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The Generalization of Einstein's $E=\Delta mc^2$ to $\Delta E=Ac^2\Delta M$

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Book: 100 Years of $E=mc^2$

Abstract

This article contains information in simplified version about generalization of Einstein's $E=\Delta mc^2$ to $\Delta E = Ac^2\Delta m$. . The subject matter is already published in international journals and conferences. Author has also published various articles in this regards on the web and in this article all the are summed up.

The theme is Einstein's Sep. 1905 paper (in which Einstein originally derived $E= mc^2$) http://www.fourmilab.ch/etexts/einstein/E_mc2/www/ is not completely studied and some predictions from this violate law of conservation of matter. This derivation also predicts that if light energy is emitted, and then mass of body must increase, it is never justified. Thus mass energy equation is derived in other way and result as $\Delta E = Ac^2 \Delta M$

Discussion I Elementary Information about $E=mc^2$

Article I
General Information

1. What is $E=mc^2$? What is its importance?

$E=mc^2$ is the most wonderful and significant equation is physics. In 1945 the explosion of atomic bombs on Hiroshima and Nagasaki were base upon this equation. According to this mass (m) can be converted to energy (E) and energy can be converted to mass.

2. This equation is doing well since past 100 years then where is the inconsistency?

The inconsistency lies in its mathematical derivation (a method to obtain a mathematical equation). In his 1905 paper Einstein did not derive it mathematically but in true sense speculated it. Einstein earlier derived $L = mc^2$ (light energy mass conversion equation). Then Einstein speculated that what is true for light energy (L) the same is true for every energy (E). This speculation results in $E=mc^2$, such a significant equation must be based upon a specific mathematical derivation and not on speculation.

3. Is Einstein's derivation of $L =mc^2$ correct?

The derivation of $L=mc^2$ is incomplete or true in special conditions only. Einstein took just handpicked parameters out of numerous possible, to obtain the equation. Einstein was aware of the reality so he left in midway after getting the desired result. If all valid values of parameters are taken, then results are contradictory in nature.

4. What are contradictory results?

Some UNDISCUSSED predictions of Einstein's 29 Sep. 1905 derivation blatantly contradict Law of Conservation of Matter. I have scientifically confirmed the same. No limitation can be bigger than this in science.

5. Was $E=mc^2$ or similar ideas existed before Einstein?

Yes, $E=mc^2$ existed before Einstein. An Italian Olinto de Pretto published $E=mc^2$ in valid scientific journal Lettere ed Atti, Feb. 1904, two years before Einstein. But Pretto died in 1921, before its experimental confirmation in nuclear physics. Newton was the first who propagated idea of intern conversion of light energy to mass firs of all.

6. Einstein speculated $E=mc^2$ from $L=mc^2$. What is the problem here ?

Firstly derivation of $L=mc^2$ is incomplete or under special conditions only. Secondly Einstein originated $E=mc^2$ on the basis of speculation only without any conceptual and mathematical basis. Basically Einstein replaced L by E in equation $L=mc^2$ to get $E=mc^2$.

7. Then how did you derive new equation, $dE = Ac^2dm$ (or $\Delta E = Ac^2 \Delta M$)?

I have derived new equation between mass-energy conservation by simple calculus method. In $dE = Ac^2dm$, A is a co-efficient of proportionality like numerous others in science. It is dimensionless variable.

8. How do you compare these two equations?

Firstly $dE = Ac^2dm$ is based upon a conceptual and mathematical derivation. On the other hand $E=mc^2$ is a speculation, it is bitter truth. Secondly $dE = Ac^2dm$ is a general equation and $E=mc^2$ is its special case. Energy emitted by new equation can be less, equal to or more than predicted by $E=mc^2$.

9. How did you justify your equation experimentally?

In Nuclear Physics there are some anomalous results which cannot be explained by $E=mc^2$. Like this there are some instances in astrophysics where my equation is extremely useful.

10. Is your work recognized by international scientific community?

Yes, it is completely recognized.

10. Is your work recognized by international scientific community?

The only way to get scientific recognition is that to get the work published in peer review international journals and conferences. My research papers are either published in international journals from America, England and Canada or being published. I have got invitation from at least 55 International Conferences to present my work. I have presented my research in international conferences in USA, England, Germany, Taiwan Ukraine etc. I have invitation from France and Italy to present my work this year.

11. What about your book, 100 Years of $E=mc^2$?

This book, **100 Years of $E=mc^2$** is being published soon.

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Article II

Should Newton, De Pretto , Preston, Hasenohrl and Soddi, Planck be given credit for discovery of $E=mc^2$?

The French chemist Antoine Lavoisier (1743-1794) was the first to formulate a law of conservation of matter in chemical reactions. The concept of inter-conversion of mass and energy has been studied by various scientists qualitatively, even before Einstein.

1. **Newton** has quoted in his book 'Opticks' in 1704 that "Gross bodies and light are convertible into one another...",

After about 200 years Einstein derived mathematical equation for Newton's perception *i.e.* $\Delta L = \Delta mc^2$ where ΔL is light energy emitted when mass Δm is annihilated and is speed of light. It is the rarest coincidence in between Newton's hypothesis and Einstein's mathematical derivation.

2. **S. Tolver Preston** proposed that a vast amount of energy can be produced from matter in his book *Physics of the Ether* in 1875. Preston determined that one grain could lift a 100,000-ton object up to a height of 1.9 miles. This deduction yields $dE \propto dmc^2$.

3. **Jules Henri Poincaré** in 1900 applied the calculations in a recoil process and reached at the conclusion in the form, $mv = (E/c^2)c$. From the viewpoint of dimensional analysis, E/c^2 takes on the role of a 'mass' associated with radiation, which yields $E=mc^2$.

4. **Olinto De Pretto** speculated $E=mc^2$, implying that when $v=c$, then $E= mv^2$ becomes $E=mc^2$, in **1903-04.** But Pretto neither gave specific derivation nor mathematical calculations. Bartocci claimed that Einstein was aware of De Pretto's speculation of $E=\Delta mc^2$, which was published about a year before.

5. **Fritz Hasenohrl** in 1904, concluded: "to the mechanical mass of our system must be added an apparent mass which is given by, $m=8E/3c^2$ where E is the energy of the radiation." In a later paper he further improved result that mass exchanged is, $m=4E/3c^2$. Ebenezer Cunningham in 1914 in the book The Principles of Relativity showed that F. Hasenöhrl, had made a slight error in his calculations. If errors are removed then the mass exchanged is $m =E/c^2$ or $E = mc^2$. Thus in this regard Hasenohrl's contribution is the most significant, before Einstein.

6. **Frederick Soddi** and M. Henri Becquerel both have predicted that in radioactive emissions the mass of body decreases i.e. energy of radiations is at the cost of mass.

7. **Max Planck** in 1907 made an in-depth investigation of the energy "confined" within a body, but he did not use Einstein's approach at all. Planck derived an expression $m-M= E/c^2$, for heat energy and mass and interpreted that

" The inertia mass of body is altered by absorption or emission of heat energy. The increments of mass of body are equal to heat energy divided by square of speed of light."

Planck acknowledged Einstein's previous derivation but did not agree with correctness of Einstein's derivation.

Should these scientists be given credit of doing basic work in assisting the discovery of $E=mc^2$?

Today, $E=mc^2$ is regarded a sole province of Einstein.

Article III
Galileo (NOT Einstein) is inventor of First postulate of Relativity

Einstein's June 1905, paper is known as Special Theory of Relativity?
The reference to this paper

http://www.fourmilab.ch/etexts/einstein/specrel/www/

In this paper Einstein stated two postulates and here we will discuss the second postulate.

Part I

First postulate of Special Relativity as re-stated by Einstein

(i) "The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion".

It refer to that law of physics are the same, if two systems or observers are UNIFROM MOTION (zero acceleration).
I t is well known that in this paper Einstein did not give any REFRENCE to the existing literature, which implies that all this postulate is his work.

Part II

Galileo is inventor of first postulate of Special Theory Relativity.
Galileo has given second postulate of Special Theory in his book
Galileo' *Dialogue Concerning the Two Chief World Systems)* ,
Ref.
Galileo, G. 1632, *Dialogues concerning the two chief world systems*, trans. S.Drake, 2nd edition 1967, University of California Press .
For this book was published by Galileo in 1632 and was persecuted for this book.
Galileo quoted an example in the *Dialogue* [14] , that if a ship is moving with uniform velocity then from motion of fish in bottle one can not judge that whether ship is moving with uniform velocity or at rest.
Thus Galileo stated

" the mechanical laws of physics are the same for every observer moving uniformly with constant speed in a straight line".

It refer to that law of physics are the same, if two systems or observers are UNIFROM MOTION (zero acceleration).

The Einstein has simply re-stated in 1905, the existing in the literature since 273 years. It is against ethics of research. Einstein should have given due credit to Galileo. Even at this time it I not too late to honor Galileo for basics of Special Theory of Relativity.

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Discussion II Limitations of Einstein's Sep 1905 derivation and alternate equation.

Article 1

Which mathematical equation from Einstein's Sep 1905 derivation predicts that when Light Energy is emitted, MASS OF BODY INCREASES?

It is inconsistent prediction from Einstein's derivation of $E=mc^2$.

In simple words, it is explained as below.

1. What is Einstein's Sep 1905 paper in few words?.

AJAY SHARMA : In this paper Einstein derived a relationship between Light energy emitted (L) and corresponding decrease in mass ($\Delta m = M_b - M_a$) as

$L = (M_b - M_a)c^2$ or $M_b - M_a = L/c^2$

From here Einstein speculated $E=mc^2$

Practically, Einstein considered a body at rest emitting light energy. Einstein measured the magnitude of light energy in a moving system. And then he derived a relation between ENERGY EMITTED (L) and DECREASE IN MASS (Δm) of body.

2. Under which conditions Einstein derived this equation $L = \Delta mc^2$?

AJAY SHARMA : In Einstein's derivation , there are four variables i.e.
(a) Number of light waves emitted by body
(b) Magnitude of energy of light waves
(c) Angles at which waves are emitted by body
(d) Velocity of measuring system w.r.t. body emitting light energy.

Einstein took SPECIAL CONDITIONS to derive $L = mc^2$ and speculated from it $E=mc^2$

(a) Einstein took , Just two light waves
(b) Energy of light wave is equal
(c) Waves are emitted in opposite directions
(d) Velocity measuring system w.r.t body is in classical region.

Thus under these conditions Einstein's derivation is OK. The result is
When body emits light energy, its mass decreases i.e. $L = (M_b - M_a)c^2$
It is correct.

3. What about Law of Conservation of momentum?

AJAY SHARMA: After emission of light energy body
(i) May remain at rest.
(ii) May tend to move
(iii) May move apparently or visibly
the law of conservation of momentum is always obeyed. The velocity of recoil can be calculated by applying equation,
Initial Momentum = Final Momentum
The velocity of recoil of gun is determined by this method.
Einstein has considered first case ONLY.

4. Which is the mathematical equation obtained by Einstein in Sep 1905 paper which predict that When light energy is emitted, mass decreases?

AJAY SHARMA: The final equation in this regard is

$$\Delta m = L/c^2$$

or M_a (mass of body after emission) = M_b (mass of body before emission) – L/c^2
Thus mass of body decreases when light energy is emitted.
Einstein has derived this equation under SPECIAL CONDITIONS by considering two light waves of equal energy(0.5L each) , emitted in opposite directions etc.

5. Which is mathematical equation which follows from Einstein's derivation and implies that when Light Energy is Emitted mass of body Increases?

AJAY SHARMA There are numerous equations to this fact which follows from Einstein's Sep 1905 derivation and predict that when
Light Energy is emitted, Mass of Body Increases.
It is contradiction of LAW OF CONSERVATION OF MATTER OR ENERGY.

One case is e.g. when body emits TWO LIGHT WAVES of energies 0.501L and 0.499L , emitted in OPPOSITE DIRECTIONS. Thus all conditions are same as that in Einstein's derivation except magnitude of Light energy (Einstein has taken energy equal to 0.5L each).

Exactly repeating the calculation as done by Einstein in Sep 1905 paper we get

Δ m = Mass of body before emission (M_b)–Mass of body after emission (M_a)

$$= -0.004L/cv + L/c^2 \qquad (16)$$

or $M_a = 0.004L/cv - L/c^2 + M_b$

Thus
Mass of body **after** emission of light energy (Ma)
= **Positive Quantity** + Mass of body **before** emission.
Hence mass Increases, when light energy is emitted.

It is not CORRECT prediction FROM Einstein's derivation.

6. How it can be justified that Einstein has speculated $E=mc^2$ from $L=mc^2$

Einstein did not derive $E=mc^2$ in 1905, but speculated it from Light energy mass equation $L=mc^2$. In derivation of $L=mc^2$ Einstein used equation

$l^* = l\{1 - v/c \cos \varphi \} / \sqrt{[1 - v^2 / c^2]}$

which he has given in June 1905 paper.
Using this as central equation Einstein obtained equation

$L=mc^2$ (1)

under special conditions (when emits TWO light wave, of equal MAGNITUDE, exactly in opposite directions, relative velocity v is in classical region).
Then Einstein replaced L (light energy) by E (every energy i.e. light energy, heat energy ,sound energy , electrical energy , energy in form of invisible radiations etc) and thus SPECULATED

$E=mc^2$ (2)

Such an important equation (INTER CONVERSION OF MASS –ENERGY) should have valid and well defined derivation.

Article 2

What are reasons for inconsistent prediction from (Light Energy is emitted, MASS Decreases) Einstein's Sep. 1905 derivation?

Part I

The central equation in Einstein derivation is very complex, it contains **FOUR** variables and each variable has **NUMEROUS** values.

(i) The basic equation Einstein used is

$\ell^* = \ell\{1 - v \cos \varphi/c \} / \sqrt{[1 - v^2 / c^2]}$ (1)

ℓ^* is light energy measured in moving in frame and ℓ is energy measured in rest frame. Einstein has given eq.(1) in his June 1905 paper, known as Special Theory of Relativity and called eq.(1) as Doppler principle for any velocities whatever. Link for paper of Special Theory of Relativity

http://www.fourmilab.ch/etexts/einstein/specrel/www/

(ii) Thus there are **FOUR** variables in derivation.

(a) Number of light waves
(b) Magnitude of energy of light waves
(c) Angles at which waves are emitted
(d) Velocity of measuring system w.r.t. body emitting light energy.

Einstein took SPECIAL CONDITIONS to derive $L =mc^2$ or $E=mc^2$

(a) Einstein took, Just two light waves
(b) Energy of light wave is equal
(c) Waves are emitted in opposite directions
(d) Velocity measuring system w.r.t body is in classical region.

Thus under these conditions Einstein's derivation is OK. The result is
When body emits light energy, its mass decreases.

Part II

L =mc^2 (Light Energy emitted, Mass Decreases), is not obtained under GENERAL CONDITIONS.

Experimentally law of inter conversion of mass energy holds good in all cases. Theoretically large number of cases is possible (Einstein's derivation is valid under these conditions also).
(p) Body may emit large number of waves
(q) The waves may be emitted at different angles.
(r) The waves may have different energies.
(t) Velocity may be in relativistic region.

Thus under general conditions Einstein's Sep 27 1905 derivation does not work well.
So Einstein's Sep 1905 derivation is true under special conditions only. This is the THEME of the paper.

Article 3

Is Einstein's E=mc^2, CONCEPTUALLY applicable for energy emitted Chemical Reactions.

Before applying any equation in any phenomena, we have to see the conditions and assumptions under which EQAUTION IS derived. What have been the CONDITIONS and ASSUMPTIONS of derivation of an equation? It is very important, to know these, before applying the equation. For example Hook's law is only obeyed within elastic limits and Ohm's Law is applicable under certain conditions.

Part I

Origin of E=mc^2 in Einstein's Sep 27 1905 paper

A. Einstein, *Annalen der Physik* 18 (1905) 639-641.
. DOES THE INERTIA OF A BODY DEPEND UPON ITS ENERGY-CONTENT?
Weblink is
Einstein's 27 Sep 1905 paper available at http://www.fourmilab.ch/etexts/einstein/E_mc2/www/

What Einstein did in the paper?

Einstein considered a body at rest emitting light energy. Einstein measured the magnitude of light energy in a moving system. And then he derived a relation between ENERGY EMITTED (L) and DECREASE IN MASS (Δm) of body.

The basic equation Einstein used is

$$\ell^* = \ell\{1 - v \cos \varphi/c \} /\sqrt{[1 - v^2/c^2]} \qquad (1)$$

ℓ^* is light energy measured in moving in frame and ℓ is energy measured in rest frame. Einstein has given eq.(1) in his June 1905 paper, known as Special Theory of Relativity and called eq.(1) as Doppler principle for any velocities whatever. Link for paper of Special Theory of Relativity

http://www.fourmilab.ch/etexts/einstein/specrel/www/

Then Einstein did calculations under classical conditions (v<<c , applied Binomial Theorem) and obtained equation

$L = (M_b - M_a)c^2 = \Delta mc^2$

L = (Mass of body before emission –Mass of energy after emission) $c^2 = \Delta mc^2$ (2)

Conceptually, mathematically, scientifically eq.(2) is meant ONLY for measurements of MASS DECREASE when LIGHT ENERGY is emitted. The reason I that eq.(1) DESCRIBES only Light Energy.

Part II

In this case Einstein SPECULATED, that

' whatever is true for Light Energy , is true for every energy'

Thus, Einstein replaced term L (light energy) by term E (every energy) without giving conceptual reasoning thus ,

E = (Mass of body before emission –Mass of energy after emission) $c^2 = \Delta mc^2$

Here E stands for every energy e.g.

(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) energy emitted in cosmological and astrophysical phenomena

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

Now Einstein's this SPECULATION implies that eq.(1) i.e.

$\ell^* = \ell\{1 - v \cos \varphi/c\} / \sqrt{[1 - v^2/c^2]}$ (1)

is valid **for all these energies**. BUT EQ.(1) IS DERIVED FOR LIGHT ENERGY ONLY.

Einstein did not mentioned about these reactions at all in his paper .But generalized eq.(2) for all these energies.

Part III

Consider simple chemical reactions i.e. combustion of wood of paper.

(i) Should energy emitted on annihilation of mass, be measured by $E=mc^2$, when its original form $L =mc^2$ is meant CONCEPTUAL for Light energy .

(ii) Should for all such cases Light Energy Mass inter conversion be derived by specifically by other methods .

(iii)

(iv) **Article 4**

Momentum is conserved in critical analysis of Einstein's derivation.

Part I

General meaning of conservation of momentum is explained in 11th class Physics.
The law of momentum conservation,

* In an isolated system, the momentum of system must be conserved.*

Mathematically implies that

Initial Momentum = Final Momentum

$$mu=mv \quad (1)$$

As mass remains same in classical mechanics.
So $u=v$
which is Newton's First law of motion. The momentum is conserved in both elastic and inelastic collision.

Applications of momentum conservation.

When body emits energy (in this cases light energy)
then it recoils .Thus it is used to calculate the velocity of recoil.
Its applications from the existing physics can be considered.

(i) Light bullet fired from TOY Gun, system remains at rest.
(body does not recoil with noticeable velocity, it tends to recoil)
The velocity can be calculated but may be of the order of
1/10000000000000000000000000000000000 m/s or 10^{-40} m/s
This case resembles with Einstein's two waves of equal energy emitted in opposite directions.

(ii) Shot fired from gun, gun moves backward.
the velocity can be calculated from conservation of momentum i.e.
initial momentum =final momentum

In this case the velocity of recoil can be calculated (as in numerous cases in existing physics) as
$V_{recoil} = mv/M \sim 2$ m/s (say)
Thus whether body moves or not, the linear momentum is conserved.
The momentum is conserved both in elastic and inelastic collisions.

Part II

The law of conservation of momentum is obeyed in my paper.

When two waves different energies are emitted. The body recoils with velocity v, with magnitude of the order of 10^{-32} m/s i.e.
V (recoil)=1/10000000000000000000000000000000000000000000000000000000000
It can be easily calculated with simple mathematical calculations.

If body emits two light waves of slightly different energies i.e. 0.5001L and 0.4999L (Einstein has used light waves of energy 0.5L and 0.5L) in opposite directions. Now using the law of conservation of momentum, it can be easily justified that in this case body remains at rest.

Let the body of mass 10kg emits light energy in two waves in visible region equal to 7.9512×10^{-19} J, this energy corresponds to TWO light waves in visible region having wavelength 5000°A or energy, $2hc/\lambda$ or 7.9512×10^{-19} J.

Let towards the observer the body emits light energy 0.5001L i.e. 3.97639512×10^{-19} J i.e. will have

momentum ($p_1 = E/c$) 1.32546504×10^{-27} m/s.

Secondly, the body emits light wave of energy 0.4999L i.e. 3.97480488×10^{-19} J, away from the observer ($\varphi = 180^\circ$) i.e. will have momentum ($p_2 = E/c$) 1.32493496×10^{-27} m/s.
Let us assume that when the body emits light waves of energy and moves (if it actually does) with velocity V_b , then according to law of conservation of momentum we get

$$0 = p_1 + p_2 + M_b V_b \quad \text{or} \quad V_b = -(p_1 + p_2)/M_b = -5.3\times10^{-32} \text{ m/s} \qquad (2)$$

Thus conservation of momentum requires that body should move with velocity -5.3×10^{-32} m/s opposite to observer. Thus body will tend to move with velocity 5.3×10^{-32} m/s (away from the observer) which is immeasurably small by all means, hence the body remains at rest. Due to this uniform relative velocity v of the system (ξ, η, ζ) will not change, if body moves then v will vary accordingly.

Part III

If body recoils then Einstein's central slightly changes

The first and basic equation in Einstein's paper is

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

In eq.(1) v is the relative velocity between light emitting body and the measuring system i.e. system (ξ, η, ζ). If body moves after emission with velocity v' away from the observer, then relative velocity will be v+v' (say V). Thus in this case eq.(1) becomes

$$\ell^* = \ell\{1 - (v+v')\cos\varphi/c\} / \sqrt{[1 - (v+v')^2/c^2]} \qquad (1a)$$

The rest of the calculations remain the same. Thus Einstein's derivation is also valid if the body moves, Einstein has considered the simplest case when velocity v' is zero (V= v+v' =v), which is special case. Also experimentally the law of inter conversion of mass energy holds good in all possible cases.

Einstein has done all calculations in classical region, thus as long as net velocity (v+v') is in classical region, the eq.(1a) is applicable in Einstein's derivation.

Discussion III

E is Proportional To Δmc^2 ($E \propto \Delta mc^2$)

$E = \Delta mc^2$ means, exactly energy is equal to mass annihilated times c^2.

It is confirmed in Nuclear Reactions as is regarded as STANDARD in measurements of nuclear masses and energies, as there are SEVEN DAYS IN WEEK.

There are various types of reactions involving inter-conversion of mass to energy, these may or may be of nuclear origin. These reactions are e.g. chemical reactions, nuclear reactions (fission, fusion and annihilation of matter and antimatter), volcanic reactions, astrophysical and cosmological reactions and process of creation of mass before Big Bang. The proportionality ($E \propto \Delta mc^2$) is justified between

mass and energy.

I

(i) CHEMICAL REACTIONS.

When Einstein derived $E=\Delta mc^2$ chemical reactions were the most abundant source of energy in nature. Till date $E=\Delta mc^2$ is not confirmed in the chemical reaction and reason cited for this is that equipments are not enough sensitive [1]. Consider burning of 1kg straw or paper or petrol in controlled way, ashes, gases and energy produced can be estimated. Even if 0.001 kg or 1gm of matter is annihilated then energy equal to 9×10^{13}J (can drive a truck of mass 1000kg to distance of 9×10^{7} km) will be produced. Until the equation is not confirmed in such reactions, then scientifically it may be not be regarded as precisely true in such cases. It is equally possible that energy emitted may be less than predicted by $E=\Delta mc^2$ or $E \propto \Delta mc^2$.

Ref . [1] Beiser Arthor, *Concepts of Modern Physics*. (McGraw Hill International Edition, New York, 4th Edition) pp. 25, 27-30,420-422 6(1987).

(ii) EXISTING EXPERIMENTAL OBSERVATION :

In laboratory it is confirmed [2-4] that using thermal neutrons the total kinetic energy (TKE) of fission fragments that result from of U^{235} and Pu^{239} is 20-60MeV less than Q-value (200MeV) of reaction predicted by $\Delta E= \Delta mc^2$. Similarly mass of particle Ds (2317) has been found more than current estimates based upon $\Delta E= \Delta mc^2$. Thus in this case $E \propto dmc^2$ is justified.

[2]. Hambsch, F.J. et al. *Nucl. Phys.A,* 491,p.56 (1989)

[3]. Thiereus, H. et al., *Phys. Rev. C,* 23 P 2104 (1981)

[4] Bakhoum, E. G. *Physics Essays*, Vol.15, No 1 2002

(Preprint archive : physics/0206061)

(iii) HOW FIRST PARTICLE OF MASS CREATED?

The most successful theory of understanding of formation of universe, the Big Bang theory (the biggest energy releasing process universe) assumes that whole mass of universe (10^{55} kg, say) was in form of 'primeval atom' and then suddenly exploded. According to $E=\Delta mc^2$ this would have been created from energy 9×10^{71} J, but how this enormous amount of energy was created in space out of nothing. Thus one query leads to another query. Hence creation of mass or energy in formation of 'primeval atom' is not consistent with $E=mc^2$, hence proportionality $E \propto dmc^2$, may be considered.

The characteristic conditions of electron-positrons annihilation process are different from chemical reactions (nucleus remain unaffected e.g. burning of wood), and those of chemical reactions are different from astrophysical or cosmological reactions. The energy emitted in Gamma Rays Bursts is of the order of 10^{45}J even in a fraction of second, these are different from chemical

reactions. Thus in all reactions $E=mc^2$ needs to be specifically confirmed.

(vi) IN FIRST ATOMS BOMB, E proportional to mc^2 ($E \propto mc^2$) is confirmed.

The efficiency of the nuclear weapons as well as nuclear reactors is far less than the theoretical value predicted by $E=\Delta mc^2$. Robert Serber (member of first American team entered Hiroshima and Nagasaki in September 1945 to assess loses), has indicated [5] that the efficiency of "Little Boy" weapon [U^{235}, 49kg] that was used against Hiroshima was about 2% only. It is assumed that all the atoms don't undergo fission, thus material is wasted. But no such waste material is specifically measured quantitatively. Thus the waste material (nuclear reactor or weapon) must be measured and corresponding energy is calculated, and it must quantitatively explain that why efficiency is less. It may require the measurements of all types of energies (may co-exist in various forms) in the processes and experimental errors.

Until such calculations are not precisely confirmed experimentally; it is equally feasible to assume that the energy emitted may be less than $E=mc^2$ (or $E \propto dmc^2$) when reactants are in bulk amount and various types of energies are simultaneously emitted. Thus both the possibilities are equally probable until one is not specifically rules out. In view of weirdness in reactions emitting energy, some theoretical inconsistencies in the derivation and non-availability of data, one can explore the second possibility even as a postulate.

[5] Serber , R The Los Alamos Primer (U.S. Govt. first published as LA1, April 1946), declassified 1965 , annotated book , 1992. also R . Serber (editor) , The Los Alamos Primer pp. 38 (Univ. of California Press, 1992)