are numerous such possibilities which need to be probed.
4	Velocity	Classical region	The velocity can be in relativistic region. The system (ξ, η, ζ) can be rest i.e. v=0. All the cases need to be probed. If v=0 derivation is NOT applicable.
5	Velocity	Uniform In classical region	The law of inter-conversion of mass to energy also holds good, when velocity is in , relativistic, classical regions or when v = 0. The velocity v can also variable.

Deductions : Einstein has taken only super-special values of parameters , and neglected many realistic values.

 Is Einstein given arbitrary authority for beyond logic of science for interpretation?

2. Einstein's derivation predicts that L $\alpha \Delta mc^2$ or   L =A Δmc^2.
 Thus energy emitted can be different from L = Δmc^2.

 Einstein has considered a body emitting two light waves of energy 0.5L each just in opposite

directions. It is equally possible that body may emit two light waves on energy 0.50001L and 0.49999L. Then equations equivalent to Einstein's equations can be written as [11-24]

$H_o = H_1 + 0.50001\ \beta\ L[(\ 1 - v/c\ \cos 0º)] + 0.49999\ \beta\ L\ [1 - v/c\ \cos 180º)]$ (23)

$H_o = H_1 + 0.50001\ \beta\ L[(\ 1\ - v/c)] + 0.49999\ \beta\ L\ [1 + v/c\ \cos\ )]$ (24)

$H_o = H_1 + 0.50001\ \beta\ L - 0.50001\ \beta\ L\ v/c + 0.49999\ \beta\ L + 0.49999\ \beta\ L\ v/c$

$H_o = H_1 + \beta\ L - 0.00002\ \beta\ L\ v/c$ (25)

$E_o = E_1 + L$ (2)

$(H_o - E_o) = (H_1 - E_1) + \beta\ L - 0.00002\ \beta\ L\ v/c - L$ (26)

$(H_o - E_o) - (H_1 - E_1) = \beta\ L - 0.00002\ \beta\ L\ v/c - L$ (27)

$= \beta\ L\ (\ 1 - 0.00002\ v/c) - L$ (28)

$= L\ [\beta\ (\ 1 - 0.00002\ v/c) - 1\ ]$ (29)

$= L\ [\ (\ 1 + v^2/2c^2\ )(\ 1 - 0.00002\ v/c) - 1\ ]$

$= L[\ 1 - 0.00002\ v/c + v^2/2c^2 - 1\ ]$ (30)

$K_b - K_a = L\ [\ 1 - 0.00002\ v/c + v^2/2c^2 - 1\ ]$ (31)

$K_b - K_a = L\ [\ -0.00002\ v/c + v^2/2c^2\ ]$ (32)

$M_b v^2/2 - M_a v^2\ /2 = L\ [\ -0.00002\ v/c + v^2/2c^2\ ]$ (33)

$M_b - M_a = L\ [\ -0.00004/cv + 1/c^2\ ]$ (34)

$\Delta mc^2 = L[-0.00004c/v + 1]$ (35)

$L = \Delta mc^2\ /\ [-0.00004c/v + 1]$ (36)

$-0.00004c/v = -0.00004 \times 3 \times 10^8\ /\ 10 = -1200$ (37)

$L = \Delta mc^2\ /\ [-1200 + 1] = \Delta mc^2\ /-1199$ (38)

$L\ \alpha\ \Delta mc^2$ or $L = A\ \Delta mc^2$

Where A is coefficient of proportionality (many in existing physics).

Thus when general conditions are applied then Einstein's Sep. 1905 derivation itself PUTS FORTH the GENERALIZED FORM which is $L = A\ \Delta mc^2$ [11-24]. Thus conversion factor between mass and energy is NOT always c^2, in Einstein's derivation. Hence the value of conversion factor other than c^2 is clearly also supported from Einstein's derivation, if properly analysed.

3. Einstein's Sep. 1905 derivation predicts

Increase in mass of luminous body when Light Energy is emitted.

We have eq.(34) as

$M_b - M_a = L\ [\ -0.00004/cv + 1/c^2\ ] = -0.00004L/cv + L/c^2$ (34)

$M_a = M_b + 0.00004L/cv - L/c^2$ (34)

$0.00004L/cv = 4L/10^5\ \times 3 \times 10^8 \times 10 = 4L\ /\ 3 \times 10^{14} = 1.333L/\ 10^{14}$ (39)

$L/c^2 = L/9 \times 10^{16} = 1.111L/\ 9 \times 10^{16} = 1.111 \times 10^{17}$ (40)

$0.00004L/cv - L/c^2 = 1.333L/\ 10^{14} - 1.111\ x10^{17}$ IS POSITIVE QUANTITY

$M_a = M_b + 0.00004L/cv - L/c^2 = M_b$ + POSITIVE QUANTITY   (41)

Mass increases when light energy is emitted.

It is contradiction of Law of Conservation of energy. How does double increase happen?
(i) How energy is emitted?

(ii) How mass increases?
HOW DOES DOUBLE INCREASE HAPPEN SIMULTANEOUSLY ? No experiment can justify this.

Now %age difference (in energy) between Einstein's special derivation and Generalized derivation can be calculated.
%age increase = $\{L/c^2 - [- 0.00004/cv + L/c^2]\} \times 100/ L/c^2$
$\qquad = 1.2 \times 10^5$ $\hspace{6cm}$ (42)

4. If the direction (angles) of waves is exchanged then results from Einstein's derivation are ENTIRELY DIFFERENT.

In previous case it is regarded as waves of energy 0.50001L makes angle $0°$ with x-axis , and wave of energy 0.49999L makes an angle $180°$.
In this case result is
'when body emits light energy its mass increases '
But if angles of the waves are interchanged then results are entirely different. It is justified below.

$H_o = H_1 + 0.49999\, \beta L[(\ 1 - v/c \cos 0°)] + 0.50001\, \beta\, L\, [1 - v/c \cos 180°)]$ $\quad$ (43)
$H_o\ = H_1 + 0.49999\, \beta\, L[(\ 1\ - v/c)] + 0.50001\, \beta\, L\, [1 + v/c \cos)]$ $\qquad$ (44)
$H_o\ = H_1 +\ 0.49999\ \beta\, L - 0.49999\, \beta\, L\, v/c +\ 0.50001\, \beta\, L +\ 0.50001\, \beta\, L\, v/c$
$H_o\ = H_1 +\ \beta\, L + 0.00002\ \beta\, L\, v/c$ $\qquad\qquad$ (45)
$E_o = \ E_1 + L$ $\hspace{6cm}$ (46)
$(H_o - E_o) = (H_1 - E_1)\ +\beta\, L + 0.00002\ \beta\, L\, v/c - L$ $\qquad$ (47)

$(H_o - E_o) - (H_1 - E_1)\ =\ \beta\, L + 0.00002\ \beta\, L\, v/c - L$ $\qquad\qquad$ (48)
$\qquad\qquad\qquad = \beta\, L\, (\ 1 + 0.00002\ v/c) - L$
$\qquad\qquad\qquad = L\, [\beta\, (\ 1 + 0.00002\ v/c) - 1\ ]$
$\qquad\qquad\qquad = L\, [\ (\ 1 + v^2/2c^2\ )(\ 1 + 0.00002\ v/c) - 1\ ]$
$\qquad\qquad\qquad = L[\ \ 1 + 0.00002\ v/c +\ v^2/2c^2 - 1\ ]$ $\qquad$ (49)

$K_b - K_a\ =\ \ L\,[\ 1 + 0.00002\ v/c +\ v^2/2c^2 - 1\ ]$ $\hspace{4cm}$ (50)
$K_b - K_a\ =\ \ L\,[\ \ 0.00002\ v/c +\ v^2/2c^2\ ]$
$M_b v^2/2 - M_a v^2\,/2 = L\,[\ 0.00002\ v/c +\ v^2/2c^2\ ]$ $\hspace{2.5cm}$ (51)
$M_b - M_a = L\,[\ \ 0.00004/cv +\ 1/c^2\,]$ $\hspace{4cm}$ (52)
$\Delta mc^2\ =\ L[\ 0.00004c/v +\ 1]$ $\hspace{5cm}$ (53)
$L =\ \ \Delta mc^2\,/\,[\ 0.00004c/v +\ 1]$ $\hspace{4.5cm}$ (54)
$L = \Delta mc^2\,/\,[0.00004c/v + 1] = \Delta mc^2\,/\,[1200+1] = \Delta mc^2\,/\,[1201]$

IN THIS CASE MASS DECREASES MORE THAN L/c^2
SO EINSTEIN'S DERIVATION DOES NOT GIVE FIXED VALUE OF ENERGY corresponding to mass annihilated.

$L\ \alpha\ \Delta mc^2\quad$ or $\quad L = A\ \Delta mc^2$ $\hspace{5cm}$ (55)
Where A is coefficient of proportionality.

Decrease in mass is more than L/c^2
$M_b - M_a = L\,[0.00004/cv +\ 1/c^2\,]$ $\hspace{4.5cm}$ (56)
$M_a =\ M_b - 0.00004L/cv -\ L/c^2$ $\hspace{4.5cm}$ (57)
Thus Einstein's derivation gives self contradictory results. $L\ \alpha\ \Delta mc^2$ is re-justified. Hence it must be re-derived by new method [11-24].

5.   The equation

$$\ell^* = \ell \frac{\left[1 - \frac{v}{c}\cos\phi\right]}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (57)$$

is NOT meant for

(i) sound energy,   (ii) heat energy,   (iii) chemical energy,

(iv) nuclear energy, (v) magnetic energy, (vi) electrical energy,

(vii) energy emitted in form of invisible radiations,

(viii) attractive binding energy of nucleus

(xi)   energy emitted in cosmological and astrophysical phenomena

(x) energy emitted volcanic reactions

(xi) energies co-existing in various forms etc. etc.

The reason is that all energies have different type of nature, and the energies are not

confirmed to obey the same equation.

Einstein initially derived 'light energy'–mass inter-conversion equation $L = \Delta mc^2$, then speculated 'every energy' –mass equation $E = \Delta mc^2$ from $L = \Delta mc^2$. As eq. (1) is only meant for light energy, not for other energies. Hence speculative transition to $E = \Delta mc^2$ from $L = \Delta mc^2$ is absolutely without any mathematical basis.

6. If the measuring system is at rest (v=0) and body emits two light waves as in Einstein's derivation then derivation is not applicable.
However in this case EXPERIMENTALLY when light energy is emitted mass decreases. It is serious limitation of Einstein's derivation.

When the measuring system (ξ, η, ζ) is at rest $v = 0$ then
$$\ell * = \ell \qquad (58)$$
$$H_o = H_1 + L/2 + L/2 \qquad (59)$$
$$E_o = E_1 + L \qquad (2)$$
$$(H_o - E_o) - (H_1 - E_1) = 0$$
As body is at rest then $(H_o - E_o)$ or $(H_1 - E_1)$ cannot be interpreted as kinetic energy.
Hence further derivation is not APPLICABLE.
It is serious limitation of Einstein's derivation, which is regarded as general in nature.

7. If velocity of body is such that $v^2/c^2 \ll 1$, then eq.(1) becomes

$$\ell * = \ell\left[1 - \frac{v}{c}\cos\phi\right] \qquad (60)$$

$$H_0 = H_1 + 0.5L\left[1 - \frac{v}{c}\cos\phi\right] + 0.5\left[1 + \frac{v}{c}\cos\phi\right] \qquad (61)$$

$$H_o = H_1 + 0.5L[2] = H_1 + L \qquad (59)$$
$$E_0 = E_1 + L \qquad (2)$$
$$(H_o - E_o) - (H_1 - E_1) = 0$$
$$M_b v^2/2 - M_a v^2/2 = 0$$
$$M_b = M_a \qquad (22)$$
Mass before emission = Mass after emission

It is again inconsistent prediction from Einstein's derivation that
(i) Energy is being emitted
(ii) Mass remains the same.
It is violation of law of conservation of matter. It is the most serious limitation.

8. Similar results are obtained if one angle is slightly changed ($180°$ to $180.05°$) in Einstein's derivation and other parameters remain the same [11-24].

   Einstein's angle = $180°$ Now angle $180.05°$ Results ???

$H_0 = H_1 + 0.5\ \beta L\ [\ (1 - v/c\ \cos 0°) + (1 - v/c\ \cos 180.05°)]$ (62)
 $H_0 = H_1 + 0.5\ \beta L[1 - v/c + 1 + 0.999999619 v/c]$

$H_0 = H_1 + 0.5\ \beta L[2 - 0.00000038 v/c]$ (63)
$E_0 = E_1 + L$
 $(H_o - E_o) - (H_1 - E_1) = \beta L[2 - 0.00000019] - L$
  $K_0 - K_1 = L[\beta(1 - 0.00000019 v/c) - 1]$
       $= L[(1 + v^2/2c^2)(1 - 0.00000019 v/c) - 1]$ (64)

$M_b v^2/2 - M_a v^2/2 = L[-0.00000019 v/c + v^2/2c^2]$
$M_b - M_a = -0.00000038 L/cv + L/c^2$
$M_a = M_b + 0.00000038 L/cv - L/c^2$ (65)

$v = 1 m/s$ or $3.6\ km/hr$
$-0.00000038 L/cv = -38/10^8 \times 3 \times 10^8 = 1.266/10^{15}$
$L/c^2 = L/9 \times 10^{16} = 1.11 L/10^{17}$ (66)
$1.266/10^{15} > 1.11 L/10^{17}$ (67)
Mass after emission = Mass before emission + positive quantity   (68)

It is contradiction of law of Conservation of Energy/Mass.
(i) How energy is emitted?
(ii) How mass increases?
HOW DOES DOUBLE INCREASE HAPPEN? No experiment can justify this prediction from Einstein's Sep. 1905 derivation. **It is the most serious limitation.**

%age increase in energy = $\{L/c^2 - (-0.00000038 L/cv + L/c^2\}\times 100/L/c^2$

         $38 \times 3 \times 10^8 \times 100/10^8 = 1.14 \times 10^4$ (69)

9. Relativistic Velocity: In the derivation Einstein has done calculations under classical conditions of velocity ($v \ll c$) and applied Binomial Theorem. Thus derivation of $L = \Delta mc^2$ is under classical conditions, and hence is obviously applicable under similar conditions. It implies that inter-conversion of mass energy takes place ONLY under CLASSICAL CONDITIONS.

        However the inter-conversion of mass and energy **ALSO** takes place under RELATIVISTIC CONDITIONS e.g. when a gamma ray photon (have speed approaching to c) of energy at least 1.02MeV, moves near the field of nucleus it is split up in electron and positron pair. The nuclear fusion of hydrogen, requires temperature of the order of 10^8 K. It also sets nuclei in motion.

So it is limitation of Einstein's derivation. Einstein's Sep. 1905 derivation implies that inter-conversion of mass and energy takes place under classical conditions of velocity, whereas experimentally the inter-conversion of mass and energy also takes place under RELATIVISTIC CONDITIONS [11-24]. The inter conversion of mass to energy also takes place when body (source) is at rest e.g. radioactive source emits radiations. It is believed that Einstein may have been influenced by radioactive emission of radiations, as he has hinted applications of theory to radium salts (highly radioactive, one million times more radioactive than uranium). Another limitation of the derivation is that if the measuring system i.e. **system** (ξ, η, ζ) is at rest then equation $L = \Delta mc^2$ is not derivable.

(10) (a) When one wave is emitted $\phi = 90°$

$H_0 = H_1 + L \beta (1 – v/c \cos 90°)$

$\quad H_0 = H_1 + L \beta$ $\hspace{4cm}$ (5)

$E_0 = E_1 + L$ $\hspace{4.5cm}$ (2)

$(H_o – E_o) – (H_1 – E_1) = L \beta – L = L (\beta – 1)$

$K_0 – K_1 = L [1 + v^2/2c^2 - 1] = Lv^2/2c^2$

$m_b – m_a = L/c^2$

$m_a = m_b – L/c^2$

When angle is 89.999°

$H_0 = H_1 + L \beta (1 – v/c \cos 89.99°)$

$H_0 = H_1 + L \beta (1 – 0.000017453 v/c)$ $\hspace{2.5cm}$ (70)

$E_0 = E_1 + L$ $\hspace{6cm}$ (2)

$(H_o – E_o) – (H_1 – E_1) = L \beta (1 – 0.000017453 v/c) – L$

$\hspace{3cm} = L [\beta (1 – 0.000017453 v/c) - 1\}$

$\hspace{3cm} = L [(1 + v^2/2c^2) (1 – 0.000017453 v/c) – 1]$ $\hspace{1cm}$ (71)

$\quad M_b v^2/2 – M_a v^2 /2 = – 0.000017453 Lv/c + Lv^2/2c^2$

$M_b – M_a = – 0.000034906 L/cv + L/c^2$

$M_a = M_b + 0.000034906 L/cv – L/c^2$ $\hspace{3cm}$ (72)

$0.000035 L/vc = 35L/10^6 \times 3 \times 10^8 = 11.66L /10^{14} = 1.166L / 10^{13}$

$L/c^2 = L / 9 \times 10^{16} = 1.11L /10^{17}$

Mass after Emission = Mass before emission + $0.000034906 L/cv – L/c^2$

Mass after Emission = Mass before emission + positive quantity

Thus again when light energy is emitted mass INCREASES, which is contradiction of Law Conservation of Matter.

(b) When two waves are emitted identically as in Einstein's case. Only difference is that in this case one angle is regarded as 0.9999° instead of 0°. The other angle remains 180°.

$H_0 = H_1 + 0.5 \beta L [(1 - v/c \cos 0.9999°) + (1 - v/c \cos 180°)]$ $\hspace{2cm}$ (73)

$H_0 = H_1 + 0.5 \beta L [(1- v/c\ 0.99984773) + (1+v/c)]$

$H_0 = H_1 + 0.5 \beta L\ -0.499923865\ \beta L\ v/c + 0.5\ \beta L + 0.5\ \beta L\ v/c$ (74)

$H_0 = H_1 + \beta L + 0.000076135\ \beta L\ v/c$

$E_0 = E_1 + L$

$(H_o - E_o) - (H_1 - E_1) = \beta L + 0.000076135\ \beta L\ v/c - L$

$\qquad\qquad\qquad = L\ [\beta(1+0.000076135\ v/c) - 1]$

$\qquad\qquad\qquad = L\ [(1+v^2/2c^2)(1+0.000076135\ v/c) - 1]$

$\qquad\qquad\qquad = L\ [1+0.000076135\ v/c + v^2/2c^2 - 1]$

$\qquad\qquad\qquad = L\ [0.000076135\ v/c + v^2/2c^2]$ (75)

$K_0 - K_1 = L\ [0.000076135\ v/c + v^2/2c^2]$

$\quad M_b v^2/2 - M_a v^2/2 = L\ [0.000076135\ v/c + v^2/2c^2]$

$M_b - M_a = [0.000076135\ L/cv + L/c^2]$ (76)

$M_a = M_b - 0.000076135\ L/cv - L/c^2$

Thus decrease in mass is more than predicted by Einstein's derivation.

Conclusion: Einstein's Sep. 1905 derivation NOT ONLY implies $L\ \alpha\ \Delta mc^2$ or $L = A\ \Delta mc^2$ ($E\ \alpha\ \Delta mc^2$ or $E = A\ \Delta mc^2$) , but also contradicts the Law of Conservation of Matter [11-24].

Table III   Comparison of RESULTS under Einstein's SUPER SPECIAL CONDITIONS or HANDPICKED CONDITIONS and GENERAL CONDITION in Sep. 1905 derivation.

Sr. No	Energy of first wave	Energy of second wave	Angle of first wave	Angle of second wave	$\Delta m = m_b - m_a$	Mass after emission (m_a)	%age difference
1	0.5L	0.5L	0°	180°	$\Delta m = L/c^2$	Decreases	NA
2	0.50001L	0.49999L	0°	180°	$\Delta m = -0.00004 L/cv + L/c^2$	Increases	1.2×10^6
3	0.49999L	0.50001L	0°	180°	$\Delta m = 0.00004 L/cv + L/c^2$	Decreases $> L/c^2$	-1.2×10^6
4	0.5L	0.5L	0°	180.05°	$\Delta m = -0.00000038 L/cv + L/c^2$	Increases	1.14×10^4
5	0.5L	0.5L	0.9999°	180°	$\Delta m = 0.00007613\ L/cv + L/c^2$	Decreases $> L/c^2$	-2.28×10^6
6	L	NA	90°	NA	$\Delta m = L/c^2$	Decreases	NA
7	L	NA	89.99°	NA	$\Delta m = -0.0000349 L/cv + L/c^2$	Increases	1.04×10^6

Deductions: Law of conservation of energy is violated e.g. Einstein's derivation implies L α Δmc^2, energy may be emitted more than L/c^2, when light energy is emitted mass increases.

Is Einstein given special authority for beyond logic of science the same ?

Part II

If body recoils when waves of different light energy are emitted.

The main equation in Einstein's derivation is

$$\ell^* = \ell \frac{\left[1 - \frac{v}{c}\cos\phi\right]}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (1)$$

where v is relative velocity between light emitting body in system (x,y,z) and measuring system **i.e. system** (ξ, η, ζ).

(i) If light emitting body is at rest then relative velocity of measuring system is only 'v'.

(ii) If light emitting body recoils away from the body V_R , then relative velocity will be

$\qquad$ v + V_R

(iii) If light emitting body is drifted towards the measuring system with velocity V_R then relative velocity will be

$\qquad$ v– V_R

But in this case the recoil velocity V_R is of the order of 5×10^{-32} m/s and with velocity body can travel a distance of 1.57×10^{-23} m in 10 years (which is undetectable).

Thus recoil velocity has no effect on the derivation.

This equation is similar to

$$M_{motion} = \frac{M_{rest}}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (15)$$

as far velocity of measuring system is concerned. Let body is placed in reference frame (x,y,z) and its mass is measured in other frame (X,Y,Z) which is moving with velocity v. If the body moves away from the measuring frame , even then its mass changes. Thus in this regard eq.(1) and eq.(15) has similar status.

How do mathematical equations vary when V_R is taken in account ?
Here main difference is that velocity is taken as (v± V_R) say (v + V_R)

$$\ell^* = \ell \frac{\left[1 - \frac{v + V_R}{c} \cos\phi\right]}{\sqrt{1 - \frac{[v + V_R]^2}{c^2}}} \qquad (77)$$

Now this equation can be applied to study variation in mass and light energy emitted as in case of eq.(1).

2.11 Conservation of momentum in general cases

helps in

Calculations of recoil velocity

This case is similar to recoil of the gun but here two feasible waves are emitted.

The momentum is conserved irrespective of the fact that body remains at rest or recoils after emission of light energy [25].

In case of Einstein's derivation momentum is confirmed in special and general cases.

(i) **When light emitting body remains at rest after emission.** In this case recoil velocity is zero i.e. $V_R = 0$, it is calculated by applying law conservation of momentum.

(ii) **When light emitting body recoils due to emission of two waves in different directions**. In this case velocity of recoil is NON-ZERO and calculated by applying law of conservation of momentum. Einstein did not consider that case.

The law of conservation of momentum can be used to calculate the velocity of recoil in this case also. Let the body of mass 1 kg emits in two waves in visible region of wavelength 5000ºA , it corresponds to $2hc/\lambda$ or 7.9512×10^{-19} J , and the energy is divided in two waves.

 Let body emits light energy (towards the observer, $\varphi = 0º$)   0.50001L i.e.

$E_1 = 3.97568 \times 10^{-19}$ J $\hspace{4cm}$ (78)

and momentum

$p_1 = E_1/c =$ 1.32522×10^{-27} kg m/s $\hspace{3cm}$ (79)

Secondly, the body emits light wave of energy (away from the observer, $\varphi = 180º$)   0.49999L i.e.

 $E_2 = 3.97522 \times 10^{-19}$ J $\hspace{4cm}$ (80)

 momentum $p_2 = E_2/c = 1.32517 \times 10^{-27}$ kg m/s. $\hspace{2cm}$ (81)

Let us assume that when the body emits light waves of energy and recoils (if it actually does) with velocity V_r .

Initial momentum of waves + initial momentum of luminous body $= 0 + 0$ $\hspace{1cm}$ (82)

Final momentum of waves + final momentum of body $= -p_1 + p_2 + MV_b$ $\hspace{1cm}$ (83)

One wave (having momentum p_2 moves towards) the direction in which body recoils and other wave moves in the opposite direction.

Then according to law of conservation of momentum we get

$$0 = - p_1 + p_2 + M_b V_r \qquad (84)$$

$$V_R = - (- p_1 + p_2) / M_b = - (-1.32522 + 1.32517) \times 10^{-27} = 0.00005 \times 10^{-27}$$

$$= 5 \times 10^{-32} \text{ m/s} \qquad (85)$$

The velocity 5×10^{-32} m/s means body remains at rest.

A body is said to at rest if it does not change its position w.r.t. to surroundings.

It is analogous to observation that a CAR cannot move when head light is switched on.

Thus conservation of momentum requires that body should move with velocity 5×10^{-32} m/s towards the observer. With this velocity the body will recoil for distance equal to

$$S(10 \text{ years}) = 5 \times 10^{-32} \text{ m/s} \times 3.14 \times 10^7 \times 10 = 1.57 \times 10^{-23} \text{ m} \qquad (86)$$

which is undetectable by all means hence conceptually body can be regarded as at rest.

Thus body will tend to move with velocity 5×10^{-32} m/s(towards the observer) which is immeasurably small by all means, hence the body remains at rest.

This recoil velocity (V_R) i.e. 5×10^{-32} m/s is negligible compared to the velocity of the measuring system.

$$S \text{ (10 years)} = vt = 5 \times 10^{-32} \text{ m/s} \times 3.14 \times 10^7 \times 10 = 15.7 \times 10^{-24} \text{ m} = 1.57 \times 10^{-23} \text{ m} \qquad (87)$$

Size of nucleus $= 10^{-14}$ m

$$S(10 \text{ years}) = 1.57 \times 10^{-9} \text{ size of nucleus} \qquad (88)$$

Thus body moves a distance of 1.57×10^{-23} m which is immeasurable. Hence body can be regarded as at rest, as in case of Einstein's derivation when two waves are emitted.

Even bigger numerical values are neglected in Physics e.g. in the relativistic variation of mass

$$M_{motion} = \frac{M_{rest}}{\sqrt{1 - \dfrac{v^2}{c^2}}} \qquad (15)$$

$$M_{motion} = M_{rest} [1 + v^2/2c^2 + 3v^4/8c^4 + \ldots\ldots\ldots]$$

$$= M_{rest} [1 + 5.55 \times 10^{-18} + 4.629 \times 10^{-31} + \ldots\ldots\ldots]$$

Here velocity is regarded as 1m/s in classical region. Like wise velocity 5×10^{-32} m/s will be regarded as neglected.

Here even term 5.55×10^{-18} is regarded as negligible, thus

$$M_{motion} = M_{rest}$$

Thus equations for recoil momentum and recoil kinetic energy KE recoil will be

$$P_{recoil} = 5 \times 10^{-32} \text{ kgm/s} \qquad (89)$$

$$KE_{recoil} = 12.5 \times 10^{-64} \text{ kgm}^2/\text{s}^2 \qquad (90)$$

Due to this uniform relative velocity v of the system (ξ, η, ζ) will not change

within measurable limits, however effect of V_r can be considered for completeness[11-24]. It is discussed below.

.   **Einstein's Sep. 1905 derivation predicts**
Increase in mass of luminous body when Light Energy is emitted.
            Recoil Velocity has no effect on the results.

If velocity of recoil is taken in account, then eq.(34) becomes
$M_b - M_a = L [- 0.00004/c (v+5\times10^{-32} \text{ m/s}) + 1/c^2]$
$= - 0.00004L/c(v+5\times10^{-32} \text{ m/s}) + L/c^2$ (91)

$M_a = M_b + 0.00004L/c(v+ 5\times10^{-32} \text{ m/s}) - L/c^2$ (92)
$0.00004L/c(v+5\times10^{-32} \text{ m/s}) = 4L/10^5 x\ 3x10^8 x[10+ 5\times10^{-32} \text{ m/s}] = 4L / 3\times10^{14}$
$= 1.333L/ 10^{14}$
$L/c^2 = L/9\times10^{16} = 1.111L/ 10^{16} = 1.111\times10^{17}$

$0.00004L/c(v+V_R) - L/c^2 = 1.333L/ 10^{14} - 1.111\times10^{17}$ IS POSITIVE QUANTITY

$M_a = M_b + 0.00004L/cv - L/c^2 = M_b + \text{POSITIVE QUANTITY}$ (93)

Mass increases when light energy is emitted.

It is contradiction of law of Conservation of energy. How does double increase happen?

(i) How energy is emitted ?

(ii) How mass increases ?

Thus Einstein's Sep. 1905 derivation leads to contradictory results frequently.

  Recoil Velocity does not change the contradictory results.

   $H_o = H_1 + 0.50001 \beta L[(1 - v/c \cos0º)] + 0.49999 \beta L [1- v/c \cos 180º)]$ (94)
$H_o = H_1 + 0.50001 \beta L[(1 - (v+V_R)/c \cos0º)] + 0.49999 \beta L [1-(v+V_R)/c \cos 180º$ (95)

$M_b - M_a = L [- 0.00004/c(v+V_R) + 1/c^2]$ (96)
$\Delta mc^2 = L[- 0.00004c/(v+ V_R) + 1]$ (97)

$L= \Delta mc^2 / [- 0.00004c /(v+ \textbf{5.3}\times\textbf{10}^{-\textbf{31}}) + 1]$ (98)
$- 0.00004c /(v+ \textbf{5.3}\times\textbf{10}^{-\textbf{31}}) = -0.00004\times3\times10^8 / (10+\textbf{5.3}\times\textbf{10}^{-\textbf{31}}) = -1200$

$L= \Delta mc^2 / [- 1200 + 1] = \Delta mc^2 / -1199$ (99)

$L \alpha \Delta mc^2$ or $L = A \Delta mc^2$ (100)
Where A is coefficient of proportionality.

Mass increases even if the velocity of recoil is taken in account.

$M_b - M_a = L [- 0.00004/c (v+V_R) + 1/c^2] = - 0.00004L/c(v+V_R) + L/c^2$ (101)

$M_a = M_b + 0.00004L/c(v+V_R) - L/c^2$ (102)
$0.00004L/c(v+V_R) = 4L/10^5 \times 3\times10^8 \times10 = 4L / 3\times10^{14} = 1.333L/ 10^{14}$
$L/c^2 = L/9x10^{16} = 1.111L / 10^{17}$

0.00004L/c(10+5×10^{-32} m/s) – L/c^2 =1.333L/ 10^{14} −1.111× 10^{17} IS POSITIVE QUANTITY

M_a = M_b +0.00004L/cv – L/c^2
  = M_b + 1.333L/ 10^{14} −1.111 ×10^{17}
  = M_b + POSITIVE QUANTITY   (103)

Hence mass increases in this case also, when light energy is emitted.

Section II

Derivation of $\Delta E = Ac^2 \Delta m$ by alternate method

(i) Newton [26] has stated that

' Light and gross bodies are convertible to each other'

in his book 'Optiks' in 1704.

Einstein tried to give mathematical derivation for Newton's perception in 1905. Under the SPECIAL or HANDPICKED conditions Einstein derived

   or L = Δmc^2 (11)

Under the general conditions

L α Δmc^2 is also possible.

From here Einstein SPECULATED whatever is true for 'light energy' is true for 'every energy' or energy content [energy in Joules , m in kg.] E i.e. E = Δmc^2 or E α Δmc^2.

Practically it is used to explain every energy as Einstein stated **that The mass of a body is a measure of its energy-content.** Einstein himself used E for heat energy, attractive binding energy, energy in form of invisible radiations etc. In the derivation Einstein has only considered that body emits light energy, but the luminous body can also emanate the heat energy or other forms of energy simultaneously.

These energies are not considered by Einstein at all in mathematical calculations.

Thus higher the mass annihilated, higher the energy emitted

   dE α dm

(ii) Einstein has derived under super special conditions that   the conversion factor between mass and energy is c^2. Also under general condition the conversion equation is in proportionality form i.e. L α Δmc^2 or E α Δmc^2

The value of conversion factor, other than c^2 can also be justified in many other cases in which E = Δmc^2 is not confirmed yet.

NON-CONFIRMATION OF E=Δmc^2 is in Chemical reactions.

The chemical reactions are the most abundant reactions in nature and were main sources of

energy even in Einstein's days. But neither Einstein nor any other scientist tried to confirm E = Δmc^2 in such reactions. Till date E=Δmc^2 is not confirmed in Chemical reactions, but E = Δmc^2 is regarded as true in such cases, which is not justified [2].

If 10^{-9} kg of matter is annihilated then energy equal to 9×10^7 J will be produced.

$$E = \Delta mc^2 = 10^{-9} \times 9 \times 10^{16} \, kg \, m^2/s^2 = 9 \times 10^7 \, J \qquad\qquad (104)$$

This energy can derive a truck of mass 1,000 kg to distance of 90 km. Such or similar predictions are not experimentally confirmed in **specific experimentation**. If we burn 1kg, hay/straw, some ashes and gases are produced. The mass of ashes and gases can be measured in sensitive instruments. Then energy corresponding to mass annihilated can be calculated by using E = Δmc^2. Then experimentally energy emitted can be checked whether it is QUANTITATIVELY consistent with theoretical estimates or not.

In terms of heat energy,

$$1 \text{ calorie} = 4.18 \text{ J} \quad \text{ or } \quad 9 \times 10^7 \text{ J} = 2.153 \times 10^7 \text{ calories} \qquad\qquad (105)$$
It will raise the temperature of mass of water 21,530 kg from 14.5°C to 15.5°C.

The energy emitted can be found less than predictions of E = Δmc^2. It is preliminary conclusion from observations, as even very little energy (comparatively) is emitted when huge amount of wood , paper, straw etc. burn. Further reason for this conclusion is that conceptually the chemical reactions (atoms are exchanged, making and breaking of bonds) are entirely different from nuclear reactions (new atoms are formed, nuclei are broken). The conditions under which nuclear reactions proceed are entirely different from chemical reactions. It would mean that the conversion factor between mass and energy is other than c^2.

The reason given by scientists for non-confirmation of E=$\Delta \mathbf{mc^2}$ in chemical reactions is that in chemical reactions energy emitted is too less to be measured. Also in the existing literature there are no evidences that ever serious attempts have been made for the confirmation. Now sophisticated instruments are being prepared to study various scientific phenomena, but no headway is made in confirmation of E=$\Delta \mathbf{mc^2}$ in chemical reactions. Such experiments may definitely change the perception of $\Delta E = \Delta mc^2$ in science.

(iii) In the laboratory[27-30] it is confirmed that using thermal neutron the Total Kinetic Energy (TKE) of fission fragments that results from U^{235} and Pu^{239} is 20-60MeV is less than predicted by $\Delta E = \Delta mc^2$. This prediction is nearly 40 years old in the existing physics. It further implies that

dE α c^2dm

(iv) Similarly mass of particle Ds(2317) has been found more than [31] current estimates based upon $\Delta E = \Delta mc^2$. Thus again

dE α c²dm

(v) Robert Serber (member of first American team entered Hiroshima and Nagasaki in September 1945 to assess losses) had pointed out that efficiency of the ''Little Boy'' weapon [U²³⁵, 49kg] that was used against Hiroshima was about 2% only [32]. The remaining 98% energy is not accounted for. It is assumed that all atoms don't undergo fission, thus material is wasted. But the wasted material is not measured. How much energy is emitted in form of heat energy, light energy or energy in form of invisible radiations is not measured? Further Einstein has derived equation (under SPECIAL CONDITIONS) for light energy only, but here energies in various forms are emitted.

But it is not calculated that how much 'material is wasted' and how much 'energy is emitted'? Einstein has simply considered emission of the LIGHT ENERGY by luminous body, but in nuclear explosion, heat energy, light energy, in form of invisible radiations etc. is also emitted. Under ground nuclear explosions also justify dE α c²dm. Until such predictions are not precisely confirmed it is equally possible that conversion factor other than c² is feasible i.e.

dE α c²dm

Thus it is absolutely incorrect to state that $\Delta E = \Delta mc^2$ is confirmed in uncontrolled nuclear explosions.

(vi) The Big Bang Theory (the biggest energy releasing process in universe), is the most successful theory of understanding of the origin of universe.

This theory assumes that whole mass of the universe (10^{55} kg, say) was in form of 'primeval atom ' and then suddenly exploded [33]. According to $\Delta E = \Delta mc^2$, this mass (10^{55} kg) would have been created from energy 9×10^{71} J.

$$E = 10^{55} \text{ kg} \times 9 \times 10^{16} \text{ m}^2/\text{s}^2 = 9 \times 10^{71} \text{ J} \qquad (106)$$

But from where this energy had come? This huge amount of energy is not is not regarded as to exist as such automatically. The answer to one question is other question.

How whole the mass is condensed to a single point?

From where energy was created for explosion?

Which is the source of energy, causing universe to expand?

But we reach at logical conclusions (justified in applications) if the conversion factor between mass and energy is considered other than c².

It means that

dE α c²dm

(vii) Webb [60] has reported results for time variability of the fine structure constant or Summerfield fine structure constant (α) using absorption systems in the spectra of distant quasars. It means the variations in the values of c are being discussed, if variation in value of

c is confirmed then automatically

$$dE \, \alpha \, c^2 dm$$

[In addition it can be justified that Einstein derived **L=Δmc²** or speculated **E=Δmc²** in 1905 and nuclear reactions were discovered in 1920s. Thus **E=Δmc²** was applied after gap of 15 years in nuclear reactions. Then this equation is used as basis i.e. defined 1Atomic Mass Unit (1amu) in terms of   **E=Δmc²** . Then all data was standardised in terms of 1amu (based upon **E=Δmc²**). Had there been ΔE =Ac²Δm, available with scientists in 1920 then they would have also tried the same. Any data which was found inconsistent with E=Δmc² was neglected, as there was no alternative. Some limitations when E=Δmc²   is used are transparent, especially while explaining 'binding energy of nucleus' and 'universal equality of masses of nucleons' simultaneously.   This aspect is separately discussed. However these can be explained with help of ΔE =Ac²Δm with value of A>>1.

  Also neither Einstein nor other scientists applied it for chemical reactions.

Further an indirect or unrelated or analogous example may be given here regarding transformation of energy from one form to other.

Energy in one form = k (energy in the other form)   (107)

where ' k ' is conversion factor just like J (4.2 ×10⁷ erg cal⁻¹) in equation

$$W = JH \qquad (108)$$

But the same transformation factor does not exist if 'electrical energy' is changed to 'sound energy' or 'light energy is changed to 'electrical energy' etc. Thus in science in many cases, other phenomenon is a new phenomenon.]

Thus from various deductions (including that of Einstein's Sep. 1905 paper) it is logically concluded that

$$dE \, \alpha \, c^2 dm$$

The above proportionality dE α c²dm can be changed into equation by introducing a constant of proportionality. The inception of proportionality constant here is consistent with centuries old perception of constant of proportionality in physics since days of Aristotle and Newton. According to Aristotle

'Speed is proportional to motive force, and inversely proportional to resistance.'

 In second law of motion (F = kma) the value of constant of proportionality, k is always unity (like universal constant) i.e. F=ma. According to *The Principia*

The alteration of motion is ever proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.

When more and more complex phenomena were studied or values of constants of proportionality were determined then it showed dependence on the inherent characteristics of the phenomena. So it varied from one situation to other.

In case **constant of proportionality** varies from one situation to other then it is known as **co-efficient of proportionality** e.g. co-efficient of thermal conductivity or viscosity etc. Thus removing the proportionality between dE and c^2dm we get:

$$dE = Ac^2dm \qquad\qquad (109)$$

where A is a coefficient used to remove that sign of proportionality; it depends upon inherent characteristics of the processes in which conversion of mass to energy takes place and it is dimensionless.

The 'constant of proportionality' varies from one situation to other depending upon inherent experimental conditions of the process. If it varies from one situation to other, then constant of proportionality is called **'COEFFICIENT OF PROPORTIONALITY'**. There are many examples about it. In $\Delta E = Ac^2\Delta m$, A is a coefficient not a constant depending upon inherent characteristics of mass energy inter-conversion processes. The concept of co-efficients of proportionality is applicable to many equations in the existing literature. For example,

equation for Hubble's law

$$V = HS \qquad\qquad (110)$$

The general range for value of H is 50 to 80 kilometers per second-Mega parsec (Mpc). Thus, there is difference of 60 percent between upper and lower limits of value of Hubble's constant, hence it should be termed as Hubble's co-efficient.

equation for Coulomb's law

$$F = KqQ/r^2 = qQ/4\pi\,\varepsilon_0\,\varepsilon_r \qquad\qquad (111)$$

value of $\varepsilon_0 = 8.854 \times 10^{-12} C^2 N^{-1} m^{-2}$ and is constant. Further the value of ε_r varies from one situation to other. For example values of ε_r are for air 1.0006, for glass 4.9 to 7.5, for distilled water 80.0, for barium-strontium-titanite 7500, hence values of K varies from one situation to other.

equation for decay constant radioactivity,

The equation for $T_{1/2} = 0.693/\lambda$

$$\text{Or} \quad \lambda = 0.693/T_{1/2} \qquad\qquad (112)$$

where λ is decay constant and its general trend is $10^{15}\,s^{-1} - 10^{-10}\,s^{-1}$.

equation for resistance of conductor,

$$V \propto I \text{ or } V = I R$$
$$R = V/I \qquad\qquad (113)$$
$$R = \rho L/a \qquad\qquad (114)$$

where ρ is resistivity of the conductor having area a and L is length of the conductor. Further the value of resistivity, ρ for

(a) metals and alloys varies from 1.6×10^{-8} to 49×10^{-8} Ωm,
(b) for semi conductors it is 3.5×10^{-5} to 2300 Ωm
(c) for insulators 10^{10}-10^{16} Ωm.

equation for co-efficient of viscosity,

$$F = \eta \, Adv/dx \qquad\qquad (115)$$

Higher the co-efficient of viscosity, more viscous is the fluid. In general the co-efficient of viscosity η varies from 1.05×10^{-3} poise to 19.2×10^{-6} poise. Similar is nature and characteristics of A.

Co-efficient of thermal conductivity

The coefficient of thermal conductivity is expressed as the quantity of heat that passes through a unit cube of the substance in a given unit of time when the difference in temperature of the two faces is 1°.

$$Q = KA \, [T_1-T_2]t/d \qquad\qquad (116)$$

The general range of variation of co-efficient of thermal conductivity K for various conductors is

0.02 $Wm^{-1}K^{-1}$ to 400 $Wm^{-1}K^{-1}$

Table IV the various values of constant of proportionality in existing Physics

Sr. No 1	Equation	Co-efficient of proportionality	Value
1	$V = HS$	H, Hubble's Co-efficient	50 to 80 kilometers per second-Mega parsec (Mpc).
2	$F = KqQ/r^2 = qQ/4\pi \, \varepsilon_0 \, \varepsilon_r$	ε_r Relative permeability of medium	ε_r are for air 1.0006, to for barium-strontium-titanite 7500,
3	$T_{1/2} = 0.693/\lambda$	λ Decay constant	general trend is 10^{15} s^{-1} – 10^{-10} s^{-1}.
4	$V \propto I$ or $V = I R$ $R = V/I$ $R = \rho L /a$	ρ Resitivity	(a) metals and alloys varies from 1.6×10^{-8} to 49×10^{-8} Ωm, (b) for semi conductors it is 3.5×10^{-5} to 2300 Ωm (c) for insulators 10^{10}-10^{16} Ωm.
5	$F = \eta \, Adv/dx$	η Co-efficient of viscosity	1.05×10^{-3} poise to 19.2×10^{-6} poise.
6	$Q = KA [T_1\text{-}T_2]t/d$	K Coefficient of thermal conductivity	0.02 Wm^{-1}K^{-1} to 400 Wm^{-1}K^{-1}
7	Many other equations are there	Different names	Many other values
8	$\Delta E = Ac^2 \Delta m$	A	Numerous values in bizarre phenomena of mass energy inter-conversion.

Thus, the value of the co-efficient of thermal conductivity varies from one body to other. Similar is nature and characteristics of A in $\Delta E = Ac^2 \Delta m$.

    equation for modulus of elasticity,
    equations of Faraday's laws of electrolysis
    equation for critical velocity in fluid dynamics,
    equation for Newton's law of cooling,
    equation for induced dipole moment,
    equations for co-efficient for linear expansion, superficial expansion, cubic expansion,
    equation for specific heat etc. etc.

 Now consider the case that when mass is converted into energy. Let in some conversion process mass decreases from M_i (initial mass) to M_f (final mass), correspondingly energy increases from E_i (initial energy) to E_f (final energy). The eq. (109) gives infinitesimally small amount of energy dE created on annihilation of mass dm. To get the net effect the eq. (109) can be integrated

$$\int dE = Ac^2 \int dm \qquad (117)$$

Initial limit of mass = M_i Initial limit of Energy = E_i

Final limit of mass = M_f Final limit of Energy = E_f

Initially when mass of body is M_i, then E_i is the initial energy of the system. When mass (initial mass, M_i) is converted into energy by any process under suitable circumstances the final mass of system reduces to M_f. Consequently, the energy of system increases to E_f the final energy. Thus M_f and E_f are the quantities after the conversion. Hence, eq. (109) becomes

or $E_f - E_i = Ac^2 [M_f - M_i]$ (118)

or $\Delta E = Ac^2 \Delta m$ (119)

     Energy evolved = Ac^2 (decrease in mass)   (120)

Now it is natural to calculate the difference in mass by subtracting the final mass from initial mass as taken as in equation
$$E_f - E_i = Ac^2 [M_f - M_i] \qquad (118)$$
For example, a child is born and has weight 5 kg (in general sense). After few years, his weight becomes 40 kg, and then we say his weight is increased by 35 kg i.e.

Increase in weight = Final weight –Initial weight = 40–5 = 35 kg.   (121)
We never say that increase in weight of child is –35 kg   i.e.

Increase in weight = Initial weight – Final weight =5–40 = –35 kg.   (122)
Further energy is scalar quantity, it has only magnitude

Special Cases

Now the following cases can be discussed for further understanding of the equation.
$$E_f - E_i = Ac^2 [M_f - M_i] \qquad (118)$$
(i) If the initial and final masses remain the same, then $M_i = M_f$ then from eq. (118)

      $E_i = E_f$ (123)

i.e. under this condition when no mass is converted into energy, the energy remains the same.

(ii) If the characteristic conditions of the process permit then whole mass is converted into energy i.e. after the reaction no mass remains ($M_f = 0$)

$$E_f - E_i = \Delta E = - Ac^2 M_i \tag{124}$$

Since E_i is the initial energy can be regarded as zero, then

$$E_f = - Ac^2 M_i \tag{125}$$

If the characteristic conditions of the process permit then whole mass is converted into energy i.e. after the reaction no mass remains ($M_f = 0$)

$$\Delta E = -Ac^2 M_i \tag{126}$$

In this case energy evolved is negative implies that energy is created at the cost of annihilation of mass and the process is exo-energic nature (energy is emitted which may be in any form). Energy is scalar quantity having magnitude only, thus no direction is associated with it.

Thus the generalized mass-energy equivalence may be stated as

"The mass can be converted into energy or vice-versa under some characteristic conditions of the process, but conversion factor may or may not always be c^2 (9×10^{16} m²/s²) or c^{-2}.

Section III
Applications
IV.   APPLICATIONS OF GENERALIZED MASS ENERGY INTERCONVERSION EQUATION $\Delta E = Ac^2 \Delta m$

(i) Chemical Reactions

Let wood or straw of mass 1kg is burnt under controlled conditions, consequently ashes and gases are emitted. The magnitude of ashes and masses are measured. Let the mass equal to 10^{-9} kg is annihilated , and equivalent amount of energy is emitted.

If 10^{-9} kg of matter is annihilated then theoretically energy equal to 9×10^7 J will be produced i.e.

$$E = \Delta mc^2 = 10^{-9} \times 9 \times 10^{16} \text{ kg m}^2/\text{s}^2 = 9 \times 10^7 \text{ J} \tag{104}$$

This energy can derive a truck of mass 1,000 kg to distance of 90 km. Such or similar predictions are not experimentally confirmed in **specific experimentation**. In daily life it appears that this prediction may not be justified, as even huge amount of wood is burnt then energy appears to be emitted too less that above prediction to be justified [2]. It is not justified to regard $E = \Delta mc^2$ true without experiments, rather it should be mentioned that $E = \Delta mc^2$ is not confirmed in this regard. THUS RESULTS ARE WIDE OPEN UNLESS SPECIFIC EXPERIMENTS ARE NOT CONDUCTED.

Let experimentally energy observed is 4.5×10^7 J corresponding to mass annihilated 10^{-9} kg, then value of A from $\Delta E = Ac^2 \Delta m$ will be 0.5 i.e.
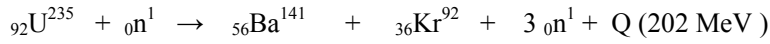
$$A = \frac{\Delta E}{c^2 \Delta m} = = 4.5 \times 10^7 / 9 \times 10^{16} \times 10^{-9} = 0.5 \tag{127}$$

Thus in this case mass energy inter-conversion equation becomes

$$\Delta E = 0.5 c^2 \Delta m \tag{128}$$

(ii) The total kinetic energy(TKE) of fission fragments of U^{235} or Pu^{239} is 20-60 MeV less than predicted by $E = \Delta mc^2$.

The familiar fission reaction is

$$_{92}U^{235} + {}_0n^1 \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3\,{}_0n^1 + Q\,(202\text{ MeV})$$

In laboratory [27-30] it has been experimentally confirmed that using thermal neutrons the total kinetic energy of fission fragments that result from U^{235} or Pu^{239} is 20-60 MeV less than the Q value of the reaction predicted by $E = \Delta mc^2$. These observations are over 35 years old. In existing physics these inconsistent observations are explained in the following ways.

(i) It is typically assumed that energy is lost in unobservable effects [27-30]. If so then such unobservable effects may also be applicable to those cases where $E = \Delta mc^2$ is regarded as to hold good.

(ii) Also attempts have been made to explain the total kinetic energy (or essentially total energy) of fission fragments by extending the successful liquid -drop model of Bohr and Wheeler [27-30]. It implies the gravity of inadequacy of $E = \Delta mc^2$ in this case.

The same can also be explained on the basis of $\Delta E = Ac^2 \Delta m$. Let according to $E = \Delta mc^2$ the total kinetic energy (or essentially total energy) of fission fragments of U^{235} or Pu^{239} is 200 MeV theoretically and experimentally observed energy is 25 MeV less i.e. 175MeV. Then according to $\Delta E = Ac^2 \Delta m$ the value of A is 0.875 i.e.

$$A = \Delta E / c^2 \Delta m = 175 / 200 = 0.875 \tag{129}$$

So in case of fission fragments of U^{235} or Pu^{239} the value of A is less than one i.e. 0.875 as in eq.(115), hence the energy emitted is less than predicted by $E = \Delta mc^2$. In this case the value of A other than unity is justified.

(iii) Anomalous Observation

The anomalous observation of excess mass of Ds(2317) can be understood with help of $\Delta E = Ac^2 \Delta m$, as mass of the observed particle is found more [31] than predictions of $E = \Delta mc^2$. In this case value of A will be more than one. For understanding consider

energy equal to 10^6J is converted into mass, then corresponding mass must be $10^{-10}/9$ kg. We are considering the case that mass is found more than this. Let the mass be $10^{-10} \times 10/ 9x9$ kg.

The value of A in this case is 1.0001 as calculated from $\Delta E = Ac^2\Delta m$ i.e.

$10^6 = A9\times10^{16}\times10\times10^{-16}/81 = 9A \times 10^7/81$

A= 0.9 (130)

Thus corresponding to more energy less mass is observed.

(vi) Annihilation of Antimatter

At the time of big bang equal amount of matter (visible 10^{55} kg) and antimatter were produced. This antimatter was annihilated during hadron epoch ($10^{-35} - 10^{-4} s$) as now no antimatter is not found at all [35]. It would have released energy equal to 9×10^{71} J i.e.

$\quad E = 10^{55}\times9\times10^{16} = 9\times10^{71}$ J (131)

Due to this energy temperature would have risen. However in this epoch temperature fell down from 10^{27}K to 10^{12} K .Thus it is contradiction, as energy is released and temperature falls.

It can be explained with help of $\Delta E = Ac^2\Delta m$. It can be explained if we assume that negligibly small amount of energy has been produced during hadron epoch, in equation $\Delta E = Ac^2\Delta m$. Let this energy be only 1 J. Now the value of A must be 1.11×10^{-72} i.e.

$1 = A 9\times10^{71}$

Or $A = 1.11\times10^{-72}$ (132)

Thus,

$\Delta E = 1.11\times10^{-72}c^2\Delta m$ (133)

Hence antimatter is not observable as it is annihilated during hadron epoch without raising the temperature. Thus this perception justifies big bang theory.

(vii) Creation of Mass Before Big Bang.

Basis of Big Bang Theory: The basis of Big Bang Theory is that time and space did not exist before Big Bang. The basic postulate of Big Bang Theory assumes that initially (t=0) whole mass of universe 10^{55}kg was in infinitely compact and singular state enclosing a space even smaller than atomic particle , instantaneously exploded in gigantic detonation [33].

How mass equal to 10^{55} kg was created?

How it changed into singular state?

How the 'primeval atom' exploded?

These questions are unaddressed in Big Bang Theory. Here the measurement of time started after 10^{-43} seconds of Big Bang, called the Planck's time.

Findings based upon NASA's Wilkinson Microwave Anisotropy Probe (WMAP).

Erickcek and colleagues [36] deduced on the basis of NASA's Wilkinson Microwave Anisotropy Probe (WMAP) that existence of time is possible before Big Bang and universe

may be created from empty space. Normally microwave background radiations are mostly smooth but Cobe satellite discovered some fluctuations. Erickcek and colleagues believed that these fluctuations contain hints that out universe 'bubbled off' from previous one. Thus time and space, hence universe existed before Big bang. Similar is conclusion of application of $\Delta E = Ac^2\Delta m$ regarding origin of the universe.

Predictions based upon $\Delta E = Ac^2\Delta m$ are justified:

It describes HOW 'primordial atom' was created in the pre-big bang world.

The explanation based upon $\Delta E = Ac^2\Delta m$ **to understand the origin of 'primeval atom' i.e. state of pre-big bang universe leads to similar results as deductions based upon WMAP's findings.** According to Wilkinson Microwave Anisotropy Probe's observations the time and space existed before Big Bang, the 'primeval atom' was created in due course of time in existing space and then exploded. It is consistent with explanation of $\Delta E = Ac^2\Delta m$ and provided natural explanation for formation of universe (creation of mass, creation of primeval atom, its explosion and acceleration). As we are simply discussing the formation of primeval atom (which is not discussed yet), hence there is no contradiction of any existing fact.

The Primeval Theory based upon $\Delta E = Ac^2\Delta m$ is consistent with WMAP's observations:

The basic motivation behind Primordial Theory is HOW and WHY 'primeval atom' is created ?

In Primeval Theory it is assumed that initially space was created and whole the space was filled with infinitely large number of particles of zero mass or undetectable by any means, may be termed as *Zeroans*. The Zeroans are the most primitive constituents of the universe in space, may be moving with infinitely large velocities. The Zeroans may have mass trillion-trillion times smaller than axioms, hypothetical particles proposed by Peccei [37], and are virtually isolated. Such particles are currently regarded as constituents of dark matter.

The mass of photon is estimated as less than 10^{-18} eV or 1.77×10^{-54} kg .

The numerous numbers of Zeroans were moving with infinitely large velocities acted as the smallest possible (but just perceivable or imaginable) pulse of energy, may be coined as Primordial Energy Pulse. It is the postulatory assumption in this perception, but now recent research based upon data from WMAP supports it, as it hints that universe bubbled of from previous universe. The zeroans are present in empty space even now.

In due course of time infinitely large number of Zeroans resulted or combined together to form pulse of energy, 10^{-100} J or less (smallest permissible units of energy) i.e. exceptionally -2 small. It may be called the 'Primordial Energy Pulse', which is subdivided in

numerous parts or pulses of energy in empty space. As creation of universe is the intricate process, thus such a low of amount of energy is perceived.

$\Delta E = Ac^2 \Delta m$ is applicable to all peculiar cases where mass-energy inter-conversion takes place, as in this case the conversion factor is not rigidly c^2. Due to its general nature $\Delta E = Ac^2 \Delta m$ was applicable even in pre Big Bang era. Thus, the equation $\Delta E = Ac^2 \Delta m$ specifically predicts that in this primordial era, diminishingly small pulse of energy, say 10^{-100} J (or less), manifested or transformed itself in mass 10^{55}kg, in due course of time. Under this condition the value of A_{uni} can be determined as:

$$A_{uni} = \frac{\Delta E}{c^2 \Delta m} = \frac{10^{-100}}{9 \times 10^{16} \times 10^{55}} = 1.111 \times 10^{-172} \tag{134}$$

These values are too peculiar , as the situation so and unaddressed. Now if the value of energy is 10^{-100} J and value of A_{uni} is 1.111×10^{-172} J then mass can be calculated as

$$\Delta m = \frac{\Delta E}{c^2 A_{uni}} = \frac{10^{-100}}{1.111 \times 10^{-172} \times 9 \times 10^{16}} = 10^{55} \text{ kg} \tag{135}$$

Thus $\Delta E = Ac^2 \Delta m$, is the first equation which at least theoretically predicts that universe (10^{55}kg) has been created (and resulted to 'primordial or primeval atom') from minuscule or immeasurably small amount of energy (10^{-100}J or less). However actual process of creation of mass may be quite tedious and time consuming process. In free the motion of Zeroans hence process of creation of mass is continuous processes. The rate of creation is too less to upset any existing calculations. As already mentioned this explanation is not possible from $E = \Delta mc^2$

(viii) The Origin of Gravitation.
WHY DO BODIES ATTRACT EACH OTHER ?

The mass may be regarded is primary form of energy in nature, is converted to other forms of energy which may co-exist in various forms. In nuclear explosion mass is converted to heat energy, light energy, energy in invisible form etc. Also energy is transformed from one form to other. In electric bulb electrical energy changes to light energy, in radio electrical energy is converted into sound energy, in cell chemical energy is changed to electrical energy, in photocell light energy changes to electrical energy there are many such examples. The inter-conversion of energy to other form may be written as

Energy in one form $= k$ (energy in the other form)   (107)

where ' k ' is conversion factor just like J (4.2×10^7 erg cal^{-1}) in $W = JH$. $E = \Delta mc^2$ states that mass is converted into energy or vice versa, whereas according to eq. (107) energy changes from one form to other.

In uncontrolled nuclear fission or in nuclear reactors mass is converted to light energy, heat energy, sound energy and energy in form of invisible radiations is emitted etc or energy may co-exist in various forms. In nucleus the mass is converted into the binding energy (attractive like gravitational energy). The attractive binding energy exists within nucleus and attractive gravitational energy exists on large scale, but both arise from the annihilation of mass. Thus law of conservation of matter is obeyed. Electrons move around the nucleus and heavenly bodies move around the sun.

In view of eq. (103) the analogous relation between mass annihilated and gravitational energy produced (measure of gravitational force or pull) can be written as

Energy emitted in annihilation of mass ($Ac^2\Delta m$) = k Gravitational energy (U_g)   (136)

or,   Gravitational energy (U_g) = Energy emitted in annihilation of mass ($\dfrac{Ac^2\Delta m}{k}$).

Where k is conversion factor which determines the extent of conversion of mass to gravitational energy. Thus higher the value of A and smaller the value of k more gravitational energy will be produced. The values of A and k depends upon inherent characteristics of the process.

The inter conversion of energy to mass is continuous process. The fraction of mass (so produced) simultaneously also changed into gravitational energy as described by eq. (136). This gravitational energy held together the created mass, if the gravitational energy produced in one particular case is considerable then that matter remained in cohesive state. So,

"*formation of mass of universe and origin of gravitation are both simultaneous processes*".

The gravitational energy is universally prevalent and is inherent property of bodies, it unites the bodies as these are produced.

At the same time it is just possible that some particles which were created from 'Primordial Energy Pulse', may have not developed considerable amount of gravitational energy, hence not condensed to bigger units and may be even as such now. These may have mass trillion-trillion times smaller than axioms; hypothetical particles proposed by Peccei [37]. Such particles may be numerous in number and are constituents of dark matter. This explanation account for dark matter as well.

**(ix)	Formation of "Primordial Atom" And Its Explosion Or Big Bang.**

The lighter particles or bodies stuck together (under extreme conditions of temperature, pressure and gravitational energy) then their mass increased. Thus high temperature and high gravitational pull caused constituents of universe to contract to a single point. As the process of annihilation of mass to energy continued so the rise in temperature and increase in gravitational energy equally continued. Thus bodies were quickly attracted and condensed as

being extremely hot they compressed to small size due to high gravitational energy consequently radius of the universe decreased. This process was repeated again and again and whole mass of the universe condensed to a single point in super dense state in due course of time.

The nature of gravitational force so developed, may be regarded as similar to inter-atomic force. The inter-atomic force is attractive up to some extent (maximum $r = 5A^\circ$) and when distance between the molecules decreases it turns strong repulsive force. As the gravitational energy increases (higher A, less k), so the size of constituents of universe decreases. As long as the size of compressed mass of universe is optimum, there is no considerable repulsion between constituents. Then the size of the universe is further decreased (due to extreme conditions of heat and gravitational energy) i.e. distance between nuclei decreased beyond the optimum distance.

At this stage (size of universe is decreased beyond optimum size), the 'primordial atom' exploded as universe was in extremely unstable, repulsive and reactive state. It is equivalent to repulsive inter-atomic force. At this stage, even small mass may have been converted to mammoth amount of energy as permissible by equation $\Delta E = Ac^2\Delta m$, in weird reaction. Due to this repulsive force 'primeval atom' exploded. It is called Big Bang and ever since constituents of universe are receding away. Thus this perception not only justifies the Big Bang Theory of Universe but also explains its earliest origin.

(**x**)   *Black Holes*.

The black holes are results of exploding stars. The black hole is regarded as end stage of stars whose mass is roughly 20-25 times (estimates may vary) the mass of the Sun. In such cases huge amount of energy is annihilated. Stars explode when they are in super active state.

On the basis of $\Delta E = Ac^2\Delta m$ the reason for formation of black hole (density of the order of 10^{18}kg/m^3) is that due to small annihilation of mass, enormous amounts of heat and gravitational energies are produced. If the gravitational pull of a heavenly body is exceptionally-2 higher even then visible light does not escape from it and remains invisible. According to this perception the pre-requisite for formation of the black hole is that it must have unimaginably high value of gravitational energy. According to eq. (136) it is only possible if the value of A must be exceptionally high and that of k must be exceptionally small. Mathematically,

$$A_{bh} = \frac{kU_g}{c^2\Delta m} \tag{137}$$

This perception implies that for annihilation of small mass, huge amount of gravitational energy is gained by body, consequently does not allow light to escape (here k is another factor which is measure of inter-transformation of one energy to other). If this condition is

satisfied then even bodies of smaller mass may become black holes. In view of this the lightest black holes are also possible, and some of them are observed to reside in the youngest galaxies. Even permeable atom may be in form of black hole.

(xi) Dark Matter

About 80 % of the matter of the universe is regarded as dark matter (supposed to exist but invisible). The dark matter can be understood in two in categories:

(i) MACHOs (Massive Astrophysical Compact Halo Objects), MACHOs are the big, strong dark matter objects ranging in size from small stars to super massive black holes. MACHOs are made of 'ordinary' matter, which is called *baryonic* matter. Astronomers search for MACHOs.

(ii) WIMPs (Weakly Interacting Massive Particles). WIMPs, are the little weak subatomic dark matter candidates e.g. yet undetected gravitinos and photinos, undetected axions particles with extremely small masses etc. which are thought to be made of stuff other than ordinary matter, called *non-baryonic* matter. Particle physicists look for WIMPs .

An Explanation for Wimps on the Basis of $\Delta E = Ac^2 \Delta m$

$\Delta E = Ac^2 \Delta m$ favors that the dark matter in form of the lightest neutrinos, axioms etc.

 (a) The reason is that the heavier particles are annihilated to energy with value of A extremely less than one say, $A = 10^{-10}$ or less

$$\Delta E = 10^{-10} c^2 \Delta m \quad \text{or less} \tag{138}$$

Thus the bulk of the mass of antecedents according to $\Delta E = Ac^2 \Delta m$ (value of A less than unity) is annihilated and small energy is emitted, thus they reduce to the lightest descendants e.g. neutrinos, axioms etc. which is consistent with existing perceptions.

 (b)   In the Primordial Theory of the Universe, it is assumed that the universe started its life from the Zeroans and changed to Primordial pulse of energy. Thus particles like gravitons , photino's , neutrinos etc were created. This process is even now continuing in the empty space. Thus, lighter particles are possible which may be contributing to the Dark Matter. Thus lighter particles i.e. WIMPS are naturally preferred candidates for dark matter according to $\Delta E = Ac^2 \Delta m$.

Explanation for MACHOS on the Basis of $\Delta E = Ac^2 \Delta m$

The MACHOS may have size from small stars to massive black holes. They may remain invisible due to two reasons.

(c) Firstly, they may have so strong gravitational field that even light energy may not be emitted. Thus, they remain invisible.

(d) Secondly, the visible energy they emit is instantly converted to some form of invisible energy or even mass. As the inter-conversion of energy from one form to other are feasible processes

(x) Gamma Ray Bursts.

Gamma ray bursts (GRBs) are intense and short (approximately 0.1-100 seconds long) bursts of gamma-ray radiations and originate at very distant galaxies (several billion light years away). GRBs are the most energetic events after the Big Bang in the universe and emit energy up to 10^{47} J in exceptionally short time. The origin of GRB can be understood on the basis of this perception also. If for black hole (formation described above) the value of A is higher and value of k is less and remains active, then it contracts beyond a optimum limit due extreme conditions of gravitation and temperature. Thus it may further result in a detonation known as black bang emitting exceptionally high amount of energy in form of GRBs, due high value of A. Thus the explosion like big bang are continuing even now but at much smaller scale emitting energy in form of GRBs and corresponding to annihilation of small mass huge energy is emitted with high value of A. This discussion permits that GRBs may be emitted from black holes of smaller bodies comparatively.

According to $E = \Delta m c^2$ if energy emitted is 10^{47} J, then mass annihilated will be 1.11×10^{30}kg, that too in few seconds. This annihilated mass is comparable with mass of Sun 1.99×10^{30} kg. [In fact in GRBs then energy emitted is experimentally estimated but the mass annihilated is not, thus exact value of A cannot be determined.] In GRB, the energy equal to 10^{47} J can be emitted from annihilation of mass of 10 kg. In this case the value of A_{grb} is 1.11×10^{29} .

$$A_{grb} = \frac{\Delta E}{c^2 \Delta m} = 1.11 \times 10^{29} \qquad (138)$$

Likewise explanation for other cosmological phenomena and bodies can be given on the basis of the generalized mass energy inter-conversion equation, Likethis energy emitted by QUASARS can be explained.

Section IV

Applications of ΔE = Ac² Δm in School level textbooks to explain mass defect

or

E = Δmc² in case of deuteron contradicts Universal Equality of Masses of Nucleons
(Binding energy observed is 2.2244MeV or 3.965×10⁻¹³J)

Abstract

There are two inherent observations;

(i) firstly masses of nucleons are fundamental constants i.e. same universally (inside and outside the nucleus in all cases)

(ii) and secondly nuclei possesses BE (Δmc^2) due to mass defect.

To explain these observations of deuteron (BE = 2.2244MeV), the difference in masses of nucleons must be 0.002388 u or about 0.11854% of masses of nucleons outside nucleus. Thus theoretically masses of nucleons must be less in nucleus, which is not justified as all data is based upon equality of masses of protons and neutrons in all cases. If the applications of the generalized equation $\Delta E = Ac^2 \Delta m$ are speculated in this regard, then it is capable of explaining both the observations simultaneously i.e. equality of masses of nucleons (assuming infinitesimally small mass defect) and binding energy. As according to $\Delta E = Ac^2 \Delta m$ even due to infinitesimally small mass defect (2.388×10^{-14} u , say) the binding energy of deuteron can be 2.2244MeV due to presence of conversion factor A. Thus $\Delta E = Ac^2 \Delta m$, explains both the intrigues simultaneously i.e. equality of masses of nucleons and binding energy of deuteron.

1.0 Decrease in masses of proton and neutron in deuteron nucleus

In the experimental and theoretical nuclear physics the masses of nucleons (protons and neutrons) are fundamental physical constants in category of atomic and nuclear constants, and binding energy (energy required to break the nucleus) is an inherent property of all nuclei. Also it is equally true that all the mass energy inter conversions are universally explained on the basis of $E = \Delta mc^2$, where Δmc^2 is mass defect.

Mass defect =

Mass of nucleons out side nucleus – Mass of nucleons inside nucleus   (139)

Binding Energy =

[Mass of nucleons out side nucleus – Mass of nucleons inside nucleus]c^2 (140)

This aspect is critically discussed in view of deuteron, which contains just one neutron and proton.

(a) The mass of proton is experimentally measured equal to 1.672621×10^{-27} kg, (1.007276u or 938.272029 MeV) and is same in all cases. Also the mass of neutron is 1.674927×10^{-27} kg (1.008664u or 939.565360 MeV) in all cases.

(b) Experimentally binding energy (BE) of deuteron is measured by various methods [38-40] has been found to be 2.2244MeV (1amu = 931.494MeV, 1amu $= 1.660\ 5381 \times 10^{-27}$ kg**)**, which is equivalent to 0.002388u (3.984×10^{-30} kg) on the basis of $\Delta E = \Delta mc^2$ i.e. masses of nucleons are converted into energy.

1.1 Decrease in mass of nucleons in nucleus is not justified.

The phenomena of universal equality of masses of nucleons and origin of binding energy of nuclei have been studied critically and quantitatively [38-40]. The binding energy of the deuteron is experimentally observed as 2.2244MeV [14.94×10⁻¹¹J], according to $\Delta E = \Delta mc^2$ it is equal to mass defect 0.002388amu. It means in the nucleus of deuterium, mass 0.002388u (of proton and neutron) is converted into binding energy.

The mass defect i.e. 0.002388u is comparable with sum of masses of the neutron and proton (2.01594 u), masses must decrease in nucleus considerably i.e. 0.11845 % (compared to mass in free state). In deuteron there are only protons and neutrons, hence theoretically decrease in mass or mass defect 0.002388u is only at the cost of mass of proton (M_p) and mass of neutron (M_n). There is no third entity whose mass may decrease. The mass of proton is 1.007276u and let decrease in mass of proton is half the mass defect (0.002388 u) i.e. 0.001194 u (which contributes towards the binding energy of deuterium). Then theoretically mass of proton in nucleus must be 1.006082u (1.67064×10⁻²⁷ kg) and then decrease in mass of proton must be 0.1185 %. Also mass of neutron is 1.008664u and let decrease in mass of neutron is half the mass defect i.e. 0.001194u. Then mass of neutron in nucleus must be 1.00747 u (1.67294×10⁻²⁷ kg). Similarly is the decrease in mass of neutron in nucleus is 0.1185%.

Like this theoretically decrease in mass of nucleons in other nuclei can be estimated taking all relevant factors in account. More the value of binding energy more would be the decrease in mass of nucleons in the nucleus. The decrease in masses of neutron and proton in deuteron, to explain the values of BE on the basis of $\Delta E = \Delta mc^2$, are shown in Table III.

1.12   E = Δmc^2, binding energy and mass of nucleons in deuteron .

If mass of nucleons remains the same universally (fundamental fact used in existing physics in all aspects of experimental and theoretical nuclear physics) i.e. mass defect ($\Delta m = 0$). Then according to $\Delta E = \Delta mc^2$, binding energy is also zero.

Binding Energy (BE) = Mass Defect $(\Delta m)c^2$ = 0   (141)

Thus universal equality of masses of protons and neutrons (means $\Delta m = 0$) implies that mass defect must be zero theoretically, hence binding energy. If binding energy (energy required to break the nucleus) is zero then nucleus will be unstable. Hence it is not experimentally justified.

The masses of proton and neutron are same inside and outside the nucleus, it is experimentally confirmed [2].

(i) When a gamma ray photon of energy 2.2244MeV hits the deuteron (binding energy of deuteron is 2.2244MeV), then deuteron is split up and proton and neutron are emitted. The mass of the released proton and neutron from nucleus is the

same as usual mass i.e. 1.007276 u and 1.008662 u.

The masses of proton and neutron are never less in nucleus i.e. 1.006082u and 1.00747u as theoretically predicted by $\Delta E = \Delta mc^2$ to explain binding energy. No external energy is provided by the gamma ray photon to increase mass of proton and neutron inside the nucleus. If the masses of proton and neutron are less in nucleus, then lighter protons and neutrons must be emitted. But masses of emitted proton and neutron are usual masses. Whatever is the energy of gamma ray photon that is provided to dissociate the binding energy of deuteron as both are exactly equal i.e. 2.2244MeV each.

Consequences of equality of masses of nucleons: Thus mass defect and binding energy both must be zero, as masses of protons and neutrons are equal both outside and inside the nucleus.

Effects: According to $\Delta E = \Delta mc^2$ binding energy of nucleus can never originate without annihilation of adequate mass of nucleons. If mass defect $\Delta m = 0$ (masses of nucleons are same inside and outside the nucleus) then binding energy is also zero; implying instability of nuclei which is never justified. Then what is the source for binding energy on the basis of $\Delta E = \Delta mc^2$? $\Delta E = \Delta mc^2$ implies instability of deuteron, as binding energy (energy required to break the nucleus is zero).

Importance of $\Delta E = Ac^2 \Delta m$: $\Delta E = Ac^2 \Delta m$ is applied (on adhoc basis) in this regard i.e. to simultaneously explain the binding energy and mass of nucleons in nucleus. Consequently the generalized mass energy equation implies that for even annihilation of **INCALCULABLE MASS** defect (this assumption is for obeying universal equality of protons and neutrons), binding energy equal to 2.2244MeV (3.965×10^{-13} J) is feasible due to presence of conversion factor A. Let us assume that in this case mass defect is 2.388×10^{-14} u or 3.965×10^{-41} kg and due to higher value of proportionality coefficient the binding energy can be 2.2244MeV. Thus there is consistency between experimentally observed facts (binding energy and equality of masses of nucleons) and theoretical predictions based upon $\Delta E = Ac^2 \Delta m$.

The $\Delta E = Ac^2 \Delta m$ implies universal equality of masses of nucleons (as mass defect is negligible) and binding energy is 2.2244MeV (as conversion factor A is very high). Thus $\Delta E = Ac^2 \Delta m$ explains both phenomena of equality of masses of nucleons and binding energy simultaneously which is not so in case of $L = \Delta mc^2$.

1.2 Explanation on the basis of $\Delta E = Ac^2 \Delta m$

Einstein's Sep. 1905 derivation of mass energy inter conversion equation [1] has been critically analyzed by the author [11-24], and found that this derivation is true under special

conditions (only for certain values of parameters, not for all values of involved parameters). In this paper firstly Einstein [1] derived under super-special conditions the light energy-mass inter conversion equation i.e.

$$\Delta L = \Delta mc^2 \qquad\qquad (11)$$

The eq.(1) is based upon relativistic variation of light energy, which was given by Einstein [1] in his June 1905 paper as

$$l^* = l \left[1-v/c \cos\phi \right] / \left[(1-v^2/c^2)^{1/2} \right] \qquad\qquad (1)$$

where l^* is energy measured in moving frame, l is energy emitted by body in rest frame, ϕ is angle at which light ray is emitted and v is relative velocity between two frames. The eq.(1) is purposely mentioned here as Einstein derived eq.(2) using it for light energy only. Neither eq.(1) nor eq.(11) is meant for attractive binding energy of nucleus. Also Einstein did not mention anything about it in the derivation. In $\Delta L = \Delta mc^2$ Einstein arbitrarily replaced light energy L by energy E (every type of energy) and speculated eq.(4) i.e.

$$\Delta E = \Delta mc^2 \qquad\qquad (14)$$

Further Einstein maintained that $\Delta E = \Delta mc^2$ holds good for all perceivable energies e.g. heat energy, attractive binding energy of nucleons in nucleus, chemical energy, nuclear energy, magnetic energy, electrical energy, sound energy, energy emitted in form of invisible radiations, energy emitted in cosmological and astrophysical energy etc. However in Einstein's derivation there is no mathematical basis which accounts for all the energies for which equation is applied. How an equation meant for calculation of 'decrease in mass of body on emission of light energy' can be applied to attractive binding energy of deuteron?

In view of theoretical situation the author [11-24] has derived the generalized mass energy inter conversion equation i.e.

$$\Delta E = Ac^2 \Delta m \qquad\qquad (118)$$

specifically for all energies by an independent method, here A is coefficient of proportionality. Like many other co-efficients of proportionality in the existing literature the value of A depends upon the inherent characteristic conditions of the process. It can be equal, less or more than one. Thus according to $\Delta E = Ac^2\Delta m$ *like* Einstein's equation mass is converted to energy but *unlike* Einstein's equation conversion factor is not always c^2. Thus according to $\Delta E = Ac^2 \Delta m$, the energy emitted can be less, equal or more than $\Delta E = \Delta mc^2$, also experimentally inter-conversion of mass and energy are bizarre processes right from chemical reactions to heavenly phenomena governing origin and development of universe.

1.21 $\Delta E = Ac^2 \Delta m$ implies smaller mass defect can give binding energy 2.2244MeV.

(i) The equality of masses of proton and neutron inside and outside the nucleus implies that mass defect is too less to be measured by all means. Only then masses of neutron and proton are fundamental physical constants. Let us speculate that the mass defect in this regard is

2.388×10⁻¹⁴ u or 3.965×10⁻⁴¹ kg , if it is the case then masses of nucleons inside and outside the nucleus are equal or difference is too less to be measured. According to the generalized form of mass-energy inter-conversion equation, for annihilation of infinitesimally small mass, large amount of energy can be emitted i.e. conversion factor is much higher than c^2. Now applying equation $\Delta E = Ac^2 \Delta m$ under this condition, the value of A can be determined as

$$BE = 0.03563752×10^{-11} \text{ J}, \quad \Delta m = 0.003965274×10^{-27}, \quad c^2 = 8.9874044×10^{16} \quad (142)$$

$$A = \Delta E / c^2 \Delta m = 0.03563752×10^{-11} / 0.003965274×10^{-27} ×8.9874044×10^{16} = 10^{10}$$

$$\Delta E = Ac^2 \Delta m = 10^{10} c^2 \Delta m \qquad (143)$$

The value of conversion co-efficient ('A') is similar to co-efficients of proportionality in C. F. von Weizsacker's semi-empirical formula [2] for binding energy (associated with Bohr's Liquid Drop Model).

(ii) The masses of neutron and proton are same inside and outside the nucleus as mass defect is 2.388×10⁻¹⁴ u or 3.965×10⁻⁴¹ kg which is incalculable. Corresponding to this mass defect mass of proton is 1.007274 u will decrease by incalculable amount 1.195×10⁻¹⁴ u. Similar is the case of neutron. Thus masses of nucleons are same inside and outside the nucleus , and in this particular case for annihilation of negligible mass defect more energy is emitted compared to predicted by $\Delta E = \Delta mc^2$. According to $\Delta E = Ac^2 \Delta m$ the mass defect 3.984×10⁻⁴¹ kg can explain binding energy equal to 2.2244MeV if A is $\mathbf{10^{10}}$. Thus generalized equation simultaneously explains both intrigues e.g. universal equality of masses of nucleons and binding energy of nucleus 2.2244MeV. The decrease in masses of neutron and proton in deuteron, to explain the values of BE on the basis of $\Delta E = Ac^2 \Delta m$ are shown in Table III.

Hence according to the generalized form of mass-energy inter conversion equation i.e. $\Delta E = Ac^2 \Delta m$ masses of protons and neutrons are the same inside and outside the nucleus; and binding energy for deuteron is same as experimentally observed i.e. 2.2244MeV. In this case conversion factor A is exceptionally more than one, thus results are consistent with observations. As newer and newer phenomena in such cases are being discovered, then in such phenomena the $\Delta E = Ac^2 \Delta m$ can be discussed critically.

Table V. The universal equality of masses of protons and neutrons is not justified when binding energy is calculated on the basis of $E = \Delta mc^2$.

Sr. No.	Characteristic	$_1H^1$ e=1 p=1	$_1H^2$ e=1 p=1 n=1
1	Binding Energy (MeV)	0	2.2244
2	Mass defect (BE/c^2) in amu	0	2.388×10^{-3} or 3.965364×10^{-30} kg
3	Decrease in mass per nucleon (amu)	0	1.194×10^{-3} Or 1.982682×10^{-30} kg
4	M_p and M_n in nucleus	$M_p =$ 1.007276	$M_p = 1.006082$ or 1.670637×10^{-27} kg $M_n = 1.00747$ or 1.672942×10^{-27} kg
5	%age Decrease in M_p	0	0.1185
6	%age Decrease in M_n	0	0.1183
7	Universal equality of masses of M_p and M_n	obeyed	Not obeyed

Table VI The universal equality of masses of protons and neutrons is justified when binding energy is calculated on the basis of $\Delta E = Ac^2 \Delta m$ ($A=10^{10}$).

Sr. No.	Characteristic	$_1H^1$ e=1 p=1	$_1H^2$ e=1 p=1 n=1
1	Binding Energy (MeV)	0	2.2244
2	Mass defect (BE/Ac^2) in amu	0	2.388×10^{-13}
3	Decrease in mass per nucleon (amu)	0	1.194×10^{-13} or 1.982×10^{-40} kg
4	M_p and M_n in nucleus	$M_p=$ 1.007276	Virtually same
5	%age Decrease in M_p	0	1.185×10^{-11}
6	%age Decrease in M_n	0	1.183×10^{-11}
7	Universal equality of masses of M_p and M_n	Obeyed as masses are precisely same.	Obeyed as masses are virtually same.

Section V

Einstein's Rest Mass Energy from the Relativistic Kinetic Energy

or

Rest Mass Energy $(E_{rest} = M_{rest} c^2)$ is obtained from non-existent equation

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Abstract

Einstein deduced the rest mass energy equation ($E_{rest} = M_{rest} c^2$) from relativistic kinetic energy equation [$KE = (M_{motion} - M_{rest})c^2$] when it is written in typical form, under the condition when body is at rest ($v = 0$, $dx = 0$). The determination of rest mass energy is inconsistent under this condition. The reason is that under this condition, the very first equation ($dK = dW = Fdx$) which leads to relativistic form of kinetic energy VANISHES, and hence other equations are NON-EXISTENT but final result is NON-ZERO. Thus it is debated that whether an equation can be interpreted to get *non-zero* result at final stage under the condition when first equation *vanishes* and intermediate equations are *non-existent*, thus final equation does not exist. It is like getting output without input, which is not justified by conservation laws.

1.0 The Relativistic form of Kinetic Energy, $KE_{rel} = (M_{motion} - M_{rest}) c^2$.

Einstein has derived four equations relating to mass (rest mass, relativistic mass and mass annihilated or created) and energy e.g. mass- energy inter conversion equation $E = \Delta mc^2$, mass-light energy inter conversion equation $L = \Delta mc^2$, relativistic energy ($E_{motion} = M_{motion}c^2$) and Rest Mass Energy $E_{rest} = M_{rest}c^2$. The author [11-24] has critically studied Einstein's mass energy inter-conversion equations and the study has lead to new findings. Here in discussion origin of the Rest Mass Energy is studied. Einstein [1] initially derived equation for relativistic form of kinetic energy and later interpreted the Rest Mass Energy [20, 41-43, 2] under condition when body is at rest ($v = 0$, $dx = 0$), by writing equation of relativistic mass energy in special way.

According to Work–Kinetic Energy equation we have

$$dK = dW = Fdx \qquad (144)$$

where dK, dW are infinitesimally small amounts of kinetic energy and work done, when force F displaces the body through distance dx.

$$dK = dW = Fdx = \frac{d}{dt}\left[M_{motion}v\right]dx \qquad (145)$$

$$= \left[M_{motion}\frac{dv}{dt} + v\frac{dM_{motion}}{dt}\right]dx$$

$$= [M_{motion} dv + v \, dM_{motion}]v \qquad [v = dx/dt]$$

$$= [M_{motion} vdv + v^2 dM_{motion}] \qquad (146)$$

The relativistic mass is

$$M_{motion} = \frac{M_{rest}}{\sqrt{1 - \frac{v^2}{c^2}}} \tag{147}$$

Eq.(147) gives appreciable results when v is comparable with c.

or $M^2_{motion} c^2 - M^2_{motion} v^2 = c^2 M_{rest}$

or $c^2 \frac{dM^2_{motion}}{dt} - \frac{d|M^2_{motion}v^2|}{dt} = \frac{d\{c^2 M_{rest}\}}{dt} \tag{148}$

Now eq.(148) can be further written as

$$c^2 \frac{dM^2_{motion}}{dt} = \frac{d(M^2_{motion}v^2)}{dt}$$

$$c^2 2M_{motion} \frac{dM_{motion}}{dt}$$

$$= 2M_{motion} \frac{dM_{motion}}{dt}v^2 + M^2_{motion} 2v\frac{dv}{dt}$$

$$c^2 2M_{motion}dM_{motion} = 2M_{motion}v^2 dM_{motion} + M^2_{motion} 2vdv \tag{149}$$

Dividing both sides of eq.(149) by 2M$_{motion}$,

$c^2 dM_{motion} = v^2 dM_{motion} + M_{motion} vdv \tag{150}$

Now eq.(146) with help of eq.(150) can be written as

$dK = dW = c^2 dM_{motion} \tag{151}$

$\int dK = \int dW = c^2 \int dM_{motion} \tag{152}$

$\qquad K = W = c^2 (M_{motion} - M_{rest})$

Or $K = W = c^2 (M_{motion} - M_{rest}) = c^2 \left[\frac{M_{rest}}{\sqrt{1 - \frac{v^2}{c^2}}} - M_{rest}\right] \tag{153}$

Or $K = W = M_{motion} c^2 - M_{rest} c^2 \tag{154}$

Applying binomial theorem(v<<c) , the classical form of kinetic energy and work done is obtained i.e.

$$K = W = M_{rest} c^2 \left[(1 + \frac{v^2}{2c^2} + \frac{3v^4}{8c^4} + \ldots\ldots\ldots\ldots -1\right)$$

$$= \frac{M_{rest}v^2}{2} \tag{155}$$

If v =1m/s then

$\qquad K = W = M_{rest} c^2 [(1 + 1/2. 9 \times 10^{16} + 3 / 8 \times 81 \times 10^{-32} + \ldots\ldots\ldots -1.)$

$\qquad K = W = M_{rest} c^2 [1 + 5.55 \times 10^{-18} + 4.629 \times 10^{-35} \quad -1]$

$\quad K = W = M_{rest} c^2 5.55 \times 10^{-18}$

If body is at rest v =0 (dx = 0) then

$\quad$ K $=$ W $=$ M_{rest} c^2 [1 +0 + 0 -1] = 0 $\hspace{4cm}$ (156)

The eq.(154) is explained in view of this deduction and interesting results are obtained.

2.0 Interpretation of Eq.(154) in Terms of Kinetic Energy and Work

The eq.(154)   i.e. K $=$ W $=$ $M_{motion}c^2 -$ $M_{rest}c^2$ is derived under some conditions.

(i) Eq.(154) is obtained if the force displaces the body in its own direction.

(ii) Eq.(154) is obtained when velocity of body is comparable to speed of light i.e. v ~ c, only then Eq.(154) is derivable or gives significant results.

(iii) In case considerable amount of force acts on body and body does not move (e.g. subtle amount of force acts on body of mass 10kg), then eq.(154) is not derivable, as eq.(144) is zero (dx=0).

Now eq.(154) can be physically interpreted as below.

 The kinetic energy attained by a body due to the influence of external force in accelerated motion when a body moves with velocity v, which is comparable to c

$$= c^2 \, (M_{motion} - M_{rest}) = c^2 \, [\frac{M_{rest}}{\sqrt{1 - \dfrac{v^2}{c^2}}} - M_{rest}] \hspace{2cm} (153)$$

= [Increase in mass of body when due to application of external force in accelerated motion, when velocity v is comparable to c] c^2 $\hspace{4cm}$ (157)

Or

 The kinetic energy attained by body due to influence of external force in accelerated motion when velocity v of body is comparable to c $+M_{rest}$ c^2 = M_{motion}c^2 $\hspace{1.5cm}$ (158)

Further, Einstein termed $M_{motion}c^2$ as relativistic kinetic energy [20, 41-43, 2]. Thus,

$\quad$ E_{motion} = KE + $M_{rest}c^2$ = $M_{motion}c^2$ $\hspace{4cm}$ (159)

Note that in eq.(153) there is one sign of equality and eq.(159) has two signs of equality .

In terms of work

The work done by body due to influence of external force in accelerated motion when velocity v which is comparable to c, the speed of light

$$= c^2 \, (M_{motion} - M_{rest}) = c^2 \, [\frac{M_{rest}}{\sqrt{1 - \dfrac{v^2}{c^2}}} - M_{rest}]$$

Similarly

$\qquad$ Work Done + $M_{rest}c^2$ = $M_{motion}c^2$ = Relativistic work done

These are relativistic equations i.e. exist when v~c, as only under this condition relativistic increase in mass is observable.

3.0. The Origin of Rest Mass Energy

In 1907, Einstein [20, 41-43, 2] interpreted the eq.(159) i.e.

$E_{motion} = KE + M_{rest}c^2 = M_{motion}c^2$

as Rest Mass Energy. Under this condition if body is at rest i.e. $v = 0$, $dx = 0$. Now the eq.(159) becomes

E_{motion} (when $v = 0$, $dx = 0$) $= 0 + M_{rest}c^2 = M_{rest}c^2$

Then Einstein interpreted or coined that

E_{motion} (when $v = 0$, $dx = 0$) $= E_{rme}$

Hence above equation becomes

$E_{rme} = M_{rest}c^2 = M_{rest}c^2$

or $E_{rme} = M_{rest}c^2$ (160)

But conceptually and mathematically it is not justified, as when body is at rest i.e. ($v = 0$, $dx = 0$) then the very first equation i.e.

$dK = dW = Fdx$

vanishes or RHS becomes zero.

So there is situation of mathematical void and because rest of the equations are NON-EXISTENT. Thus the origin of Rest Mass Energy lies in the equation which itself vanishes, if this condition ($v = 0$, $dx = 0$) is applied. Hence Einstein's deduction is not justified. Also in this case eq.(156) is zero i.e.

  $K = W = M_{rest}\ c^2\ [\ 1 + 0 + 0 - 1] = 0$ (156)

 (i) **Rest mass energy NOT obtained from eq.(154)**

 Also we have equation for relativistic form of kinetic energy (**when v~c**) or work done as eq.(154)

   $W = K = c^2\ (M_{motion} - M_{rest})$ (154)

   Applying the condition that body is at rest, i.e. $v = 0$, $dx = 0$, $dW = dK = 0$,

$0 = c^2\ (M_{rest} - M_{rest})$

  Or $M_{rest}\ c^2 = M_{rest}\ c^2$

  Or $1 = 1$ (161)

which is true. Nevertheless, result in no case is rest mass energy ($E_{rest} = M_{rest}c^2$) in any way as obtained by Einstein under this condition i.e. $v = 0$, $dx = 0$.

(ii) **Rest mass energy is NOT obtained if eq.(154) is re-arranged.**

The eq.(10) can be written as

$$KE + M_{rest}\, c^2 = M_{motion}\, c^2 \qquad\qquad (162)$$

When a body is at rest i.e. $v = 0$, $dx = 0$, $dW = dK = 0$, then under this condition eq.(162) becomes,

$$0 + M_{rest}\, c^2 = \frac{M_{rest}\, c^2}{\sqrt{1-\dfrac{0}{c^2}}} = M_{rest}\, c^2$$

$$M_{rest}\, c^2 = M_{rest}\, c^2$$

$$\text{Or} \quad 1 = 1 \qquad\qquad (161)$$

which is true. Hence in no way the Rest Mass Energy equation ($E_{rest} = M_{rest}c^2$) is obtained.

(iii) Einstein wrote eq.(154) in arbitrary way to get Rest Mass Energy :

Einstein wrote eq.(154) as eq.(164) in such way that there are TWO EQUALITY SIGNS (=) that appear in one equation. Only this form of equation gives $E_{rme} = M_{rest}c^2$ under this condition ($v = 0$, $dx = 0$).

According to Einstein,

$$M_{motion}\, c^2 = \text{Total Energy due to motion } \textbf{when v} \sim \textbf{c} \text{ or } E_{motion} \qquad (163)$$

The eq.(163) is also known as Relativistic energy. Thus eq.(162) becomes

$$KE + M_{rest}\, c^2 = M_{motion}\, c^2 = \text{Total Energy due to motion } \textbf{when v} \sim \textbf{c} \quad (164)$$

In eq.(162) there is only one sign of equality.

When a body is at rest, i.e. $v = 0$, $dx = 0$, $dW = dK = 0$, then under this condition eq.(164) becomes

$$0 + M_{rest}\, c^2 = M_{rest}c^2 = \text{Total energy due to motion } (v = 0, dx = 0) \qquad (165)$$

Einstein wrote

Total energy ($M_{motion}\, c^2$) due to motion (when $v = 0$, $dx=0$) = E_{rest} $\qquad$ (166)

or $0 + M_{rest}\, c^2 = M_{rest}c^2 = $ Total energy due to motion when $\textbf{v} \sim \textbf{c}$ ($v = 0$, $dx = 0$) $= E_{rest}$

Thus,

$$E_{rest} = M_{rest}c^2 = M_{rest}\, c^2$$

Hence in this case when

(a) Velocity $v = 0$, $dx = 0$

(b) The momentum of body is zero

(c) Classical kinetic energy is zero

(d) Eq.(144) or eq.(155) is zero

it is not justified to draw or interpret *non-zero* results ($E_{rest} = M_{rest}c^2$) at final stage of derivation when very first equation is *zero*. It is like getting output without input. Under this condition first equation is ZERO and other equations are NON-EXISTENT, and final equation gives NON-ZERO results. It is never justified by any means. Thus no conclusions should be drawn from NON-EXISTENT equation as in this case. Thus Einstein's conclusion regarding the Rest Mass Energy from NON-EXISTENT equation is not scientifically

consistent.

The various results are shown in Table VII

Table VII : The various values of magnitude of Rest Mass Energy $E_{rest} = M_{rest} c^2$, as obtained from various equations.

Sr	Equation	Condition ,	Result
1	dW = dK =F.dx	v = 0, dx = 0	0
2	$W=K= [M_{motion} - M_{rest}]c^2$	v = 0, dx = 0	0
3	$W + M_{rest} c^2 = M_{motion} c^2$	v = 0, dx = 0	0
4	$K = W = M_{rest} c^2 [(1 + \dfrac{v^2}{2c^2} + \dfrac{3v^4}{8c^4} + \ldots\ldots\ldots - 1)$	v = 0, dx = 0	0
5	$E_{motion} = W + M_{rest} c^2 = M_{motion} c^2$	v = 0, dx = 0	$E_{rest} = M_{rest} c^2$ if E_{motion} (when v=0 , dx=0) = E_{rest}

Deductions : In equations i.e. dW = dK =F.dx, $W=K= [M_{motion} - M_{rest}]c^2$, $W + M_{rest} c^2 = M_{motion} c^2$ and $K = W = M_{rest} c^2 [(1 + \dfrac{v^2}{2c^2} + \dfrac{3v^4}{8c^4} + \ldots\ldots\ldots - 1)]$ don't yield Rest Mass Energy $E_{rest} = M_{rest} c^2$ under the condition when body is at rest i.e. v = 0 , dx = 0 .

The Rest Mass Energy is obtained $E_{rest} = M_{rest} c^2$ when equation $W + M_{rest} c^2 = M_{motion} c^2$ is obtained in arbitrary way i.e.

$E_{motion} = W + M_{rest} c^2 = M_{motion} c^2$

It must be noted when equation,

$W + M_{rest} c^2 = M_{motion} c^2$

is written in natural and condition , v= 0 , dx =0 is applied the rest mass energy is not

obtained.

WHY DID EINSTEIN WROTE EQAUTION, $W + M_{rest} \ c^2 = M_{motion} \ c^2$ IN SPECIAL WAY TO OBTAINED REST MASS ENERGY?

Is Einstein given special authority for beyond logic of science to interpret   the law of physics ?

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