Quanton based model for space fabric interactions

Ayman Kassem *(a) , (b)*

(a) **Aeronautical engineer, Cairo Egypt**

(b) ***Contact address :*** ***Phyiscalmodel2017@Gmail.com***

Abstract

The mechanism of the universe's inflation is variation of energy in space and in time , the relationship between space and time varying energy fields is governed by energy constraining inside a Planck scale entity : the quanton

as energy varies in space or in time, it creates associated fields and through their interactions, inflationary momentum and the fundamental forces are generated

this model comes in three parts : energy constraining , the evolution of the quanton and its different transitions are discussed until the stable state is reached

the second part , electromagnetic waves in terms of space and

time varying energy fields and role of Maxwell equations in the evolution of the quanton

the third part , energy fields and their interactions , while using basic physics concepts , it shows that the origin many of the physical phenomena can be traced back to the Planck scale world

Key words

space and time varying fields , energy degrees of freedom

Contents

1.Physical basis of this model 6

2.Definition of the model 8

3.Mathematical brief 10

4. Definition of various energy field parameters 12

5.Energy constraining 13

6.Bridging the gap between mathematics and physics in energy constraining 29

7.Energy degrees of freedom 33

8.Superposition principle inside quanton 38

9.Defining directional component of energy fields 41

10.Dimensional energy symmetry 44

11.Energy packet / field relationship 48

12.Energy constraining as a possible origin of the entropy 51

13.Space fabric expansion and the release of thermal energy 55

14.origin of cosmic microwave back ground(CMB) 59

15. Mechanism of quanton splitting and expansion 60

16.feedback mechanism through energy constraining 64

17.mathematics behind expansion / constraining inside the Quanton 66

18.wave like properties of space fabric 72

19. quanton evolution and its degrees of freedom 78

20. anti quanton evolution and its degrees of freedom 85

21.variation of quanton energy fields with time 90

22.why quanton does not achieve equilibrium 91

23.energy fields parameters 93

24.Dimensions of energy fields 100

25.Relative field variation with time 102

26. directional field subcomponents 104

27.wave model inside the quanton 111

28.a. electromagnetic waves as space and time varying fields 112

28.b. differences between quanton and electromagnetic waves 121

29. Maxwell equations of energy fields 122

30.role of Maxwell equations in the evolution of the quanton 130

31. Lorentz transformation of EM energy fields 134

32.some concepts behind space fabric 138

33.energy field interactions 139

34.bound and nonbinding energies 140

35.types energy field interactions 142

36.space fabric field interactions 149

37. how the space fabric binding interaction is generated 163

38.Dimensions of energy field interactions 165

39.Quanton energy division between various interactions 166

40. inverse relationship between wave length and energy- a possible explanation 171

41.quanton stable degrees of freedom 173

42. role of individual energy fields in the formation of space fabric 176

43. conclusions 178

44. references 178

1. The physical basis of this model

This model is based on the following two concepts

a-the relationship between energy field density and the energy packet is not only volumetric but based on energy degrees of freedom as well (defined in terms of wave parameters k , ω , or r_q (quanton radius))

b- the complex nature and behavior of energy packet

throughout this model the following points will be discussed

1- as the energy packet varies its position in space or in time

It creates associated fields that vary also in space and in time, thus

Thus giving rise to wave like behavior

2- energy packet expresses the wave energy in a symmetric way

By variation in in space and in time

3- as energy expands by variation in space or in time , the relationship between those varying fields is governed by

: energy degrees of freedom

2-Definition of the model

2.a Quantons

1-quantons are an accumulation of space and time varying energy fields , as they do so at a periodic rate , they possess wave like behaviour, (it will be later discussed why those wave likes do not interact with electromagnetic waves ,and when and how they leave the quanton)

each quanton is composed of two different type of energy fields which interact to form a binding relationships

2-they exist in lattice form which constitutes the space fabric

3-quantons are spherical in shape due to dimensional energy symmetry but may vary in their energy content and in size with time

4-Quantons are held in a quasi equilibrium state under the effect of Internal and external interactions of energy fields

5-due to the imbalance of these interactions the quantons expand , then split up into two to maintain dimensional energy symmetry , both quantons share up the original energy content

2.a.1 Quanton generation

quntons are generated due to

1- expansion of space varying energy fields

2-the splitting action of the quntons to maintain dimensional energy symmetry under condition of inflation

2.b.Anti quantons

anti quantons are similar to quantons but the dominant nature of their energy differs from that of the quanton

2.b.1 Anti quanton generation

anti quntons are generated as a result of

1- the expansion of the time varying energy in space

2-Splitting action of anti quantons as they expand in space

3. Mathematical brief

The following formulations concerns physics inside the quanton

(anti quanton) ,

$E_{sf} = \frac{\partial E}{\partial s}$ **: free space varying energy** **(1-3)**

$E_{tf} = \frac{\partial E}{\partial t}$ **(free time varying energy)** **(2-3)**

$E_{sc} = \int E\, ds$ **(space varying constrained energy)** **(3-3)**

$E_{tc} = \int E\, dt$ **(time varying constrained energy)** **(4-3)**

$E_s = E_{sf}\, E_{sc}$, $E_t = E_{tf}\, E_{tc}$ **(5,6-3)**

quanton and anti quanton energy equation is in the form of

$E_q = E_{sf}\, E_{sc}\, E_{tf}\, E_{tc}$ **and NEITHER in the form** **(7-3)**

$E_q = \sqrt{E_{sf}^2 + E_{sc}^2 + E_{tf}^2 + E_{tc}^2}$ **NOR the form**

$E_q = E_{sf} + E_{sc} + E_{tf} + E_{tc}$

(spatial energy fields are vector quantities which have direction as well as magnitude)

An energy field like free space varying energy can be defined as $E_{sf} = K_{sf} D_{sf}\ \psi_{sf}$ **(8-3)**

where D_{sf} **: energy field strength (degree of freedom)parameter ,**

K_{sf} **: field intensity parameter which is proportional to the quanton total energy**

and ψ_{sf} **is reserved for wave parameter of space varying energy**

-the two types of quanton wave like energy fields $E_{qf} = E_{sf} E_{tc}$ **and** $E_{qc} = E_{sc} E_{tf}$ **can be expressed by the one-dimensional PDE**

$(E_{qf})_{tt} = c^2\ (E_{qf})_{xx}$ **or** $(E_{qc})_{tt} = c^2\ (E_{qc})_{xx}$

-$E = E_s E_t$ **(an energy packet) which is generated by energy constraining**

-The following expansion is possible only in primordial time

$$\frac{\partial}{\partial s}(E) = \frac{\partial E}{\partial s}\frac{\partial E}{\partial t} = E_{sf}\, E_{tf} \qquad (9\text{-}3)$$

4. Various energy field wave parameters

quanton (or anti quanton) energy equation defined as the multiplication of four functions for four types of energies and two opposing natures which takes the form

$$E_q = (E_{sf}\, E_{tf})\,(E_{sc}\, E_{tc}) \qquad (1\text{-}4)$$

Every one of those four functions expresses the change of either space or time as follows ,

$1 - \psi_{sf} = e^{+j\,kr}$ which is the wave parameter that defines change of free energy in space

$2 - \psi_{sc} = e^{-j\,kr}$ which is the wave parameter that defines change of constrained energy in space

$3 - \psi_{tf} = e^{+jwt}$: wave parameter that expresses variation of

free energy in time

$4 - \psi_{tf} = e^{-jwt}$: wave parameter that expresses variation of

constrained energy in time

5. <u>Energy constraining</u>

1-Energy constraining describes interaction of energy fields

Due to their wave like and field behaviour which is summarized as

a-the act of containment free energies (E_{sf}, E_{tf}) inside

quantons (or anti quantons) (this will be discussed in the

section : Maxwell equations role in the evolution of quantons)

b-the appearance of constrained energies (E_{sc} E_{sc})

c-the rearrangement of the energy degrees of freedom

(discussed in the section : quanton stable degrees of freedom)

d-energy expansion inside the quanton and its subsequent

splitting

e- the alteration of between field behaviour (varying in space and

in time and packet state (energy not varying in space or time)

2-as energy expands in space , it's said to have free degrees of freedom , and it must express this degree of freedom in space in a symmetric way with respect to all spatial dimensions ,and this is only possible inside a spherical structure, a quanton , so , dimensional energy symmetry (DES) is behind the act of energy containment and the formation of the quantons (anti quantons)

3-as energy is released , it must expand , not only by variation In space but by variation in time as well , hence the appearance of energy fields E_{sf} , E_{tf} (free energy that varies in space and free Energy that varies in time)

4-energy fields cannot vary in space and time simultaneously , so no energy field is in the form $E_{s,t} = fn\,(s\,,t)$

, but rather $E = E_{sf}\,(x, y, z)\; E_{tf}\,(t)$

and this is because the relationship between the expansion of space varying and time varying energies is diametric , the time varying field (curls) the free expansion of space varying field hence energy constraining takes place (this point will be further explained in the section Maxwell equations of energy fields)

5-Energy fields can either be free in space varying

($E_{sf} = \frac{\partial E}{\partial s}$) or free in time varying field ($E_{tf} = \frac{\partial E}{\partial t}$)

or constrained in space ($E_{sc} = \int E_s \, ds$) or constrained in time ($E_{tc} = \int E \, dt$) , while unconstrained energy in the form ($E_s \;\; E_t$) can be defined as an energy packet :energy that does not change in space or in time

6-the appearance of constrained energy fields inside the quanton (anti quanton) , is due to the fact that free energies ($E_{sf} \;\; E_{tf}$) seek to form a more stable binding interactions with these newly appeared constrained energies ($E_{sc} \;\; E_{tc}$) under

inflationary conditions rather than the less stable repulsive self Interactions (discussed in detail in the section : space fabric field interactions and why space fabric generates binding interactions)

7-as energy expands by space varying field (E_{sf}) , it must have a constrained time varying field (E_{tc})such that E_q = $E_{sf}E_{tc}$, so quantons are originated from a predominantly Free space varying energy field (E_{sf})

8-as time varying energy expands (E_{tf}) , it must be constrained in part to form a space varying constrained energy field (E_{sc}) such that E_{aq} =E_{sc} E_{tf} ,hence, anti quantons are originated from a predominantly free time varying energy field (E_{tf})

9-inside quanton (anti quanton) energy cannot expand by free variation in space and in time without having a part of this energy

being constrained and vice versa, so no energy is in the form

E_q = E_{sf} E_{tf} or of the form E_q = E_{sc} E_{tc} alone

10-as free space varying and the constrained time varying

Energy fields E_{sf} E_{tc} expand in the quanton ,

a-recalling point (3) , free energy must expand by variation

in time as well as in space , so part of constrained time

varying energy (E_{tc}) becomes a free time varying energy (E_{tf})

b-constrained energy must be varied in space as well as in time ,

as a result , part of the free energy in space (E_{sf})has to be

constrained and becomes (E_{sc}) the new type of energy becomes

E_q = $(E_{sf}E_{tc})(E_{sc}\,E_{tf})$ = $E_{qf}\,E_{qc}$ (1-5)

This quanton energy equation represents two wave-likes with

wave like behaviour , (discussed in the section : wave

propagation inside the quanton)

one of them is free energy dominated or $E_{qf} = (E_{sf}E_{tc})$,and the

other is constrained energy dominated $E_{qc} = (E_{sc}E_{tf})$ **(2-5)**

and E_q **represents the instanteous value of the quanton field energy density**

11-for the anti quanton , as free time varying , constrained space varying energy fields E_{sc} E_{tf} **expand ,**

a-free energy must expand by variation in space , as a result part of the space constrained field (E_{sc} **) must become free space varying energy , hence energy field (** E_{sf} **) appears**

b-constrained energy must vary in time as well as in space , as a so part of the free time varying energy becomes constrained and the new the energy field (E_{tc} **) appears**

the new type of energy equation for the anti quanton becomes

E_{aq} **= (** $E_{sf}E_{tc}$) (E_{sc} E_{tf}**) =** E_{aqf} E_{aqc}

which is the anti quanton's energy equation, this is the same

energy equation as quanton's , but energy levels (i.e degrees of freedom) are different for each energy field in both cases as it will be discussed later in the sections : quanton and anti quanton energy degrees of freedom

12- energy expansion inside the quanton is more or less a process of differentiating two variables

13- as differentiation is the mathematical expression of free energy expansion by variation in space or time , integration is the corresponding mathematical expression of energy constraining in space or time

14- Full expansion in space $\frac{\partial}{\partial x}\frac{\partial y}{\partial y}\frac{\partial}{\partial z}(E)$ can be expressed as

$\frac{\partial E}{\partial s}$, while constraining takes the form $\iiint E$ dx dy dz = $\int E \quad ds$

15- as we have pointed out previously, the main energy fields , that space fabric evolved from are free space varying and free time

varying energies which evolved as follows

$$\frac{\partial}{\partial s}(E) = \frac{\partial E}{\partial s}\frac{\partial E}{\partial t} = E_{sf}\ E_{tf}$$

16-as expansion of energy fields by variation in space or time

follows differentiation of two variables rules

$$\frac{\partial}{\partial x}(f(x)\ g(x)) = \frac{\partial f}{\partial x}\ g(x) + \frac{\partial g}{\partial x}\ f(x)$$

product of an energy expansion process =

expansion of the first term *constraining of the second) +

constraining of the first term * expansion of the first term

let's consider the case of expansion of E_{sf} inside the quanton

or $\frac{\partial}{\partial s}(\frac{\partial E}{\partial s}) = \frac{\partial E}{\partial s}\ \int E\ \ dt = E_{sf}\ E_{tc}$

as energy fields $(E_{sf}\ E_{tc}$) expands In space , part of it must be

constrained or

$$E_q = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\int E\ dt\right) = \left(\frac{\partial E}{\partial s}\ \int E\ \ dt\right)\left(\int E\ \ ds\ \frac{\partial E}{\partial t}\right) = (E_{sf}\ E_{tc})(E_{sc}\ E_{tf})$$

(this step will be further elaborated in the chapters : quanton

degrees of freedom and the role of Maxwell equations in the evolution of the quanton where a slightly modified scenario will be offered)

17- similarly for the case of anti quanton

$$\frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right) = \frac{\partial E}{\partial t} \int E \; ds = E_{sc} \; E_{tf}$$

as energy fields E_{sc} E_{tf} expand or constrained , part of it must be constrained or expands

$$E_{aq} = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial t} \int E \; ds\right) = \left(\frac{\partial E}{\partial s} \int E \; dt\right)\left(\int E \; ds \; \frac{\partial E}{\partial t}\right) = (E_{sf} \; E_{tc})(E_{sc} \; E_{tf})$$

again the same energy equation Like that of the quanton's but with different energy *Dof*'s

18-all stable energy systems are of complex nature (part free – part constrained) , and can be defined as quanton energy = free energy * constrained energy or $E_q = E_{sf} \; E_{tf} \, E_{sc} \; E_{tc}$

19- any quanton system has four degrees freedom which is the

sum of free energy fields degree of freedom plus the constrained energy fields degrees of freedom or

Dof_q **=** Dof_{sf} **+**$Dof_{sc} + Dof_{tf} + Dof_{tc}$ **=4**

20- it is understood that the space varying energy fields (free and constrained) have three degrees of freedom or

Dof_{sf} **+**Dof_{sc} **= 3**

while time varying energy fields (free and constrained) have one degree of freedom or $Dof_{tf} + Dof_{tc}$ **=one**

21 –energy fields E_{sf} , E_{tf} , E_{sc} , E_{tc} **do not have the dimensions of energy , but their product (**E_q **) does have the dimensions of energy density which is defined as energy divided by three dimensional volume** $[E_q] = [\frac{energy}{volume}] =$ **M** $L^{-1}T^{-2}$

(later , it will be shown that this energy density is in fact 4 dimensional that expands in 3 D space)

22-Expansion of an already expanded energy field gives

the same results so, $\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right)$ **=** $\frac{\partial E}{\partial s} + \int \frac{\partial E}{\partial s}$ **ds or**

$\frac{\partial}{\partial s}\left(E_{sf}\right) = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right)$ **=** $\frac{\partial E}{\partial s}$ **+constraining term**

and $\frac{\partial}{\partial t}\left(E_{tf}\right) = \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)$ **=** $\frac{\partial E}{\partial t}$ **+**$\int \frac{\partial E}{\partial t}$ **dt or**

$\frac{\partial}{\partial t}\left(E_{tf}\right) = \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)$ **=** $\frac{\partial E}{\partial t}$ **+constraining term**

and so on for higher order derivatives, and this process represents the expansion of the free energy by variation in space or time which must be accompanied by constraining while inside the quanton

23-constraining of an already constrained energy field gives the same constrained energy field in addition to expansion products : $\int \left(\int E \; ds\right) ds$ **=** $\int E \; ds$ **+** $\frac{\partial}{\partial s}\left(\int E \; ds\right)$ **or**

$\int \left(\int E \; ds\right) ds$ **=**$\left(\int E_{sc} \; ds\right) ds$ **=** $\int E \; ds$ **+expansion term , and**

$\int \left(\int E \; dt\right) dt$ **=**$\left(\int E_{tc} \; dt\right) dt$ **=**$\int E \; dt$ **+**$\frac{\partial}{\partial t}\left(\int E \; dt\right)$ **or**

$\int\ (\int E\ \ dt)\ dt\ \ =(\int\ E_{tc}\ \ dt)\ dt\ =\int E\ \ dt$ +expansion term ,

this means that constraining of constrained energy fields

(which expresses their expansion inside the quanton) must be

accompanied by expansion of those constrained energy

fields

24-expansion of constrained energy field will give unconstrained

energy in space and in time

$\frac{\partial}{\partial s}\ (\int E\ \ ds)\ =E_s\, E_t\ +\cdots$ *and* $\frac{\partial}{\partial t}(\int E\ \ dt)\ = E_s\, E_t\ +.....$

25- constraining of free energy field will give the unconstrained

energy in space and in time

$\int\ (\frac{\partial E}{\partial s})\ ds\ \ = E_s\ E_t +....$, *and* $\int(\frac{\partial E}{\partial t})\ dt\ = E_s\, E_t\ +\cdots$

26- when energy is released from an expansion of constrained

energy field or constraining of a free energy field as shown in (23)

and (24) , it is released in the packet energy state

$E = E_s\ E_t$ in other words , released energy cannot take the form of $E_s\ or\ E_t$ as either of those forms of energy do not exist independently

27- a cycle of expansion and constraining is not a reversible process due to losses and effect of entropy (irreversible process) (will be further clarified in the section energy constraining and the origin of entropy)

28- energy degree of freedom / constraining conditions in space must be identical in spatial dimensions for (E_{sx}, E_{sy} , E_{sz}) otherwise energy field is deemed to be unstable

29- in an energy expansion process gives the original type of energy after expansion plus energy constraining products , so it is expected that the total energy content of the quanton (or anti quanton) to decrease during the process of expansion (this point discussed in the section : energy

constraining and origin of entropy)

30- total energy of the quanton -as a quantum energy entity- is governed by solely the Planck -Einstein relationship so, energy field's share of the total energy of the quanton is determined by its wave parameters (k , ω) , while the energy degree of freedom , as it will be discussed later , is just a mechanism of division of energy between the various space and time varying fields

31- recalling point (7) , energy of the following forms do not exist independently

a- $\frac{\partial E}{\partial s}\ \frac{\partial E}{\partial t}$ **(energy can not expand in space and in time Simultaneously without being constrained in space and in time)**

$b - (\int E \ \ ds \int E \ \ dt\,)$ **(energy cannot be constrained in space and in time simultaneously without having an free expansion component)**

32- energy of the following forms do not exist in a stable form

$a - E_q = (\int E \ \text{ds} \frac{\partial E}{\partial t}) \ (E_s \ E_t \quad)$

b-$E_q = (\frac{\partial E}{\partial s} \int E \ \ \text{dt}) \ (\ E_s \, E_t \,)$

those types of energy reflect a transient type of energy and do not exist in a stable form since a stable energy field must be part free / part constrained with respect to space and time which represent wave variation of the type $E_q = (\ \frac{\partial E}{\partial s} \int E \, \text{dt} \,) \, (\int E \ \text{ds} \frac{\partial E}{\partial t})$

which is the stable quanton (anti quanton) energy form

33- though quanton includes both energy types (free and constrained) energies , but there will be a dominant type of energy based on which type has the majority of *Dof's*

34- for the quanton system , the free energy is the dominant while for anti quanton , the constrained type of energy is the dominant type of energy

35 – it will be shown that free space varying energy (E_{sf}) is capable through energy constraining , of generating both types of constrained energies E_{sc} , E_{tc} and free time varying energy (E_{tf}) is also capable of generating both types of constrained energies E_{sc} , E_{tc} as well

36- E_{qf} , E_{qc} are not true waves as they do not possess four degrees of freedom individually, so it will be referred to them as Wave-likes

37- the energy packet in this model assumes two roles

a-The total energy of the quanton which is defined as

$$E_p = \frac{h}{2\pi}\,\omega = \int_{V_q} E_q \; dV$$

b- packet state which is the result from constraining process and defined as E = $E_s \;\; E_t$

(energy that does not vary in space or in time)

6. Bridging the gap between mathematics physics of energy constraining

1-While differentiation of two functions involves

differentiating only one at a time and maintaining the other

constant , in real world this is not possible since energy must vary

either in space or in time

2-constraining through integration is the physical equivalent

to mathematically maintaining one function as a constant

3-expansion of two energy fields of the form

$\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s} \quad \frac{\partial E}{\partial t}\right) = \left(\frac{\partial E}{\partial s} \quad \frac{\partial E}{\partial t}\right)\left(\int E\ ds \int E\ dt\right)$

Could not be in the form $\left(\frac{\partial E}{\partial s} \quad \frac{\partial E}{\partial t}\right)+\left(\int E\ ds \int E\ dt\right)$

Since the energy fields $\left(\frac{\partial E}{\partial s} \quad \frac{\partial E}{\partial t}\right)$ **are unstable in this form as**

the quanton is in the process of formation and constrained

energies could not be generated independently

4-The quanton equation $E_q = \left(\frac{\partial E}{\partial s} \frac{\partial E}{\partial t}\right)\left(\int E\ \mathrm{ds} \int E\ \mathrm{dt}\right)$

Expresses two physical entities

(free energies : ($\frac{\partial E}{\partial s}\frac{\partial E}{\partial t}$) and constrained energies

($\int E\,\mathrm{ds} \int E$ dt)) and each of these energies behave as single

physical entity (ie single variable) , so four different energy

fields , are in fact ,representing only two variables instead of

four(energy field interactions will be based on this particular point)

5-after expansion and as a product there will be 8 energy

components , which represent four physical entities , two

expansion products , one of them is the original type of energy

6-recalling points (13), (14) from previous section , for complex

energies (free /constrained)

$E_q = E_{sf}\, E_{sc}\, E_{tf}\, E_{tc}$ **energy constraining which happens through**

expansion of energy in space is defined as

$\frac{\partial}{\partial s}(E_q) = \frac{\partial}{\partial s}((E_{sf}\, E_{tc})(\, E_{sc}\;\, E_{tf})\,)$

$(\frac{\partial E_{sf}}{\partial s} \int E_{tc}$ dt $)(\int E_{sc}\, ds\, \frac{\partial E_{tf}}{\partial t}) + (\int E_{sf}\, ds\, \frac{\partial E_{tc}}{\partial t})(\frac{\partial E_{sc}}{\partial s} \int E_{tf}$ dt)

$= (E_{sf}\, E_{tc}\;\; E_{sc}\;\; E_{tf}) + E_s E_t$

7- the differentiation / integration procedure is a stable one for assessing the results of expansion / constraining inside the quanton, and this method is not affected by how energy components fields are arranged neither by the order of differentiation / integration according to which process is performed

8-we suggest to use the following convention when dealing with Energy expansion / constraining :

a-expansion term : differentiating free energies *integration of constrained energies

b-constraining term : integrating free energies * differentiating constrained energies

9- for energy expansion of terms like

$$\frac{\partial}{\partial s}\left(\left(\frac{\partial E}{\partial s}\int E\ \mathrm{dt}\right)(E_s\ E_t)\right), \frac{\partial}{\partial s}\left(\int E\,\mathrm{ds}\,\frac{\partial E}{\partial t}\right)(E_s E_t)$$

which express transient energy behaviour , the unconstrained energy of the type ($E_s E_t$) must be subjected to the opposite operation (differentiation / integration) of the free / constrained energy component so as to reach the final stable energy of the form (E_q) = ($\frac{\partial E}{\partial s}\int E\ \mathrm{dt}$) ($\int E\,\mathrm{ds}\frac{\partial E}{\partial t}$) (this point will be clarified in the section : quanton evolution and its Dof)

10- energy expansion process inside the quanton , involves both free and constrained energies , so to avoid confusion while Using the gradient operator (∇) for both cases of expansion ,the use of the differential / integral operators will be continued $\frac{\partial}{\partial s}$ for expansion of free energy fields and $\int$ for the expansion of constrained energy fields inside the quanton

11- when dealing with energy expansion we will use the

wave like form E_q = $(E_{sf}\ E_{tc})(E_{sc}E_{tf}$)

while when dealing with fields and energy interactions

the form E_q = $(E_{sf}\ E_{tf})(E_{sc}E_{tc}$) will be used

7. Energy Degrees of freedom

1-as energy is allowed to vary in every dimension in space or in time , it is said to have an energy degree of freedom

2- the quanton energy density is defined in terms of the degrees of freedom of its wave parameters ($\omega, k , or\ \ r_q$) , later

3-E_q will be shown to be directly proportional to ω^4 , k^4 or $\frac{1}{{r_q}^4}$

4- while the energy density of the quanton is defined in terms of ω^4 , k^4 or $\frac{1}{{r_q}^4}$, however the energy fields are defined in terms of Field strength or in terms of the constant (c) in the form of

D_{sf} = $c^{Dof_{sf}}$, Dof_{sf} : degrees of freedom of free space varying

field (transformation from degrees of freedom in terms of wave parameters , to degrees of freedom in terms of (c))

5-For space varying and time varying energy fields , where the resultant energy density is in the form

E_q **=** $(E_{sf}\ E_{tc})(E_{sc}E_{tf}$ **) and not in the square root form**

$$E_q = \sqrt{{E_{sf}}^{2} + {E_{sc}}^{2} + {E_{tf}}^{2} + {E_{tc}}^{2}}$$

this multiplier form of resultant , allowed (c) to become an energy degree of freedom , where energy is divided up symmetrically in all dimensions , between the space and time varying fields

6-the constant (c) plays a bigger role than being the speed of light or the speed of transmission of the fundamental forces , as it plays the role of ratio of variation between space and time varying fields , this is based on the following

a- the constant (c) represents the relationship between energy

expansion by variation in space and in time ,

the relationship between variation of wave parameters

ψ_{tc} , ψ_{sf} **where** $\psi_{tc} = e^{-j\omega t}$, $\psi_{sf} = e^{+jk(x+y+z)}$

$$\psi = \psi_{tc} \quad \psi_{sf}$$

$$\frac{\partial \psi_{tc}}{\partial t} = j\omega\, \psi_{tc} \ , \qquad , \frac{\partial \psi_{sf}}{\partial x} = jk \ \psi_{sf}$$

$$\left(\frac{\partial \psi}{\partial t}\right) = \frac{\partial}{\partial t}(\psi_{sf} \quad \psi_{tc}) = \psi_{sf} \ \frac{\partial \psi_{tc}}{\partial t} = -\, j\omega \ \psi_{sf}\psi_{tc}$$

$$\left(\frac{\partial \psi}{\partial x}\right) = \frac{\partial}{\partial x}(\psi_{sf} \quad \psi_{tc}) = \frac{\partial \psi_{sf}}{\partial x} \ \psi_{tc} = \ jk \ \psi_{sf}\psi_{tc}$$

$$-\frac{(\frac{\partial \psi}{\partial t})}{(\frac{\partial \psi}{\partial x})} = \frac{j\omega \ \psi_{sf}\psi_{tc}}{jk \ \psi_{sf}\psi_{tc}} = \frac{\omega}{k} = c \qquad \textbf{(1-7)}$$

which is the relationship between rate of energy wave parameter

variation in time and in space

b- recalling the Lagrangian (*L) of an action as* $\frac{d}{dt}\frac{\partial L}{\partial x'} - \frac{\partial L}{\partial x} = 0$

given that momentum P= $\frac{\partial L}{\partial x'}$

we get $\frac{\partial P}{\partial t} = \frac{\partial L}{\partial x}$ **or alternatively** $\frac{\partial L}{\partial P} = \frac{\partial x}{\partial t}$ **= c**

an energy degree of freedom: the rate of change of the total energy of the system with respect to its momentum

c-the same result can be obtained directly from the energy momentum relationship $E^2 = P^2c^2 + {m_o}^2c^4$

Differentiating both sides 2 E dE = 2 P dP

$\frac{dE}{dP}$ = ($\frac{P\,c}{E}$) c , and $\frac{dE}{dP}$ = c

where for space fabric case (m_o= zero) , E= P c

which is an alternative definition of the energy degree of freedom

6-both results of (a) and (c) are equivalent , given that

$\psi = \psi_{sf}\ \ \psi_{tc}$

c-Using the Schrödinger equation , for time derivative

$-\frac{\partial\psi}{\partial t} = -\frac{jE}{2\pi h}\psi$

$\nabla\psi = \frac{jp}{2\pi h}\psi$

$$\frac{\frac{\partial\psi}{\partial t}}{\nabla\psi} = \frac{E}{p} = c \qquad \textbf{(2-7)}$$

Based on the above points ,the division of energy between space and time varying fields can be done where strength of space and time varying energy fields (Dof) can be expressed in terms of the constant (c) that defines the relationship between them

It is worth noting that

1-energy field degrees of freedom (field strength) is not related to the total energy of the quanton , as it is only a mechanism for the division of the quanton energy between the various energy space and time varying energy fields , and what differs any quanton from another is ONLY the rate of variation of energy with time and space according to Planck Einstein relationship $E_p = \frac{h}{2\pi}\omega$

2- the energy degrees of freedom can be classified as follows

a- active (actual degrees of freedom) that belong to the energy fields (energy components) active *Dof's* = (3)+(1)

b- kinetic degrees of freedom which expresses the propagation of energy (outside the quanton in the form of electromagnetic waves) in one direction , this kinetic degree of freedom is subtracted from the available four degrees of energy freedom for space and time variation (discussed in the section : electromagnetic waves out of quanton) , where active *Dof's* = (2)+1instead of (3)+(1)

c- constrained degrees of freedom : when energy fields are restricted from variation in one dimension in space or in time this constrained degree of freedom is added to the existing free and constrained energy fields to obtain the usual four degrees of freedom (discussed in the section : normal mater quantons) energy)

8.The superposition principle inside the quanton

1-we make the distinction between the linear superposition of Energy fields which still applies inside the quanton with a product

that would be a resultant field that would be equal to the addition of their individual field intensities on condition that

a-those fields must be of the same type (free / constrained) and

b- have the same degree of freedom

$$E_{sfi} + E_{sfj} = K_{sfi} D_{sf} + K_{sfj}\ D_{sf}$$

$$= (K_{sfi} + K_{sfj})\ D_{sf} \qquad \textbf{(1-8)}$$

$$E_{sfi}\ E_{tci} + E_{sfj} E_{tcj} = K_{sfi} D_{sf} K_{tci}\ D_{tc} + K_{sfj}\ D_{sf}\ K_{tcj}\ D_{tc}$$

$$= (K_{sfi} + K_{sfj})\ (K_{tci} + K_{tcj})\ (D_{sf} + D_{tc}) \qquad \textbf{(2-8)}$$

while the superposition of field energies between fields of different nature (free / constrained) or fields that do have different energy Dof's where the addition is done by adding their field strength (ie exponential degree of freedom) and multiplying their intensities

2- according to superposition principle which states that when two fields of the same kind meet at a point in space, the resultant

amplitude at that point is the vector sum of the amplitudes of the two fields separately at that point

this is the superposition principle in its linear form , while the exponential form of superposition applies,

as energy fields are defined in terms of energy degree of freedom (*Dof*) , which is expressed as the exponent of (c^{Dof})

the resulting superposition inside the quanton will not be a linear one instead , it is an exponential superposition where

$$E_{sfi} + E_{scj} = K_{sfi}D_{sf} + K_{scj}\ D_{sc}$$

$$= (K_{sfi} + K_{sfj})\ (D_{sf} + D_{sf}) \qquad \textbf{(3-8)}$$

$$E_{sfi} + E_{tcj} = K_{sfi}D_{sf} + K_{tcj}\ D_{tc}$$

$$= (K_{sfi} + K_{tcj})\ (D_{sf} + D_{tc}) \qquad \textbf{(4-8)}$$

and for the quanton as a whole

$$E_q = (E_{sf}\ E_{tc})(\ E_{sc}E_{tf}) = (K_{sf}\ D_{sf})(\ K_{tc}D_{tc})\ ((K_{sf}D_{sf})(\ K_{tc}D_{tc}))$$

$$= (D_{sf}\ D_{tc}\ D_{sc}\ \ D_{tf})(K_{sf}\ K_{tc}\ K_{sc}\ \ K_{tf})$$

$$=(K_{sf}\, K_{tc}\, K_{sc}\, K_{tf}\,)\, c^{Dof_{sf}+Dof_{tc}+Dof_{sc}+Dof_{tf}} \;=\; (K_{sf}\, K_{tc}\, K_{sc}\, K_{tf}\,)\, c^{4}$$

(5-8)

b- instead of the addition of the same type of energy , while inside the quanton , the addition can be between two different types of energies (space and time varying energies) and of two different natures (free / constrained) to give a complex energy field

the main reason behind this is that free and constrained fields cannot be considered as an independent energy entity individually , since either of them does not possess four degrees of energy freedom and hence their Dof's must be added exponentially to obtain either a complex field or the total energy density of the quanton if the addition is for all four energy fields

9.<u>Definition of directional energy components in various dimensions</u>

For a quanton energy equation of the form E_q **=** $(E_{sf}E_{tc})(E_{sc}\,E_{tf})$

Where E_{sf}, E_{sc} are space varying energies (constrained and free) and E_{tf}, E_{tc} are time varying energies (constrained and free) and the total energy of a quanton is the product of the dimensional energy components

We have to stress again that E_{sf}, E_{sc} , E_{tf}, E_{tc} do not have the dimensions of energy but their product has the dimension of energy divided by three dimensional volume

$$E_{sf}= \sqrt{{E_{sfx}}^2 + {E_{sfy}}^2 + {E_{sfz}}^2} \qquad \textbf{(1-9)}$$

and constrained energy in space components

$$E_{sc}= \sqrt{{E_{scx}}^2 + {E_{scy}}^2 + {E_{scz}}^2} \qquad \textbf{(2-9)}$$

for spatial energy dimensional components

$$E_{sx}= E_{sfx}\, E_{scx} \quad , \quad E_{sy}= E_{sfy}\, E_{scy} \qquad \textbf{(3-9)}$$

$$E_{sz}= E_{sfz}\, E_{scz} \quad , \qquad \textbf{(4-9)}$$

And for time varying energy components,

$E_t = E_{tf}\ E_{tc}$ **(5-9)**

Those are 8 energy components , 6 that vary in space and 2 that vary in time

3 are constrained in space and one is constrained in time

and 3 are free in space and one is free in time

it is worth noting that

1- there is no direct interdependence between spatial dimensions

i.e no energy component of the form E_{sfxy} , E_{sfxz} , does exist

where E_{sfxy} = fn (x , y) , E_{sfxz} = f(x, z)

, since if there were such energy components the variation with time of such components $\frac{\partial}{\partial t}(E_{sx_{i,j}})$ = 0 , which means that the such an energy component would be time invariant , while other energy components are supposed to change with time to reflect an inflationary scenario , which against the fundamental

cosmological principle of homogeneity and uniformity of space fabric

2- spatial and time energy fields cannot exist independently from each other , as discussed in energy constraining section

10.Dimesional energy symmetry (DES)

Dimensional energy symmetry is the mechanism which ensures the uniformity and homogeneity of energy under inflationary conditions inside the quanton

the basis of this symmetry lies in the fact the packet / field energy density relationship is not only volumetric but based on the energy degrees of freedom as well

given that $E_q = (E_{sf} E_{tc})(E_{sc} E_{tf})$

energy as it expands in along the x- axis

$\frac{\partial}{\partial x}(E_q)$ **will not only give as the result of the expansion**

$(\frac{\partial E_{sf}}{\partial x} \int E_{tc}\ \mathrm{dt}\ )(\int E_{sc}\ \mathrm{dx}\ \frac{\partial E_{tf}}{\partial t})$ **+**

$(\ \int E_{sf}\ \ \mathrm{dx}\ \frac{\partial E_{tc}}{\partial t}\ \ )\ (\frac{\partial E_{sc}}{\partial x}\ \int E_{tf}\ \ \mathrm{dt}\ )$ **, but it will be of the form**

$\frac{\partial}{\partial x}(E_q) = \frac{\partial}{\partial x}\ (E_{sf}E_{tc}E_{sc}\ E_{tf}) =$

$\frac{\partial}{\partial x}\ (E_{sfx}E_{scx})\ \frac{\partial t}{\partial x}\frac{\partial y}{\partial t}\frac{\partial}{\partial y}\ (E_{sfy}E_{scy})\ \frac{\partial t}{\partial x}\frac{\partial z}{\partial t}\frac{\partial}{\partial z}\ (E_{sfz}E_{scz})\frac{\partial t}{\partial x}\frac{\partial}{\partial t}\ (E_{tf}E_{tc})$

$= (\ \ (\frac{\partial}{\partial x})(\frac{\partial t}{\partial x}\frac{\partial y}{\partial t}\frac{\partial}{\partial y})\left(\frac{\partial t}{\partial x}\frac{\partial z}{\partial t}\frac{\partial}{\partial z}\right)\left(\ E_{sf}\ \right)\int(E_{tc})\ \mathrm{dt}\ \ )$

$(\int\ \int\ \int(E_{sc})\ \ \mathrm{dx}\ \ dy\ (\frac{dt}{dy}\frac{dx}{dt})\ \mathrm{dz}(\frac{dt}{dz}\frac{dx}{dt})\ \left(\frac{\partial t}{\partial x}\frac{\partial}{\partial t}\right)(\ E_{tf}\ ))$ **+**

$(\int\ \int\ \ \int(E_{sf})\ \ \mathrm{dx}\ \ dy\ (\frac{dt}{dy}\frac{dx}{dt})\ \mathrm{dz}(\frac{dt}{dz}\frac{dx}{dt}))\left(\frac{\partial t}{\partial x}\frac{\partial}{\partial t}\right)(\ E_{tc}\ ))$

$(\ (\frac{\partial}{\partial x})(\frac{\partial t}{\partial x}\frac{\partial y}{\partial t}\frac{\partial}{\partial y})\left(\frac{\partial t}{\partial x}\frac{\partial z}{\partial t}\frac{\partial}{\partial z}\right)(\ E_{sc}\ )(\int(E_{tf})\ \ \mathrm{dt}\ \ \left(\frac{\partial x}{\partial t}\right))$

Given that $\frac{\partial x}{\partial t} = \frac{\partial y}{\partial t} = \frac{\partial z}{\partial t} = c$

$\frac{\partial}{\partial x}(\ E_q\ ) = (\ \frac{\partial E_{sf}}{\partial s}\ \int E_{tc}\ \ \mathrm{dt}\ )(\int E_{sc}\ \mathrm{ds}\ \ \frac{\partial E_{tf}}{\partial t}\ ) +$

$(\int E_{sf}\ \mathrm{ds}\ \ \frac{\partial E_{tc}}{\partial t}\ )\ \ (\ \frac{\partial E_{sc}}{\partial s}\ \ \int E_{tc}\ \ \ dt\ )\ \ =\ \ \frac{\partial}{\partial s}(\ E_q\ )$ **(1-10)**

<u>Note</u> : we applied the chain rule for differentiation and integration by change of variables

We can clearly see as energy expands along one axis ,it must not only expand along other spatial and temporal axes but be constrained along the spatial and temporal axes as well ,

we conclude that

1-Events in one direction are immediately reflected in the other spatial and temporal directions , and by the same magnitude, so as to ensure the dimensional energy symmetry (DES)

2-The uniformity and the homogeneity of space fabric is ensured through the role time plays as the link between all the three spatial axis (and via the constant (c))

3-to satisfy dimensional energy symmetry for quanton energy system that has degrees of freedom , the degrees of freedom must be symmetric with respect space and time varying energy fields

Define the Dof_q , D_q (in terms of c)

Where the degree of freedom parameter

$$Dof_q = \quad Dof_{sf} + Dof_{tf} + Dof_{sc} + Dof_{tc} = 4 \qquad \textbf{(2-10)}$$

Energy field strength parameter $D_q = D_{sf} D_{tf} D_{sc} D_{tc} = \quad c^4$ **(3-10)**

$$D_s = c^3 \quad , \quad D_{sf} = c^{Dof_{sf}} \quad , \quad D_{sc} = c^{Dof_{sc}} = c^{3-Dof_{sf}} \qquad \textbf{(4,5,6,7-10)}$$

$$D_t = c \quad , \quad D_{tf} = c^{Dof_{tf}} \quad , \quad D_{tc} = c^{Dof_{tc}} = c^{1-Dof_{tf}} \qquad \textbf{(8,9,10-10)}$$

$$\mathrm{Dof}_{sfx} = \mathrm{Dof}_{sfy} = \mathrm{Dof}_{sfz} \qquad \textbf{(11-10)}$$

4-the degree of freedom of constrained energy components must

be identical for spatial time varying component

$$Dof_{scx} = Dof_{scy} = Dof_{scz} \qquad \textit{(12-10)}$$

5-the degree of freedom of time varying energy components must

be identical free and constrained energies , namely

$$Dof_{tf} = Dof_{tc} \qquad \textit{(13-10)}$$

in other words for free and constrained energies the degree of

freedom must be expressed in a symmetric way across all spatial

varying energies and time varying energies

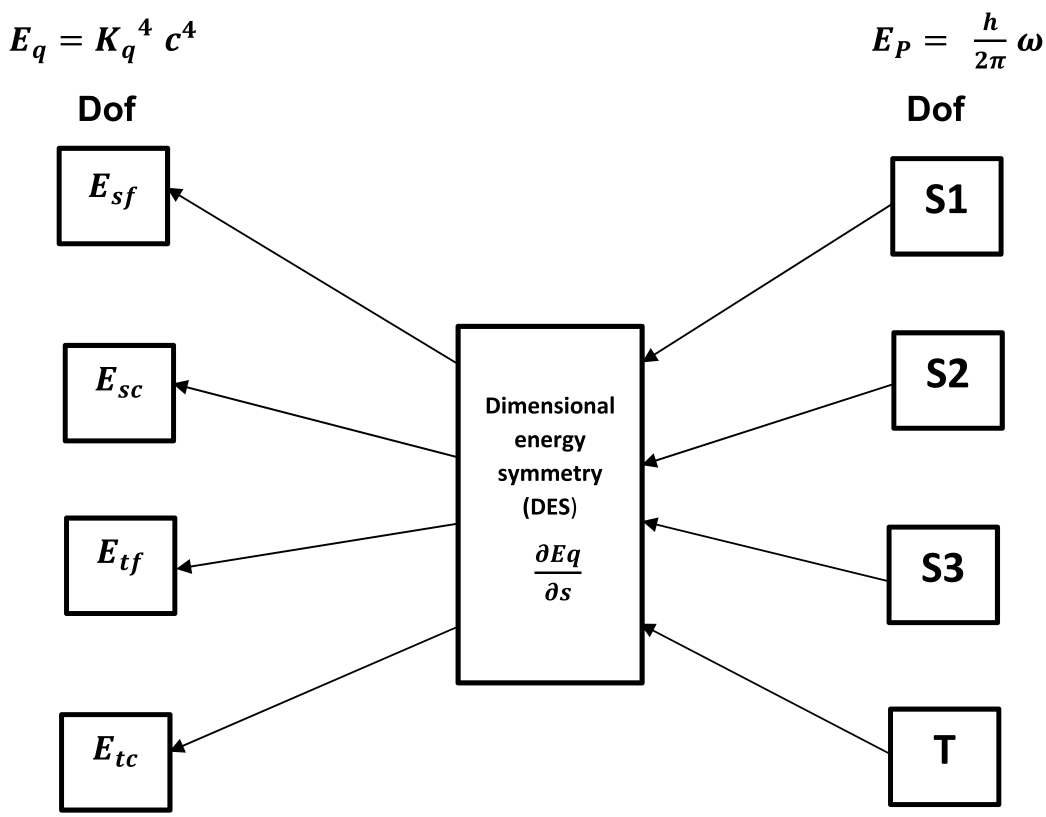


Fig (1) Role of dimensional energy symmetry in ensuring the uniformity of energy distribution inside the quanton

11. Energy packet / field relationship

the quanton shape is sinusoidally varying as it is composed of wave likes ,however its volume is constant and can be represented by 3 dimensional sphere shape

Given the minuscule dimensions of the quanton, and dimensional

energy symmetry which allow for the following relation as an approximation

$$E_p = \int_{V_q} E_q \, dV = E_q \, V_q = \frac{h}{2\pi} \, \omega \qquad (1\text{-}11)$$

where E_q is the average energy field density inside the quanton , E_p : packet energy ,

based on energy symmetry inside the quanton , $V_q = \frac{4}{3}\pi \, r_q^{\,3}$

given that ω = kc , k later will be defined as equal to $\frac{\pi}{r_q}$

$$V_q = \frac{4}{3}\pi \, r_q^{\,3} = \frac{4}{3} \; \frac{\pi^4}{k^3} = \frac{4}{3} \; \frac{\pi^4 c^3}{\omega^3} \qquad (2\text{-}11)$$

This shows that the quanton volume can be defined in terms of the parameters k , ω , this indicates that the relationship

$E_p = \int_{V_q} E_q \, dV = E_q \; V_q$ is not only a volumetric relationship but An energy degree of freedom as well

for E_p = h ω , which can be written alternatively as

$E_p = \frac{h}{2\pi\,\omega^3}\ \omega^3\ \omega = \frac{h}{2\pi\,\omega^3}\ \mathrm{k}^4\ \mathrm{c}^4$

While ω = kc , (k) = $\frac{\pi}{r_q}$, then

$E_p = \frac{h}{2\pi\,\mathrm{k}^3\,\mathrm{c}^3}\ \mathrm{k}^4\ \mathrm{c}^4 = \frac{h\ r_q^{\,3}}{2\pi\,(\pi)^3\,\mathrm{c}^3}\ \mathrm{k}^4\ \mathrm{c}^4 = \frac{h\,(\frac{4}{3}\pi\,r_q^{\,3})}{2\,\pi^4\,(\frac{4}{3}\pi\,)\mathrm{c}^3}\ \mathrm{k}^4\ \mathrm{c}^4$

$$E_p = \frac{h\ V_q}{\frac{8}{3}\pi^5\,\mathrm{c}^3}\ \mathrm{k}^4\ \mathrm{c}^4 = \frac{3h\ V_q}{8\,\pi\ \mathrm{c}^3}\,\frac{\mathrm{c}^4}{r_q^{\,4}} \qquad (3\text{-}11)$$

$$E_q = \frac{E_p}{V_q} = \frac{3h}{8\pi^5\ \mathrm{c}^3}\ \mathrm{k}^4\ \mathrm{c}^4 = \frac{3h}{8\pi^5\ \mathrm{c}^3}\ \omega^4 = \frac{3h}{8\,\pi\ \mathrm{c}^3}\,\frac{\mathrm{c}^4}{r_q^{\,4}} \qquad (4\text{-}11)$$

And this is a very important relationship since the term

$\frac{3h}{8\,\pi^5\ \mathrm{c}^3}$ **, or** $\frac{3h}{8\,\pi\ \mathrm{c}^3}$ **= constant , in other words ,**

Field energy density inside the quanton is linearly proportional to

the four degrees of freedom as expressed by either (ω^4**,**k^4 **or** $\frac{1}{r_q^{\,4}}$ **),**

define $h_q = \frac{3h}{8\,\pi^5\ \mathrm{c}^3}$ **(5-11)**

$$E_q = h_q\,\omega^4 = h_q\,\mathrm{k}^4\mathrm{c}^4 = \pi^4\ h_q\,\frac{\mathrm{c}^4}{r_q^{\,4}} \qquad (6\text{-}11)$$

substituting $E_p = E_q\,V_q = h_q\,V_q\,\omega^4$

let S_p to be an arbitrary variable such that $S_p = h_q V_q$

or $E_p = S_p\, \omega^4 = h_q V_q\ \omega^4 = \frac{h}{2\pi}\ \omega$

$$\frac{h_q}{h} = \frac{\frac{\omega}{2\pi}}{V_q\ \omega^4} = \frac{1}{2\pi\ V_q\ \omega^3} = \frac{3}{4\,\pi^4\,c^3} \quad \textbf{(7-11)}$$

$$\frac{1}{V_q\ \omega^3} = \frac{3}{2\pi^3\,c^3} \quad \text{or} \quad V_q = \frac{2\,\pi^3\,c^3}{3\,\omega^3} \quad \textbf{(8-11)}$$

$$\frac{V_{q2}}{V_{q1}} = \left(\frac{r_{q2}}{r_{q1}}\right)^3 = \frac{{\omega_1}^3}{{\omega_2}^3} \quad \text{and} \quad \frac{r_{q2}}{r_{q1}} = \frac{\omega_1}{\omega_2} \quad \textbf{(9-11)}$$

Which expresses the inverse relation between energy and wave

length given that k= $\frac{\pi}{r_q} = \frac{2\pi}{\lambda}$

12 -Energy constraining and the origin of entropy- a possible explanation

1-as the quantons expand , energy constraining takes place

2-Energy constraining is the mechanism of ensuring dimensional

energy symmetry (DES) under inflationary conditions

3-Energy constraining during quanton inflation as follows

a-Expansion of free energy components ($E_{sf}E_{tf}$)must be accompanied by constraining of part - of the expanding energy component

b-constraining of an energy fields ($E_{sc}E_{tc}$)must be accompanied by an expansion of part of the constrained energy field

c-In both cases , the result will be the release of the unconstrained energy (: energy packet) of the form E = E_s E_t

for the free type of energy as it expands

$$\frac{\partial}{\partial s}\left(E_{sf}\, E_{tf}\right) = \left(\frac{\partial E_{sf}}{\partial s}\,\frac{\partial E_{tf}}{\partial t}\right)\left(\int E_{sf}\, ds \int E_{tf}\, dt\right)$$

$$= \left(E_{sf}\, E_{tf}\right)\left(E_s\, E_t\right)$$

where $\frac{\partial E_{sf}}{\partial s}$ **=** E_{sf} , $\frac{\partial E_{tf}}{\partial t}$ **=** E_{tf} , **,**

$\int E_{sf}\, ds = E\,(= E_s\, E_t)$ **and** $\int E_{tf}\, dt = E_s\, E_t$

and in detail

$\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\ \frac{\partial E}{\partial t}\right)$ **=(** $\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right)\frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)$**)(** $\int \frac{\partial E}{\partial s}$ **ds** $\int$ $\frac{\partial E}{\partial t}$ **dt)=**

$(\frac{\partial E}{\partial s} \quad \frac{\partial E}{\partial t})\ (E_s E_t)$

while the first term : = $\frac{\partial E}{\partial s} \frac{\partial E}{\partial t}$ equals the original free energy

which expands through variation of energy in space and in time ,

The second term $E_S\ E_t$: represents the release of energy packet

which is due to due to the constraining of part of the free energy

field for the constrained energy

$$\int (E_{sc}\ E_{tc})\ ds = (\int E_{sc}\ ds\ \int E_{tc}\ dt\ )\ (\frac{\partial E_{sc}}{\partial s} \frac{\partial E_{tc}}{\partial t})$$

= $(E_{sc}\ E_{tc})(E_s E_t)$, and in details

$\int (\int E \ \ \mathrm{ds} \ \ \int E\ dt\ )$ =

$(\int \ \int E\ \mathrm{ds}\ \ \mathrm{ds}\ \int \ \int E\ dt\ \ dt\ )(\frac{\partial}{\partial s} \int E \ \ \mathrm{ds}\ \frac{\partial}{\partial t} \int E\ dt\ )$

= $(\int E \ \ \mathrm{ds} \ \ \int E \ \ \mathrm{dt}\ )\ (E_s E_t)$

first term: the original constrained energy term

the second term : unconstrained energy , as it is released due to

the expansion of constrained energy

for complex energy systems $E_q = (E_{sf}\ E_{tc})(E_{tf}\ E_{tf})$

$$\frac{\partial E_q}{\partial s} = (\frac{\partial}{\partial s}(E_{sf}) \int (E_{tc})\ dt\ )\ (\int (E_{sc})\ ds\ \frac{\partial}{\partial t}(E_{tf}))\ )$$

$$+(\int\ (E_{sf})\ ds\ \frac{\partial}{\partial t}(E_{tc})\ )\ (\frac{\partial}{\partial s}(E_{sc}) \int (E_{tf})\ dt\ )$$

and given that $= \frac{\partial}{\partial s} E_{sf} = E_{sf}$, $\int E_{sc}\, ds = E_{sc}$,

$$\frac{\partial}{\partial t} E_{tf} = E_{tf} , \int E_{tc}\ dt = E_{tc}$$

$\frac{\partial E_q}{\partial s} = E_{sf}\ E_{tf}\ E_{sc} E_{tc} + E_s\ E_t$, and in details

$$\frac{\partial E_q}{\partial s} = \frac{\partial}{\partial s}\ (\frac{\partial E}{\partial s} \int E\ dt\ )\ (\int E\ ds\ \frac{\partial E}{\partial t}))$$

$$= (\frac{\partial}{\partial s}(\frac{\partial E}{\partial s}) \int (\int E\ dt)\ dt\ )\ (\int\ (\int E\ ds)\ ds\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\ \right))$$

$$+ (\int\ (\frac{\partial E}{\partial s})\ ds\ \ \frac{\partial}{\partial t}(\int E\ dt))\ (\frac{\partial}{\partial s}\ (\int E\ ds)\ \ (\int \left(\frac{\partial E}{\partial t}\ \right)\ dt\ ))$$

$$= (\frac{\partial E}{\partial s} \int E\ dt\ )\ (\int E\ ds\ \frac{\partial E}{\partial t}\ ) + E_s\ E_t$$

The first term represents the original quanton energy E_q after expansion ,while the second term represents the generation of packet energy , we conclude that

1-expansion of free energy fields always is accompanied by part-constraining of free energy varying in space and time

2-constraining of constrained energy fields is accompanied by part-expansion of the constrained energy

3-whether due to constraining of a free energy or expansion of a constrained energy, in both cases packet energy is generated as a result of the expansion process, later , it will be shown how a part of this energy packet is released from the quanton as it expands which is at the origin of increasing disorder accompanying the inflationary process

13.Space fabric expansion and the release of thermal energy

Inflation of the universe (expansion of space fabric) is a free expansion process and is accompanied by the release of thermal energy , the idea that a free expansion process gives off heat is rather odd , since expansion is closely related to reduction in

temperature , in fact any release of thermal energy is more than offset by the effects of inflation , so the net result would be a net reduction in temperature (observed as thermal degradation of CMB photons)

inflation of the universe is a free expansion process , which according to the second law of thermodynamics, is an irreversible process , this irreversibility is due to losses in the form of space fabric giving off heat during expansion process

the origin of this release of thermal energy : is energy constraining

to show the source of this released energy we consider the case of quanton as it is expands (discussed in the following section) from a volume (V_{q1}) to (V_{q2})

1-the quanton radius r_q changes in the following manner

$$\frac{V_{q2}}{V_{q1}} = (\frac{r_{q2}}{r_{q1}})^3$$

2- quanton energy fields change periodically with time

, this variation at the rate of $\omega\ rad/sec$, and vary in space at

the rate of k (= $\frac{\pi}{r_q}$)

the total energy of the quanton (as a quantum entity) is governed

by Planck Einstein relationship (function only in its wave

parameters) , namely E_p = hf = $\frac{hkc}{2\pi}$ = $\frac{hc}{r_q}$

The relationship between quantons of different energy content can

be put in the form $\frac{E_{p2}}{E_{p1}} = \frac{\omega_2}{\omega_1} = \frac{k_2}{k_1} = \frac{\lambda_1}{\lambda_2} = \frac{r_{q1}}{r_{q2}}$

Which means that the quanton radius (and the wave length

of its characteristic wave behaviour are inversely proportional

to its total (packet) energy content

3-recalling here the first concept upon which this model is based

namely the Dof relationship between energy density inside the

qauanton and its total (packet) energy content

total (packet) energy density inside the quanton can be assessed as

$E_p = \mathrm{E}_q\ V_q$ **or** $\mathrm{E}_q = \frac{E_p}{V_q}$ **, then**

$\frac{\mathrm{E}_{q2}}{\mathrm{E}_{q1}} = (\frac{E_{p2}}{E_{p1}})(\frac{V_{q1}}{V_{q2}})$

Substituting for $(\frac{E_{p2}}{E_{p1}}) = (\frac{r_{q1}}{r_{q2}})$ **, and** $(\frac{V_{q1}}{V_{q2}}) = (\frac{r_{q1}}{r_{q2}})^3$

We get $\frac{\mathrm{E}_{q2}}{\mathrm{E}_{q1}} = (\frac{r_{q1}}{r_{q2}})^4$ **(1-13)**

Which deviates from what we would expect in a classical Volume / density relationship of the form $\frac{\varrho_2}{\varrho_1} = \frac{V_1}{V_2} = (\frac{r_1}{r_2})^3$

and this is due to the fact that energy density inside the quanton is proportional to ${r_q}^4$ **and not to** ${r_q}^3$

this previous relationship can be obtained directly from the equation (6-11) , namely $E_q = \pi^4\ h_q \frac{\mathrm{c}^4}{{r_q}^4}$ **or**

$E_q = (\frac{\mathrm{constant}}{{r_q}^4})$

Hence , as quantons expand , free energy is being constrained and constrained energy is being expanded , as a result of this process , thermal energy is being released from the quanton as it expands to allow for energy density variation to the fourth order with the quanton diameter or E_q α $(\frac{1}{r_q})^4$

14. Origin of cosmic microwave back ground (CMB)

Based on the previous results ,we can conclude that the CMB is due – at least in part –to release of thermal energy during Free expansion of the space fabric itself

the extraordinarily high degree of CMB homogeneity with variation of the order of (10^{-5}) , reflects the high degree of homogeneity of space fabric it self as it releases radiation during the free expansion process , and , in fact energy constraining inside the quantons is behind that release of radiation energy

15.Mechanism of quanton splitting

There are two mechanisms that can cause the quantons to

Expand , namely

a-Splitting action of the quantons due dimensional energy

asymmetry

b-The sole release of energy from the quantons

as for the first mechanism

1-Stage (1-2): expansion under the effect of unbound repulsive field

While there are two types of energies inside the quanton (free and constrained) , they interact , creating a binding relationship but since the energy levels (field strength which is in terms of Dof's) of both types are not the same , the fields of the dominant type of energy self-interact creating a repulsive interaction that causes the quantons to expand under this self-interaction of nonbinding energy fields (E_{sfn}) for quantons and (E_{scn}) for anti quantons

(will be discussed in the section bound and nonbinding energies)

, the expanding quanton radius can be defined as

r_{q2} **= (x** r_{q1} **, (** $1 < x < \sqrt[3]{2^4}$ **)**

no change in the quanton wave parameters(ω, k) **since**

there is no energy release from the quantons at this stage

2-<u>Stage (2-3) dimensional energy asymmetry occurs and quanton splits</u>

Since the quanton parameters (ω, k) **do not reflect the change**

in (r_q**) , (** $\frac{r_{q1}}{r_{q2}}$ **must equal** $\frac{E_{p2}}{E_{p1}} = \frac{\omega_2}{\omega_1} = \frac{k_2}{k_1}$ **while** $r_{q2} > r_{q1}$ **and**

E_{qp2} **still equals** E_{qp1} **and** $\omega_2 = \omega_1$**) , this conflict of wave**

parameters causes

a-dimensional energy asymmetry to develop and

b-quanton splits as a mechanism to restore (DES) such that

(r_{q3}) **= (**$\frac{r_{q2}}{2}$ **) ,** $E_{p3} = \frac{E_{p2}}{2} = \frac{E_{p1}}{2}$

3-Stage (3- 4) quanton expands

as E_{p3} drops following quanton splitting , wave parameters

(ω, k) $also$ must change such that $\frac{\omega}{k}$ = c= constant

So quanton expand to the stage (4) to satisfy the relationship

$$\frac{E_{p4}}{E_{p2}} = \frac{\omega_4}{\omega_2} = \frac{k_4}{k_2} = \frac{r_{q2}}{r_{q4}} = \frac{1}{2}$$

as the quantons expand , they release thermal energy in the form

of CMB energy packets , to maintain the relationship

$\frac{E_{q2}}{E_{q1}} = (\frac{r_{q1}}{r_{q2}})^4$ **and to arrive at the final pseudo stable state**

stage	(1)	(2)	(3)	(4)
Total quanton energy : E_p	E_{p1}	E_{p1}	$\frac{E_{p1}}{2}$	$< \frac{E_{p1}}{2}$
Wave parameters ω , k	ω_1 k_1 ,	ω_1 k_1 ,	ω_1 , k_1	$<\frac{\omega_1}{2}$, $<\frac{k_1}{2}$
Field energy density : E_q	E_{q1}	$\frac{E_{q1}}{x^3}$	$\frac{E_{q1}}{x^3}$	$< \frac{E_{q1}}{16}$
Quanton radius r_q	r_{q1}	$x\, r_{q1}$	$\sqrt[3]{\frac{1}{2}}\, x\, r_{q1}$	$> 2\, r_{q1}$
Quanton volume V_q	V_{q1}	$x^3 V_{q1}$	$\frac{x^3}{2} V_{q1}$	$>8\, V_{q1}$
Number of quantons	one	one	two	two

Summary of the stages of the quanton splitting and expansion

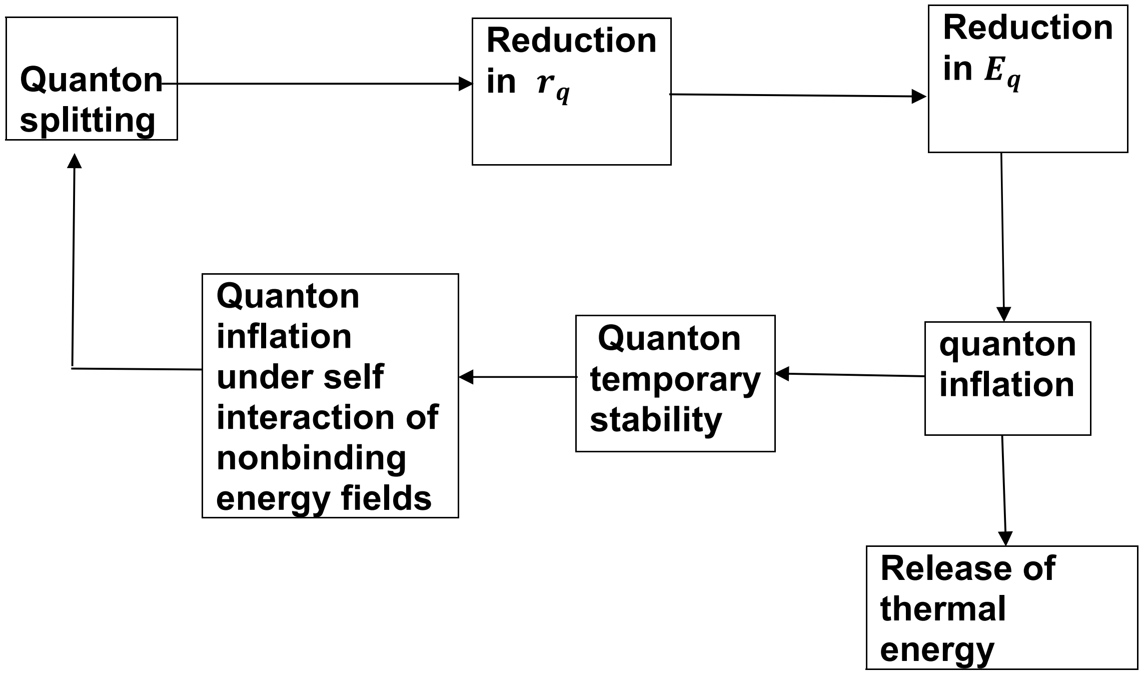


Fig (2) cycle of quanton splitting and subsequent inflation

The second method is the pure release of thermal energy which is followed up by a subsequent quanton expansion this mechanism is such an inefficient one in comparison to the fore described method of quanton splitting and subsequent expansion , given the high efficiency of previous process as a mechanism to manage the expansion of the quanton through both inflation and multiplication while on the other hand minimizing the thermal energy release , it is clear that such quanton splitting and

subsequent expansion is the actual mechanism of space fabric expansion

<u>16.Qunaton feedback mechanism through energy constraining</u>

1-as quanton expands $\frac{\partial E_q}{\partial s}$, the process results in two main products a- The energy expansion

the expansion term is $\left(\frac{\partial E_{sf}}{\partial s} \int E_{tc}\ dt\right)\left(\int E_{sc}\ ds\ \frac{\partial E_{tf}}{\partial t}\right)$

and gives energy components $(E_{sf}\ E_{tc})(E_{sc}\ E_{tf})$ which are exactly the same product as the original unexpanded energy (though with lesser total energy content)

b-constraining or Feedback term , defined as

$$\left(\int E_{sf}\ ds\ \frac{\partial E_{tc}}{\partial t}\right)\left(\frac{\partial E_{sc}}{\partial s} \int E_{tf}\ dt\right) = E_s\, E_t$$

The destiny of this feedback term is dependent on the dimensional energy symmetry , if satisfied this term will be recycled in the form of further full expansion

If (DES) is not satisfied , this term can still be either

a-Partially released from the quanton to allow for further expansion of the quanton as we have discussed In the previous chapter

b- Partial expansion to re-establish (DES)

The expansion term represents 75% of the quanton field energy , while the feedback term represents the remaining 25% , the origin of this division lies in the fact that expansion of the quanton in 3 dimensional space corresponds to 3 degrees of freedom out of four while the constraining term represents the equivalent to the fourth degree of freedom and as the quanton expands , it has to release energy packets which correspond to this fourth degree of freedom (or 25% of its total energy , to maintain the energy relationship

$$\frac{E_{q2}}{E_{q1}} = \left(\frac{r_{q1}}{r_{q2}}\right)^4$$

expansion of feedback term inside the quanton

$\frac{\partial}{\partial s}(E_s\, E_t)=\ E_{sf}\, E_{tc}$ then $(E_{sf}\, E_{tc})(E_{sc}\, E_{tf})$

While for anti quanton

$\frac{\partial}{\partial s}(E_s\, E_t) = (E_{sc}\, E_{tf})$ then $(E_{sf}\, E_{tc})(E_{sc}\, E_{tf})$

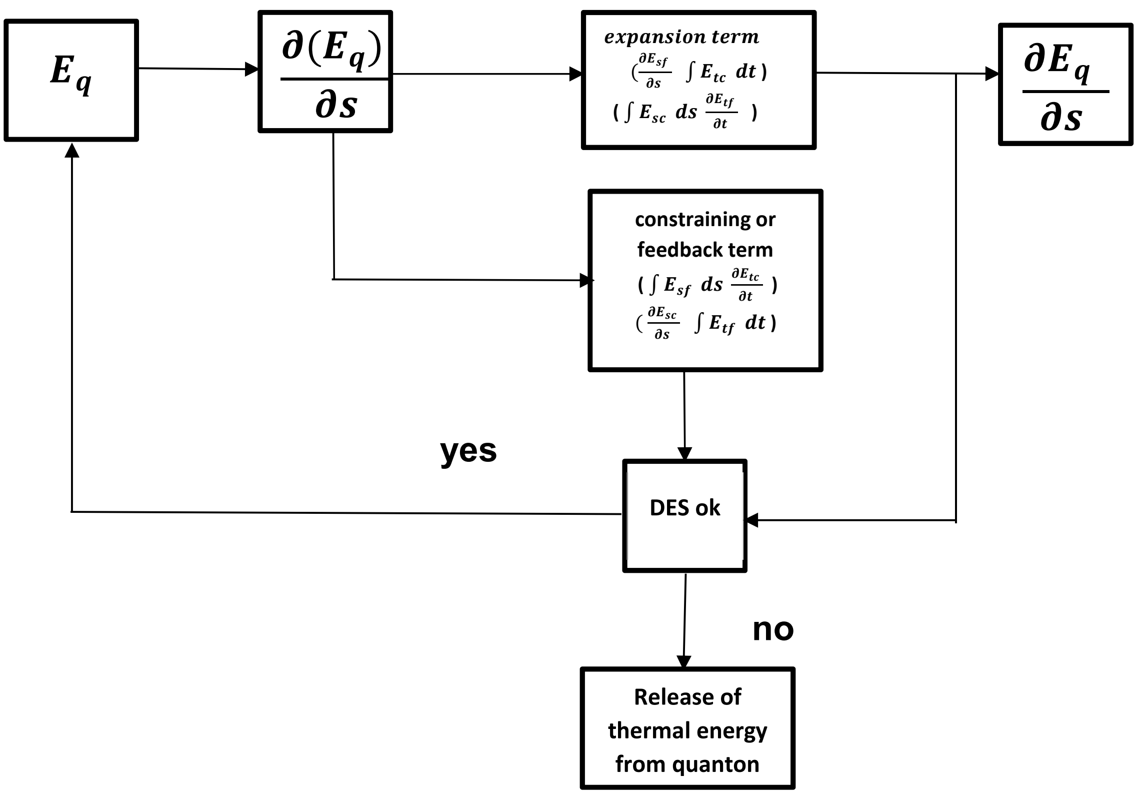


Fig (2). feedback mechanism through energy constraining to achieve uniform and homogeneous expansion inside the quanton

17.mathematics behind constraining term

1-Constraining process changes the nature of the energy (from free dominated to constrained dominated and vice versa in order

to maintain dimensional energy symmetry under inflationary conditions

2- to perform such an operation energy must transit through a packet state (energy that does not change in space or in time)

3-the constraining operation (integration / differentiation) takes place at an exponential level , so the exponent of wave behaviour parameter which is operated upon and not the parameter itself

4-The concept of energy degree of freedom transition between different space and time varying energy fields to satisfy dimensional energy symmetry (Des) has its routes in the exponential degree of freedom inside the quanton ,

as those energy degrees of freedom are in an exponential form (c^{Dof}) , so we can expect to expect the constraining action (differentiation / integration) to take place at an exponential level of the wave parameters too

For an expansion of the free space varying energy

a– $\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right) = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right)\left(\int\left(\frac{\partial E}{\partial s}\right) ds\right) = \left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)$

$= \frac{\partial}{\partial s}(K_{sf} D_{sf} \ \psi_{sf}) = K_{sf} D_{sf} \frac{\partial}{\partial s}(\psi_{sf})$

$= K_{sf} D_{sf} \frac{\partial}{\partial s}(e^{jks})(e^{\frac{\partial}{\partial s}(jks)})$ **(1-17)**

$= K_{sf} D_{sf} \frac{\partial}{\partial s}(e^{jks})(K_s D_s \ K_t D_t e^{(jk)})$

$= \frac{\partial E}{\partial s}\left(K_s D_s \ K_t D_t e^{(jk)}\right) = \left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)$

$b - \frac{\partial}{\partial s}\left(\left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)\right) = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right)\int(E) \ dt = \left(\frac{\partial E}{\partial s}\right)\left(\int E \ dt\right)$

$\frac{\partial}{\partial s}\left(\left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)\right) = \frac{\partial E}{\partial s}\left(K_s D_s \ K_t D_t e^{-\int(jk) \ ds}\right)$ **(2-17)**

$= K_{sf} D_{sf} \frac{\partial}{\partial s}(e^{jks})(K_s D_s \ K_t D_t e^{-\int(jk) \ ds})$

We perform the following change of the integration parameters

$K = \frac{\omega}{c}$, $ds =$ dx dy dz , dx , dy , dz = c dt

$\frac{\partial}{\partial s}\left(\left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)\right) = K_{sf} D_{sf} \frac{\partial}{\partial s}(e^{jks})(K_{tc} D_{tc} e^{-\int\frac{\omega}{c} \ c \ dt})$

$$= K_{sf}\, D_{sf}\, \frac{\partial}{\partial s}\,(e^{jks})(K_{tc}\, D_{tc}\, e^{-j\omega\, dt}) \qquad \textbf{(3-17)}$$

$$=\frac{\partial}{\partial s}\,(\frac{\partial E}{\partial s}) = \frac{\partial E}{\partial s} \int E \text{ dt}$$

For the case of expansion of free time varying energy

$$\text{a}- \frac{\partial}{\partial t}\,(\frac{\partial E}{\partial t}) = (\frac{\partial}{\partial t}\,(\frac{\partial E}{\partial t}))\,(\int(\frac{\partial E}{\partial t})\ \ dt\ ) = (\frac{\partial E}{\partial t})\,(E_s\ \ E_t)$$

$$= \frac{\partial}{\partial t}\,(K_{tf}\, D_{tf}\ \ \psi_{tf}) = K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}(\psi_{tf})$$

$$= K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}\,(e^{j\omega t})(e^{\frac{\partial}{\partial t}(j\omega t)}) \qquad \textbf{(4-17)}$$

$$= K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}\,(e^{j\omega t})(K_s\, D_s\ \ K_t\, D_t\ \ e^{\,(j\omega)})$$

$$= \frac{\partial E}{\partial t}\,(K_s\, D_s\ \ K_t\, D_t\, e^{\,(j\omega)}) = (\frac{\partial E}{\partial t})\,(E_s\ \ E_t)$$

$$b - \frac{\partial}{\partial t}\,((\frac{\partial E}{\partial t})\,(E_s\ \ E_t)) = \frac{\partial}{\partial t}\,(\frac{\partial E}{\partial t}) \int(E\,)\ \ ds \ \ = (\frac{\partial E}{\partial t})(\int\ E\ \ ds\,)$$

$$= \frac{\partial}{\partial t}\,((\frac{\partial E}{\partial t})\,(E_s\ \ E_t)) = \frac{\partial E}{\partial t}\,(K_s\, D_s\ \ K_t\, D_t\, e^{-\int(j\omega)\ dt}) \qquad \textbf{(5-17)}$$

$$= K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}\,(e^{j\omega t})(K_s\, D_s\ \ K_t\, D_t\, e^{-\int(j\omega)\ dt})$$

Again , we perform the change of the integration parameters

$$\omega = kc \qquad , \qquad dt = \frac{dx}{c} = \frac{dy}{c} = \frac{dz}{c} \ , \ \ ds = dx\ dy\ dz$$

$$= K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}\,(\, e^{j\omega t})(\, K_{sc}\, D_{sc}\, e^{-\int kc\ \frac{ds}{c}}) \qquad \textbf{(6-17)}$$

$$= (\, K_{tf}\, D_{tf}\, \frac{\partial}{\partial t}\,(\, e^{j\omega t}))(\, K_{sc}\, D_{sc}\, e^{-jks})$$

$$=\frac{\partial}{\partial t}\,(\,\frac{\partial E}{\partial t})\ =\frac{\partial E}{\partial t}\int E\ \text{ds}$$

a-Expansion part

As mentioned earlier , the expansion of constrained energies is

Handled by integration process

$$\frac{\partial}{\partial s}\,(E_q) = \frac{\partial}{\partial s}((\, E_{sf}\ E_{tc})(\ \ E_{sc}\ \ E_{tf})\,)$$

$$= K_{sf}K_{tc}\, D_{sf}\, D_{tc}\frac{\partial}{\partial x}\,\psi_{sf}\int\ \ \psi_{tc}\, dt\,)(K_{sc}\, K_{tf}\, D_{sc}D_{tf}\int\ \ \psi_{sc}\, dx\frac{\partial}{\partial t}\ \psi_{tf}) \qquad \textbf{(7-17)}$$

$$= K_{sf}\, K_{tc}\, D_{sf}\, D_{tc}(\ \frac{jk}{-j\omega}\ \psi_{sf}\, \psi_{tc})\,(K_{sc}\, K_{tf}\, D_{sc}\, D_{tf})(\,\frac{j\omega}{-jk}\ \psi_{sc}\, \psi_{tf})$$

$$= K_{sf}\ \ \psi_{sf}D_{sf})(K_{tc}\ \ D_{tc}\ \ \psi_{tc})\ \ ((K_{sc}D_{sc}\,\psi_{sc}\,)(K_{tf}\ \ \ D_{tf}\ \ \psi_{tf}\,)$$

$$= (\, E_{sf}\ \ E_{tc})\,(\, E_{sc}\ \ E_{tf}) =\ E_q$$

b- constraining term

$$(\int E_{sf}\, ds\,\frac{\partial\, E_{tc}}{\partial t}\,)(\,\frac{\partial\, E_{sc}}{\partial s}\int E_{tf}\ \text{dt}\,)$$

= $K_{sf}\, K_{tc}\, D_{sf}\, D_{tc}\, \frac{\partial}{\partial x}\ e^{\frac{\partial}{\partial s}(jks)} e^{\frac{\partial}{\partial t}(-j\omega t)}$) $(K_{sc}\, K_{tf}\, D_{sc}\, D_{tf}\ e^{\frac{\partial}{\partial s}(-jks)}\ dx\ e^{\frac{\partial}{\partial t}(j\omega t)}$)

= $K_{sf}\, K_{tc}\, D_{sf}\, D_{tc}\ e^{(jk)} e^{(-j\omega)}$) $(K_{sc}\, K_{tf}\, D_{sc}\, D_{tf}\ e^{(-jk)} e^{(j\omega)})$

=($K_{sf}\, K_{tc}\, D_{sf}\, D_{tc} e^{(jk)} e^{(-j\omega)}\ )(K_{sc}\, K_{tf}\, D_{sc}\, D_{tf}\ e^{(-jk)} e^{(j\omega)})$

= $K_s\, D_s\, K_t\, D_t =\ E_s E_t$

To summarize, the exponential differentiation / integration would be

applied in either of the following cases

1-Change of the nature of the energy field (free / constrained)

or (space varying / time varying) and vice versa

2- change in the degrees of freedom of any energy field (Dof

rearrangement between fields)

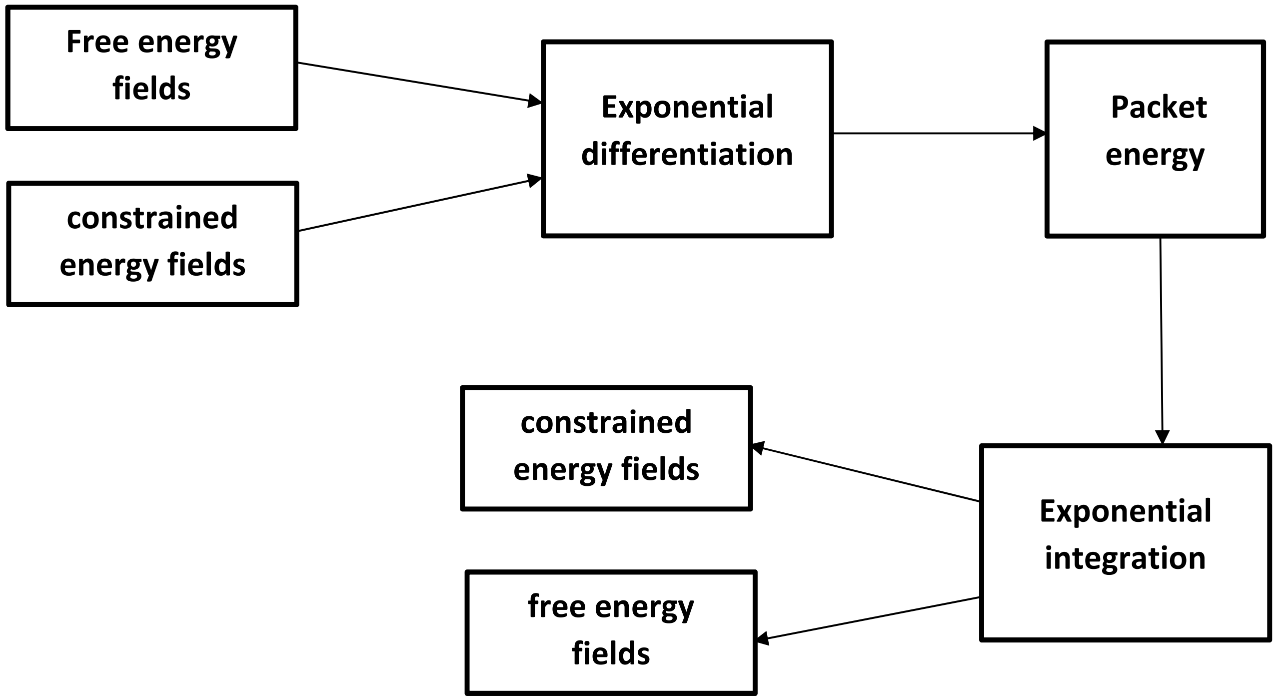


Fig (3).constraining operations through exponential differentiation/integration

18. Wave- like properties of space fabric

Energy which varies in time and varies in space has wave like properties as it changes at periodic rate that equals ω rad /sec (= $2\pi f$) and the space varying energy , does vary at the rate of k (= $\frac{2\pi}{\lambda}$) , such that $\frac{\omega}{k}$ = constant = c

In fact the quanton (or anti quanton) is represented by two (wave like) equations , while a true wave must possess four

degrees of energy freedom neither free dominated E_{qf} nor constrained dominated E_{qf} possess those four degrees of freedom individually , so we cannot call them waves , but as they expand they (and due to their interaction) they possess those four *Dof's*

to show how the wave equations would look like for the energy fields of the free and constrained wave-likes , first remembering that $\psi_{sf} = e^{jkx}$, $\psi_{tc} = e^{-j\omega t}$, $\psi_{sc} = e^{-jkx}$, $\psi_{tf} = e^{j\omega t}$

the free energy dominated wave parameters

$\psi_{qf} = (\psi_{sf}\ \psi_{tc})$ differentiating both sides w.r.t time

$$\frac{\partial \psi_{qf}}{\partial t} = \frac{\partial \psi_{tc}}{\partial t}\ \psi_{sf} = -j\omega\, \psi_{sf}\psi_{tc}$$

$$\frac{\partial^2 \psi_{qf}}{\partial t^2} = \frac{\partial^2 \psi_{tc}}{\partial t^2}\ \psi_{sf} = j\omega^2\, \psi_{sf}\psi_{tc}$$

while differentiating w.r.t (x)

$$\frac{\partial \psi_{qf}}{\partial x} = \frac{\partial \psi_{sf}}{\partial x}\ \psi_{tc}$$

$$\frac{\partial^2 \psi_{qf}}{\partial x^2} = \frac{\partial^2 \psi_{sf}}{\partial x^2}\ \psi_{tc} = jk^2\, \psi_{sf}\psi_{tc}$$

For a wave equation $\frac{\partial^2 \psi_{qf}}{\partial t^2} = c^2 \frac{\partial^2 \psi_{qf}}{\partial x^2}$ **to be satisfied**

$\frac{\partial^2 \psi_{tc}}{\partial t^2}$ **=** c^2 **(**$\frac{\partial^2 \psi_{sf}}{\partial x^2} \frac{\psi_{tc}}{\psi_{sf}}$**)** **or** $(E_{qf})_{tt}$ **=** c^2 $(E_{qf})_{xx}$ **as before (1-18)**

Which is the PDE forth free energy dominated wave

similarly ,for the constrained energy dominated wave

ψ_{qc}**=** $(\psi_{sc}\ \psi_{tf})$ **differentiating both sides w.r.t time**

$$\frac{\partial \psi_{qc}}{\partial t} = \frac{\partial \psi_{tf}}{\partial t} \psi_{sc}$$

$\frac{\partial^2 \psi_{qc}}{\partial t^2} = \frac{\partial^2 \psi_{tf}}{\partial t^2} \psi_{sc}$ **, while differentiating w.r.t x**

$$\frac{\partial \psi_{qc}}{\partial x} = \frac{\partial \psi_{sc}}{\partial x} \psi_{tf}$$

$$\frac{\partial^2 \psi_{qc}}{\partial x^2} = \frac{\partial^2 \psi_{sc}}{\partial x^2} \psi_{tf} ,$$

for a wave equation $\frac{\partial^2 \psi_{qc}}{\partial t^2} = c^2 \frac{\partial^2 \psi_{qc}}{\partial x^2}$ **to be satisfied**

$\frac{\partial^2 \psi_{tf}}{\partial t^2}$ **=** c^2 **(**$\frac{\partial^2 \psi_{sc}}{\partial x^2} \frac{\psi_{tf}}{\psi_{sc}}$**)** **or** $(E_{qc})_{tt}$ **=** c^2 $(E_{qc})_{xx}$ **(2-18)**

Which is the PDE for the constrained energy dominated wave,

this shows how a quanton energy equation for space and time

varying functions would look like as a wave equation , but does the

quanton energy equation in its differential / integral form really

represent two wave equations ?

a-For the free energy dominated term ($\frac{\partial E}{\partial s} \int E\ dt$)

Differentiating with respect to time $\frac{\partial}{\partial t}\left(\frac{\partial E}{\partial s} \int E\ dt \right) =$

$$\left(\frac{\partial x}{\partial t} \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s} \right) \int E\ dt \right) + \left(\frac{\partial E}{\partial s} \frac{\partial}{\partial t}\left(\int E\ dt\right)\right)$$

$$= \left(c \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s} \right) \int E\ dt \right) + \left(\frac{\partial E}{\partial s} \frac{\partial}{\partial t}\left(\int E\ dt\right) \right)$$

Differentiating again with respect to time

$$\frac{\partial}{\partial t} \left(\left(c \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s} \right) \int E\ dt \right) + \left(\frac{\partial E}{\partial s} \frac{\partial}{\partial t}\left(\int E\ dt\right)\right)\right)$$

$$= \left(c \frac{\partial x}{\partial t} \frac{\partial^2}{\partial x^2} \left(\frac{\partial E}{\partial s}\right) \int E\ dt \right) + \left(c \frac{\partial}{\partial x} \left(\frac{\partial E}{\partial s} \right) \frac{\partial}{\partial t} \left(\int E\ dt \right)\right)$$

$$+\left(\frac{\partial x}{\partial t} \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s} \right) \frac{\partial}{\partial t}\left(\int E\ dt\right)\right) + \left(\frac{\partial E}{\partial s} \frac{\partial^2}{\partial t^2}\left(\int E\ dt \right)\right) =$$

$$\left(c^2 \frac{\partial^2}{\partial x^2}\left(\frac{\partial E}{\partial s} \right) \int E\ dt \right) + 2\,c \left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right) \frac{\partial}{\partial t}\left(\int E\ dt\right)\right) + \left(\frac{\partial E}{\partial s} \frac{\partial^2}{\partial t^2}\left(\int E\ dt\right) \right)$$

For the same energy type differentiating with respect to x

$$\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\int E\ dt\right) = \left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\int E\ dt\right) + \left(\frac{\partial E}{\partial s}\ \frac{1}{\frac{\partial x}{\partial t}}\frac{\partial}{\partial t}\left(\int E\ dt\right)\right)$$

$$= \left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\int E\ dt\right) + \left(\frac{\partial E}{\partial s}\ \frac{1}{c}\frac{\partial}{\partial t}\left(\int E\ dt\right)\right)$$

differentiating again with respect to x

$$\frac{\partial}{\partial x}\left(\left(\left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\int E\ dt\right) + \left(\frac{1}{c}\frac{\partial E}{\partial s}\ \frac{\partial}{\partial t}\left(\int E\ dt\right)\right)\right)\right)$$

$$=\left(\frac{\partial^2}{\partial x^2}\left(\frac{\partial E}{\partial s}\right)\int E\ dt\right) + \left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\frac{1}{\frac{\partial x}{\partial t}}\ \frac{\partial}{\partial t}\left(\int E\ dt\right)\right) +$$

$$\left(\frac{1}{c}\ \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\frac{\partial}{\partial t}\left(\int E\ dt\right)\right) + \left(\frac{1}{c}\frac{\partial E}{\partial s}\ \frac{1}{\frac{\partial x}{\partial t}}\ \frac{\partial^2}{\partial t^2}\left(\int E\ dt\right)\right)$$

$$=\left(\frac{\partial^2}{\partial x^2}\left(\frac{\partial E}{\partial s}\right)\int E\ dt\right) + 2\,\frac{1}{c}\left(\frac{\partial}{\partial x}\left(\frac{\partial E}{\partial s}\right)\ \frac{\partial}{\partial t}\left(\int E\ dt\right)\right)+$$

$$\left(\frac{1}{c}\right)^2\left(\frac{\partial E}{\partial s}\ \frac{\partial^2}{\partial t^2}\left(\int E\ dt\right)\right)$$

by comparing the results of both double differentiation

$$\frac{\partial^2}{\partial t^2}\left(\frac{\partial E}{\partial s}\int E\ dt\right) = c^2\,\frac{\partial^2}{\partial x^2}\left(\frac{\partial E}{\partial s}\int E\ dt\right)$$

which is customary form of for a wave relation

b- For the constrained energy dominated wave

$E_{qc} = \int E\ ds \frac{\partial E}{\partial t}$, **expanding in x direction**

$$\frac{\partial}{\partial x}\left(\int E\ ds \frac{\partial E}{\partial t}\right) = \left(\frac{\partial}{\partial x}\left(\int E\ ds\right) \frac{\partial E}{\partial t}\right) + \left(\int E\ ds\ \frac{\partial}{\partial x}\left(\frac{\partial E}{\partial t}\right)\right)$$

$$= \left(\frac{\partial}{\partial x}\left(\int E\ ds\right)\frac{\partial E}{\partial t} \right) + \left(\int E\ ds\ \frac{1}{\frac{\partial x}{\partial t}}\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)$$

$$= \left(\frac{\partial}{\partial x}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right) + \left(\frac{1}{c} \int E\ ds\ \ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)$$

Differentiating again with respect to x- axis

$$\frac{\partial}{\partial x}\ \left(\left(\frac{\partial}{\partial x}\left(\int E\ ds\right)\frac{\partial E}{\partial t} \right) + \ \left(\frac{1}{c}\ \int E\ ds\ \ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)\right)$$

$$=\left(\frac{\partial^2}{\partial x^2}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right) + \left(\frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{1}{\frac{\partial x}{\partial t}}\ \ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right) +$$

$$\left(\frac{1}{c}\ \frac{\partial}{\partial x}\ \left(\int E\ ds\ \right)\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right) + \left(\frac{1}{c} \int E\ ds\ \ \frac{1}{\frac{\partial x}{\partial t}}\ \ \frac{\partial^2}{\partial t^2}\left(\frac{\partial E}{\partial t}\right)\ \right)) =$$

$$=\left(\frac{\partial^2}{\partial x^2}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right)+2\left(\frac{1}{c}\ \frac{\partial}{\partial x}\ \left(\int E\ ds\ \right)\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)+\left(\frac{1}{c}\right)^2\left(\int E\ ds\ \ \frac{\partial^2}{\partial t^2}\left(\frac{\partial E}{\partial t}\right)\right)$$

when differentiating with respect to time

$$\frac{\partial}{\partial t}\left(\int E\ ds\ \frac{\partial E}{\partial t}\ \right) = \left(\frac{\partial x}{\partial t}\ \frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{\partial E}{\partial t}\ \right) + \left(\int E\ ds\ \ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)$$

$$= \left(c\ \ \frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{\partial E}{\partial t}\ \right) + \left(\int E\ ds\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\ \right)$$

Differentiating again with respect to time

$$\frac{\partial}{\partial t}\left(\left(c\,\frac{\partial}{\partial x}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right) + \left(\int E\ ds\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right)\right)$$

$$=\left(c\,\frac{\partial x}{\partial t}\frac{\partial^2}{\partial x^2}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right) + \left(c\,\frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right) +$$

$$\left(\frac{\partial x}{\partial t}\ \frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{\partial E}{\partial t}\right) + \left(\int E\ ds\ \frac{\partial^2}{\partial t^2}\left(\frac{\partial E}{\partial t}\right)\right) =$$

$$=\left(c^2\,\frac{\partial^2}{\partial x^2}\left(\int E\ ds\right)\frac{\partial E}{\partial t}\right)+2\left(c\,\frac{\partial}{\partial x}\left(\int E\ ds\right)\ \frac{\partial}{\partial t}\left(\frac{\partial E}{\partial t}\right)\right) + \left(\left(\int E\ ds\ \frac{\partial^2}{\partial t^2}\left(\frac{\partial E}{\partial t}\right)\right)\right.$$

by comparing the results of both double differentiations

$$\frac{\partial^2}{\partial t^2}\left(\int E\ ds\ \frac{\partial E}{\partial t}\right) = c^2\,\frac{\partial^2}{\partial x^2}\left(\int E\ ds\ \frac{\partial E}{\partial t}\right)$$

again , which is the usual form of the wave equation

<u>19. quanton evolution and degrees of freedom</u>

In this section the quanton evolution will be discussed and before free/ constrained energy field interaction ,the quanton (or anti quanton) achieves partial Dof stability and after free/ constrained energy interaction the quanton achieves the stable state (w.r.t) energy degrees of freedom of space and time varying

fields which will be discussed in detail in the (section : the quanton stable Dof's)

<u>a-Quantons evolution</u>

1-through energy constraining ,the free energy (E_{sf}) is capable of generating both types of constrained energy (E_{sc}, E_{tc}) but only after being constrained inside the quanton

2-as the quantons evolved from mainly free space varying energy (E_{sf}) , there are two mechanisms for such an evolution

a-Independent of free time varying energy

b-coevolution of both (E_{sf}) and (E_{tf}) , which is discussed in the section : role of Maxwell equations in the evolution of quantons

3-For ($case\ (a)$) As free energy expands by variation in space It has to have a time varying field ,a constrained one

$$a - \frac{\partial}{\partial s}(\frac{\partial E}{\partial s}) = (\frac{\partial}{\partial s}(\frac{\partial E}{\partial s}))(\int(\frac{\partial E}{\partial s})\ ds) = (\frac{\partial E}{\partial s})(E_s\ E_t) \quad \textbf{(1-19)}$$

Knowing that E= $E_s \ E_t$, expanding again in space

$$b - \frac{\partial}{\partial s}\left(\left(\frac{\partial E}{\partial s}\right)(E_s \ E_t)\right) = \frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right) \int (E) \ dt \ = \left(\frac{\partial E}{\partial s}\right)\left(\int \ E \ dt\right) \qquad \textbf{(2-19)}$$

expanding again in space $\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s} \int E \ dt \ \right)$ **=**

$$\left(\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right) \int \ \left(\int E \ dt\right) dt\right)\left(\int \left(\frac{\partial E}{\partial s}\right) ds \ \frac{\partial}{\partial t}\left(\int E \ dt\right)\right) = \left(\ \frac{\partial E_s}{\partial s} \ \int E_t \ \ dt\right)(E_s E_t)$$

(3-19)

which is unstable energy (due to the term $(E_s E_t)$, as it expands again , following the differentiation of two variables as mentioned before $\frac{\partial}{\partial s}\left(\left(\ \frac{\partial E}{\partial s} \ \int E \ \ dt \ \right)(E_s E_t)\right)$**=**

$$\left(\frac{\partial}{\partial s}\left(\frac{\partial E}{\partial s}\right) \ \int\left(\int E \ dt\right) \ \ dt\right)\left(\int (E)\, ds \frac{\partial}{\partial t}(E)\ \right) +$$

$$\left(\int \left(\frac{\partial E}{\partial s}\right) ds \ \ \frac{\partial}{\partial t}\left(\int E \ dt\right) \ \ \right)\left(\frac{\partial}{\partial s}(E) \ \int (E)\, dt\,\right) =$$

$$= \left(\frac{\partial E}{\partial s} \int E \ dt\right)\left(\int E \ \ ds \ \ \frac{\partial E}{\partial t}\right) + \left(\ \frac{\partial E}{\partial s} \ \int E_s \, dt\,\right)(E_s E_t) \qquad \textbf{(4-19)}$$

The first term is the quanton energy equation (energy expansion term) , while the second represents the original unstable energy (constraining term) , the ratio between the two terms is three : one , so this is a recursive energy relation that would

continue until exhausting this type of unstable energy :

$$\left(\frac{\partial E}{\partial s} \int E \; dt \right)(E_s E_t)$$

now the stable quanton energy equation becomes

$$E_q = \left(\frac{\partial E}{\partial s} \int E \quad dt\right)\left(\int E \;\; ds \frac{\partial E}{\partial t}\right) = (E_{sf}E_{tc})(E_{sc}E_{tf}) = E_{qf}E_{qc}$$

(5-19)

which expresses two apparently separate (but otherwise linked)

wave like equations, E_q can be put as

$$E_q = \left(\frac{\partial E}{\partial s} \; \frac{\partial E}{\partial t}\right)\left(\int E \; ds \int E \; dt \right)$$

The term $\left(\frac{\partial E}{\partial s} \; \frac{\partial E}{\partial t}\right)$ expresses free energy fields

The term $\left(\int E \;\; ds \;\; \int E \;\; dt \right)$ expresses constrained energy

fields

4-for space constrained energy field E_{sc},its energy Dof equals one

third of the corresponding free energy field E_{sf}

5-for free time varying energy field E_{tf} , its energy degree of

freedom equals one third of the corresponding time constrained

energy field E_{tc}

6-the number of Free (nonbinding) energy degrees of freedom

inside quaton is equivalent to the number of free energy degrees

of freedom (space plus time varying) minus the energy

constrained degrees of freedom (space and time varying)

7- Free (nonbinding) energy is manifested in the form of quanton

inflation , the previous discussion can be summarized in the

following 4 simultaneous equations by solving them we obtain

the quanton transitional Dof for the four energy fields

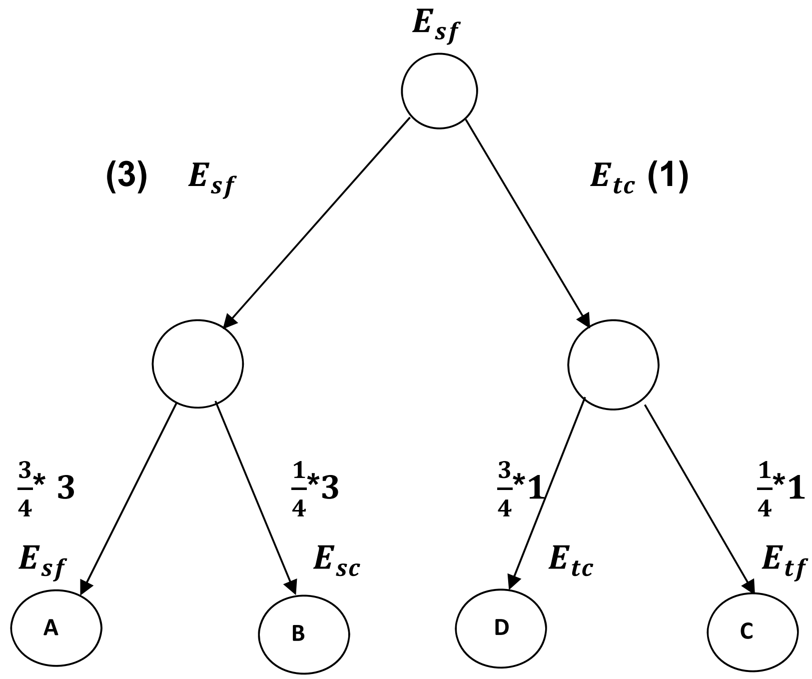
$\mathbf{Dof}_{sf} = 3\ \mathbf{Dof}_{sc}$, $\mathbf{Dof}_{tc} = 3\ \mathbf{Dof}_{tf}$

$\mathbf{Dof}_{sf} + \mathbf{Dof}_{sc} = 3$, $\mathbf{Dof}_{tf} + \mathbf{Dof}_{tc} = 1$,

which gives the following results

$Dof_{sf} = 2.25$, $Dof_{sc} = 0.75$

$Dof_{tf} = 0.25$, $Dof_{tc} = 0.75$



Fig(4).Tree diagram for the evolution and the degrees of freedom of quanton energy fields (a slightly modified version will be offered in the section Maxwell roll in the evolution of quantons)

8- as free and constrained energy fields create corresponding field binding interaction inside the quanton , the result of such this interaction would be a rearrangement of the degrees of freedom in such a way that maximizes its stability this can be ensured by creating a symmetry of free and constrained degrees of freedom (discussed in the section : quanton stable Dof)

the stable energy *Dof* (after rearrangement)

$\boldsymbol{Dof_{sf}}$ **= 2 ,** $\boldsymbol{Dof_{tf}}$ **= 0.5**

$\boldsymbol{Dof_{sc}}$ **= 1 ,** $\boldsymbol{Dof_{tc}}$ **= 0.5**

9-for the quanton system despite having an constrained energy fields, it is dominated by the free energy field of the form ($\frac{\partial E}{\partial s}\ \frac{\partial E}{\partial t}$ **) since this energy term represents 2.5 degrees of freedom while the constrained type (**$\int E \quad ds \int E \quad dt$ **) constitutes 1.5 degrees of freedom of energy out of four**

$D_{sfn}\ \ D_{tfn}$ **(nonbinding)(in magnitude)=**$\frac{(D_{sf}\, D_{tf}\,)}{(D_{sc}\, D_{tc}\,)}$ **=** $\frac{c^2 c^{0.5}}{c \quad c^{0.5}}$ **= c (6-19)**

Net (nonbinding)free Dof =($\sum(\textbf{free Dof}) \ -\sum(\textbf{constrained Dof}) =$

= $\left(\boldsymbol{Dof_{sf}}\right) + \left(\boldsymbol{Dof_{tf}}\right) - (\boldsymbol{Dof_{sc}}) - (\boldsymbol{Dof_{tc}}\,)$ **= (2.5-1.5)=** $+\mathbf{1}$

10-for the quanton case the free energies ($E_{sf}\ E_{tf}$**) are said to have inflationary properties while constrained energies (** $E_{sc}\ E_{tc}$**) are said to be inertial in nature (since they resist inflationary effects**

20. Anti quanton evolution and its degrees of freedom

The anti quanton had evolved from free time varying energy (E_{tf}),

which was in part constrained in space and gave rise to the

constrained energy of the type $\int E \ \ ds$

1-as the time varying energy expands in space , a part of it had to

be constrained in the form of space varying energy field

$$a - \frac{\partial}{\partial t} (\frac{\partial E}{\partial t}) = \frac{\partial}{\partial t} (\frac{\partial E}{\partial t}) (\int \frac{\partial E}{\partial t} \ dt \ ) =(\frac{\partial E}{\partial t}) (E_s \ E_t) \qquad (1\text{-}20)$$

Expanding w.r.t time

$$b\text{-} \frac{\partial}{\partial t} ((\frac{\partial E}{\partial t}) (E_s \ E_t)) = \frac{\partial}{\partial t} (\frac{\partial E}{\partial t}) \int (E \ ) \, ds = (\frac{\partial E}{\partial t} \int E \ \ ds) \qquad (2\text{-}20)$$

Expanding further , a part of this energy had to be constrained by

variation in time while the space constrained field has to expand ,

thus $\int (\int E \ \ ds \ \frac{\partial E}{\partial t}) \, ds =$

$$(\int (\int E \ \ ds) \, ds \ \frac{\partial}{\partial t} (\frac{\partial E}{\partial t}))(\frac{\partial}{\partial s} (\int E \ \ ds) \int \left(\frac{\partial E}{\partial t}\right) dt \ )=(\int E \ ds \ \frac{\partial E}{\partial t})(E_s E_t) \ , \qquad (3\text{-}20)$$

then expanding again $\int (\int E \ ds \ \frac{\partial E}{\partial t}) \ (E_s E_t)) \, ds =$

$$(\int(\int E\ ds)\ ds\ \frac{\partial}{\partial t}(\frac{\partial E}{\partial t}))(\frac{\partial}{\partial s}(E)\ \int(E)\ dt)$$

$$+(\frac{\partial}{\partial s}(\int E\ ds)\int(\frac{\partial E}{\partial t})\ dt)(\int(E)\ ds\ \frac{\partial}{\partial t}\ (E\ ))\ =$$

$$(\int E_s\ ds\ \frac{\partial E}{\partial t})(\frac{\partial E}{\partial s}\int E_t\ dt) + (\int E\ \ ds\ \frac{\partial E}{\partial t})(E_s E_t) \qquad (4\text{-}20)$$

The first term is the anti quanton energy equation while the second term is the original unstable energy ,this is a recursive relationship that will continue until the exhausting of the unstable energy term

For the energy degrees of freedom inside anti quanton

4 simultaneous equations for four energy fields are

$\mathbf{Dof}_{sc} = 3\ \mathbf{Dof}_{sf}$, $\mathbf{Dof}_{tf} = 3\ \mathbf{Dof}_{tc}$

$\mathbf{Dof}_{sf} + \mathbf{Dof}_{sc} = 3$, $\mathbf{Dof}_{tf} + \mathbf{Dof}_{tc} = 1$,

By solving we get $\mathbf{Dof}_{sc} = 2.25$, $\mathbf{Dof}_{sf} = 0.75$

$\mathbf{Dof}_{tf} = 0.75$, $\mathbf{Dof}_{tc} = 0.25$

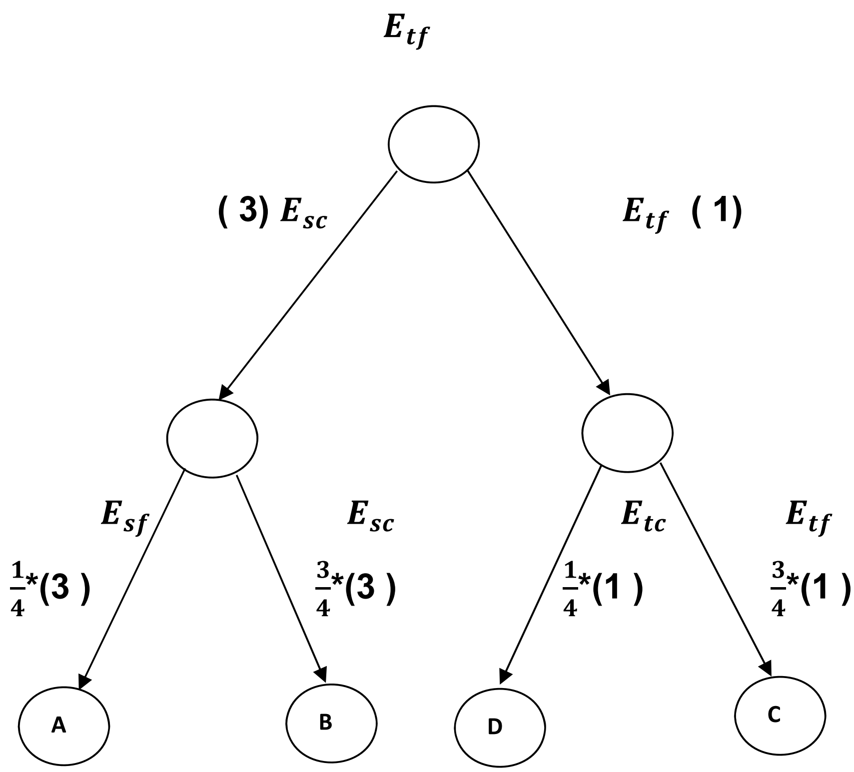


Fig (5).Tree diagram for the evolution and the degrees of freedom of anti quanton energy fields

as free and constrained energies inside the anti quanton create energy fields create binding interaction , a rearrangement of the Dof's in such a way that would ensure stability of this interaction by creating a symmetry between free and constrained space and time varying energy fields , the stable anti quanton Dof's are

$$\mathrm{Dof}_{sc} = 2.0 \quad , \quad \mathrm{Dof}_{sf} = 1.0$$

$$\mathrm{Dof}_{tf} = 0.50 \, , \quad \mathrm{Dof}_{tc} = 0.50$$

5-the dominant energy of the anti quanton system is constrained

D_{net} **(nonbinding)(in magnitude) =** $\frac{\text{constrained energy components}}{\text{free energy components}}$**=**

D_{scn} D_{tcn} **(nonbinding)(in magnitude)**$= \frac{(D_{tc}D_{sc})}{(D_{sf}D_{tf})} = \frac{c^2 c^{0.5}}{c \quad c^{0.5}} = \text{c}$

(nonbinding)constrained Dof = ($\sum(\text{constrained Dof})$

$-\sum(\text{free Dof})$ **=**$(Dof_{sc}) + (Dof_{tc}) - (Dof_{sf}) - (Dof_{tf})$

= (2.5-1.5)= $+1$

6-for the anti quanton the constrained energies (E_{sc} E_{tc}**) are said to have inflationary properties while free energies(** E_{sf} E_{tf}**) are said to be inertial in nature , which is the opposite to the case of the quanton**

So the inflationary , and inertial nature of the energy fields is subject to the parent structure which they exist in and which energy type is the dominant one

the anti quanton is a stable part of the space fabric with a

ratio of 25% (as it is originated from the expansion of the free

time varying energy (E_{tf}) , and this conclusion is based on the following points which we will discuss later

1-its role in the electromagnetic wave generation

(will be discussed in electromagnetic section)

2-its role in the formation of the negatively charged particles

(electrons , down quarks)

3-anti quanton is stable under expansion conditions

(no degeneration)

4-the interactions generated by anti quanton energy fields are symmetric to those of the quanton ,hence , it can not affect the space fabric homogeneity and integrity

21.Variation of quanton energy fields with time

Not only the nonbinding energy field $E_{sfn}\, E_{sfn}$ of the quanton (or $E_{scn}\;\; E_{scn}$ for anti quanton) which change with time as the quanton (or anti quanton) expands , but rather all the other energy fields , and this is so , to ensure the dimensional energy symmetry with respect to all axes

a-Variation of space varying energy with time

$$\frac{\partial E_{sf}}{\partial t} = \frac{\partial E_{sf}}{\partial x}\,\frac{\partial x}{\partial t} = c\,\frac{\partial E_{sf}}{\partial x}$$

$$\frac{\partial E_{sf}}{\partial x} = j\,k\,E_{sf}$$

$$\frac{\partial E_{sf}}{\partial t} = j\,kc\,E_{sf}$$

b- Variation time varying energy field with time

$$\frac{\partial E_{tf}}{\partial t} = j\,w\,E_{tf}$$

c-Relative rate of Variation between different energy fields

$$\frac{\partial E_{sf}}{\partial E_{tf}} = \frac{\partial E_{sf}}{\partial t}\,\frac{1}{\frac{\partial E_{tf}}{\partial t}} = (jkcE_{sf})\,\left(\frac{1}{j\,w\,E_{tf}}\right) = \frac{E_{sf}}{E_{tf}} = \frac{D_{sf}}{D_{tf}} \qquad (1\text{-}21)$$

and this means that the rate of change between any two energy fields is constant with time and equals the ratio between their degrees of freedom and this is due to dimensional energy symmetry inside the quanton

22.Why quanton does not achieve equilibrium

an alternative method of expressing dimensional energy symmetry Is to look at the relative parameter variation between energy fields , for wave behaviour terms

$$\frac{\partial \psi_{tf}}{\partial \psi_{sf}} = \left(\frac{\partial \psi_{tf}}{\partial t}\right)\left(\frac{1}{\frac{\partial x}{\partial t}}\right)\left(\frac{1}{\frac{\partial \psi_{sf}}{\partial x}}\right) \qquad \textbf{(1-22)}$$

given that $\psi_{tf} = e^{+j\omega t}$, $\frac{\partial \psi_{tf}}{\partial t} = j\omega \ \psi_{tf}$

$\psi_{sf} = e^{+jk(x+y+z)}$, $\frac{\partial \psi_{sf}}{\partial x} = jk \ \psi_{sf}$

$$\frac{\partial \psi_{tf}}{\partial \psi_{sf}} = \frac{1}{c}\frac{\omega}{k} = 1 = \text{constant} \ , \qquad \textbf{(2-22)}$$

While from before $\frac{\partial E_{tf}}{\partial t} = j\omega \ E_{tf}$, $\frac{\partial E_{sf}}{\partial x} = jk \ E_{sf}$

$\frac{\partial \mathrm{E}_{tf}}{\partial \mathrm{E}_{sf}} = \frac{1}{c}\frac{\omega}{k} \frac{\mathrm{E}_{tf}}{\mathrm{E}_{sf}} = \frac{\mathrm{E}_{tf}}{\mathrm{E}_{sf}} = \frac{D_{tf}}{D_{sf}}$, which means that (3-22)

1-the rate of variation of energy fields wave parameters with respect to each other = 1 = constant (same rate of variation for all energy fields)

2-relative rate of variation of energy fields is equal to the ratio between their degrees of freedom

The action of the dimensional energy symmetry is to try to rearrange the quanton Dof to satisfy the condition of the stability of field Interactions such that

$\mathrm{Dof}_{tf} = \mathrm{Dof}_{tc} = 0.5$

$\mathrm{Dof}_{sf} = \mathrm{Dof}_{sc} = 1.5$, $\mathrm{Dof}_{sf}\,\mathrm{Dof}_{tf} = \mathrm{Dof}_{sc}\,\mathrm{Dof}_{tc} = 2$

Under such conditions the quanton is in equilibrium ,no nonbinding energies to cause inflation or splitting ,

But this will not happen since the energy constraining mechanism manages only 25 % of the quanton energy , while the remaining

75% of the quanton's energy is involved in the expansion process.

to achieve actual equilibrium the constraining term must deal with

50 % or of the quanton total energy , which is only possible in

2 D space and (DES) has to work within the limits of inflationary

scenario in 3 dimensional space

once the quanton achieves the stable form $\mathbf{E}_q = \mathbf{E}_{sf}\mathbf{E}_{tf}\mathbf{E}_{sc}\mathbf{E}_{tc}$

There is no way of interchange of degrees of freedom between

Free and constrained energies

Instead , a rearrangement happens due to field interaction

between free and constrained energies which must reflect the

symmetry between bound free and constrained energy fields

23. Energy field parameters

while the energy degrees of freedom of the quanton E_q **are in**

terms of the wave parameters (k , ω , r_q **) , the energy degrees of**

freedom for the energy fields are in terms of the constant (c) as pointed out earlier , this is because the constant (c) is what determines the relationship between variation of energy in time and in space

The relationship between energy wave / packet behaviours can be summarized as follows

1 – quanton wave like behaviour is a reflection of the periodic behaviour of energy packet inside the quanton (variation in position and orientation)

2-Energy packet expresses its energy in the form of energy Fields and which symmetric in space and in time

3-this symmetry of packet energy expression reflects a deeper symmetry within the packet itself, which can be regarded as composed of spatial and temporal parts

as energy expands in the form of energy fields ,

In three dimensional space , the instantaneous field energy can be expressed as

packet energy E_p = $E_q * quanton\ volume$ = E_p = $\int E_q$ dv

And given minuscule volume of the quanton which allows us to assume energy density uniformity inside the quanton

$$E_q = \frac{E_p}{V_q} \quad (V_q = \frac{4}{3}\pi\ r_q{}^3),$$

the relationship between (λ) and r_q (and subsequently V_q)

is dependent on the nature of the quanton wave-like

the proposed model for such a wave suggests a relationship of the type $r_q = \frac{\pi}{k}$

$$V_q = \frac{4}{3}\pi\ (r_q)^3 = \frac{4}{3}\pi\,(\frac{\pi}{k})^3 = \frac{4\,\pi^4}{3\,(k)^3}$$

$$E_q = \frac{E_p}{V_q} = \frac{h\omega}{2\pi}\ \frac{1}{\frac{4}{3}\pi\, r_q{}^3} = \frac{3\,h\omega}{8\pi^2\, r_q{}^3}$$

$\frac{\pi^3}{{r_q}^3} = k^3 = \frac{\omega^3}{c^3}$, **then** $E_q = \frac{3\,h}{8\,\pi^5\,c^3}\ \omega^4$ **alternatively , (1-23)**

$\frac{E_q}{\omega^4} = \frac{3\,h}{8\ \pi^5\ c^3}$ **= constant ,**

$E_q = h_q\ \omega^4$ **= constant *** ω^4 **(2-23)**

While in terms of the wave parameter (k), the quanton energy density takes the form

$$E_q = \left(\frac{3\,h}{8\,\pi^5\,c^3}\right) k^4\, c^4 = \text{constant} * k^4\, c^4 \qquad \textbf{(3-23)}$$

ie , energy as it expands by variation in space and time , has four degrees of freedom, which can be used to define the various energy fields

$$E_q = \frac{3\,h}{8\,\pi^5\,c^3}\, k^4\, c^4 = \text{constant} * \left(\frac{\pi}{\lambda}\right)^4 c^4 = \frac{constant}{4\,D\ \ volume} * c^4 \qquad \textbf{(4-23)}$$

This relationship does not only expresses a volumetric relationship of energy density as it expands into a 4 D volume , but it expresses an energy density – degree of freedom relationship as it is in terms of the wave parameters (k ,ω , $\frac{1}{r_q}$**)**

the energy degrees of freedom which can be put as

$D_q = c^4$= $D_{sf}\, D_{sc}\, D_{tf}\, D_{tc}$ = the Dof parameter of energy fields

where D_{sf} = $c^{Dof_{sf}}$, D_{sc} = $c^{Dof_{sc}}$

D_{tf} = $c^{Dof_{tf}}$, D_{tc} = $c^{Dof_{tc}}$

also , the quantity $K_q{}^4 = (\frac{3\,h}{8\,\pi^5\,c^3}\; k^4)$ where

E_q = $\frac{3\,h}{8\,\pi^5\,c^3}\; k^4\, c^{\;4}$ = $K_q{}^4\;\; c^{\;4}$

can be put as $K_q{}^4 = h_q\, k^4$= $K_{sf}\, K_{sc}\, K_{tf}\, K_{tc}$: energy field

intensity parameters ,

where $K_{sf} = K_q = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\; k$

$K_{sc} = K_q = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\; k$, $K_{tf} = K_{tc} = K_q = \sqrt[4]{(\frac{3\,h}{8\,\pi^5\,c^3})}\; \frac{\omega}{c}$

it must be noted that while $\frac{E_q}{\omega^4}$ = $(\frac{3\,h}{8\,\pi^5\,c^3})$= h_q = constant ,

however , $\sqrt[4]{\frac{E_q}{\omega^4}}$ ≠ constant , and $\sqrt[4]{\frac{E_q}{k^4}}$ ≠ constant

the division of the field intensity parameter does not follow the energy degree of freedom but follows the division of energy types (free dominated and constrained dominated types) otherwise the Energy fields E_{sf} , E_{tc} or E_{sc} , E_{tf} could exist independently one can be drawn to think that the division of $K_q{}^4$ between various energy fields such that $K_{sf} = K_q{}^{Dof_{sf}} = K_q{}^2$, or $K_{tf} = K_q{}^{Dof_{tf}}$, but since there are no wave parameters in nature of The type k^2 or $\omega^{0.5}$ due to the symmetry of the wave behavior Which is previously defined as $\frac{\partial \psi_{tf}}{\partial \psi_{sf}} = \frac{1}{c}\frac{\omega}{k} = 1$ = constant

and $\frac{\partial E_{tf}}{\partial E_{sf}} = \frac{1}{c}\frac{\omega}{k}\frac{E_{tf}}{E_{sf}} = \frac{E_{tf}}{E_{sf}} = \frac{D_{tf}}{D_{sf}}$

Which leads to the result that $K_{sf} = K_{sc} = K_{tf} = K_{tc} = K_q$

Finally , we can write the energy fields themselves as

$$E_{sf} = E_{sfo}\ \psi_{sf} = K_q\ D_q{}^{Dof_{sf}}\ \psi_{sf} = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\ k\ c^2 \psi_{sf} = \sqrt[4]{\frac{3\,h}{8\,\pi\ c^3}}\ \frac{c^2}{r_q}\ \psi_{sf} \qquad (5\text{-}23)$$

$$E_{sc} = E_{sco}\ \psi_{sc}\ = K_q\ D_q^{Dof_{sc}}\ \psi_{sc}\ = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\ \mathrm{k}\ c\,\psi_{sc} = \sqrt[4]{\frac{3\,h}{8\,\pi\ c^3}}\ \frac{c}{r_q}\ \psi_{sf}$$

(6-23)

$$E_{tf} = E_{tfo}\ \psi_{tf}\ = K_q\ D_q^{Dof_{tf}}\ \psi_{tf} = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\ \frac{\omega}{c}\sqrt{c}\ \psi_{tf} = \sqrt[4]{\frac{3\,h}{8\,\pi\ c^3}}\ \frac{\sqrt{c}}{r_q}\ \psi_{tf}$$

(7-23)

$$E_{tc} = E_{tco}\ \psi_{sc}\ = K_q\ D_q^{Dof_{tc}}\ \psi_{tc} = \sqrt[4]{\frac{3\,h}{8\,\pi^5\,c^3}}\ \frac{\omega}{c}\sqrt{c}\ \psi_{tc} = \sqrt[4]{\frac{3\,h}{8\,\pi\ c^3}}\ \frac{\sqrt{c}}{r_q}\ \psi_{tc}$$

(8-23)

$$\frac{E_{tc}}{E_{sf}} = \frac{K_q\ D_q^{Dof_{tc}}\ \psi_{tc}}{K_q\ D_q^{Dof_{sf}}\ \psi_{sf}} = \frac{D_q^{Dof_{tc}}\ \psi_{tc}}{D_q^{Dof_{sf}}\ \psi_{sf}} = c^{1.5}\ \frac{\psi_{tc}}{\psi_{sf}}$$ **(9-23)**

So , through a constant value K_q for all energy fields which ensures that the relationship between the magnitudes of different fields depends only on the degrees of freedom of such fields and not on the intensity of such fields

in general a field energy can be seen as the product of two terms

field energy = field intensity (defined in terms of K_q and wave parameters) * field strength (D_q expressed in terms of energy degrees of freedom)

24.Dimensions of vector energy fields

While being a scalar quantity , energy as it expands in space , it becomes a vector quantity

individual energy field densities for each component in the form ($\frac{energy}{volume}$) do not exist , and that is due to the fact that quanton energy fields are inextricably linked to the quanton volume in a dependence relationship , that does not make it possible to determine the individual energy field densities inside the quanton and so, the energy fields must be defined in terms of the quanton dimensions , in addition to energy dimensions and degrees of freedom for each energy field

the quanton radius (r_q) and , its volume (V_q)are not constant but rather inversely proportional to its packet energy content , and consequently its energy fields

while V_q = fn($r_q{}^3$) = fn(λ^3) = fn($\frac{1}{\omega^3}$)

and E_q =E_{sf} E_{sc} $E_{tf}E_{tc}$ =$\left(\frac{3\,h}{8\,\pi^5\,c^3}\right)\omega^4$= constant *$\omega^4$

hence V_q= fn ($\frac{\omega}{E_{sf}\,E_{sc}\,E_{tf}E_{tc}}$) ie quanton volume is dependent on the

product of four energy field densities

product of individual energy field densities of the form

E_{sf} = $\frac{Dofsf\sqrt{E_p}}{V_q}$ does not represent quanton energy density E_q ,

since , under such form E_q would be equal to $\frac{E_p}{(V_q)^4}$

while if we consider the total energy density E_q to be the

summation of four energy field densities , this would be a

contradiction with the definition proposed for of the total energy

density to be the product of energy field densities , the only

remaining alternative is to define the individual energy fields in

terms of parameters (or alternatively quanton dimensions

under such conditions fractional dimensions of individual energy

fields are expected as follows

$$(E_{sf}) = [\sqrt[4]{(\frac{3\,h}{8\,\pi^5\,c^3})}\ \mathrm{k}\ c^2\ \ \psi_{sf}]$$

$$[E_{sf}] = M^{.25}\ L^{.5-.75-1+2}\ T^{-.25+.75-2} = M^{.25}\ L^{0.75}\ T^{-1.5} \qquad \textbf{(10-23)}$$

$$[E_{sc}] = [\sqrt[4]{(\frac{3\,h}{8\,\pi^5\,c^3})}\ \mathrm{k}\ c\ \ \ \psi_{sc}] = M^{.25}\ L^{-0.25}\ T^{-0.5}\ , \qquad \textbf{(11-23)}$$

$$[E_{tf}] = \left[E_{tf}\right] = [\sqrt[4]{\left(\frac{3\,h}{8\,\pi^5\,c^3}\right)}\ \frac{w}{c}\ \sqrt{c}\ \ \ \psi_{tc}] = M^{.25}\ L^{-0.75}\ T^{0.00} \qquad \textbf{(12-23)}$$

<u>25. relative field variation with time</u>

The idea of exponential degrees of freedom had been discussed previously , and it had been stressed that those energy degree of freedom in terms of the constant (c) is mechanism of the division of energy between various fields and not related directly to actual energy levels while the energy degree of freedom is the mechanism the division of energy density between the space and time varying energy fields ,so as to maintain a constant ratio between them , it does not determine the percentage share of

each energy field with respect to thee total quanton energy

for space varying energies value (in magnitude)

$$E_s = E_{sf}\ E_{sc} = (K_q\ \ c^{2})\ (K_q\ \ c\ ) = {K_q}^{2}\ \ c^{3}\ = \sqrt[2]{(\frac{3\ h\ c^{3}}{8\ \pi^{5}})}\ k^{2}$$

for time varying energies

$$E_t = E_{tf}\ E_{tc} = (K_q\ \ c^{0.5})\ (K_q\ \ c^{0.5}) = {K_q}^{2}\ \ c\ = \sqrt[2]{(\frac{3\ h}{8\ \pi^{5}\ c})}\ k^{2}$$

While the relative ratio between space and time varying energies

$\frac{E_{sf}\ E_{sc}}{E_{tf}\ E_{tc}}$ **= constant = c^{2} , the percentage distribution of the space**

and time energies does vary as the wave parameters change

very high values of (k , ω) (corresponding to primordial time)

the percentage share of the time varying energies was very high

as the universe expands , this percentage drops while the

percentage of the space varying energies increases comparatively

26. Directional sub-components

1-as free and constrained dominated energy fields vary in space and time , they generate free and constrained energy dominated wave-likes $E_{qf} = E_{sf}E_{tc}$, $E_{qc} = E_{sc}E_{tf}$ respectively

2- the quanton wave vector instead of representing a traveling Wave along a certain direction (along x- axis for example) as it is the case of electromagnetic waves) , here in the case of quanton , it represents variation of energy in space and time , as the energy fields are contained inside the quanton

3- energy varies in space (along x- axis for example) and in time at the rate of ω= $\frac{2\pi}{T}$, while variation of energy in space (along the quanton's diameter) where k= $\frac{\pi}{r_q}$

4-the quanton energy field is orthogonal to its wave vector (it is two dimensional , for example : in the (y-z) Plane as packets spin

around the quanton while varying in magnitude along x- direction

(quanton diameter)

5- quanton energy fields must be symmetrically expressed in three dimensional space , under this condition of dimensional energy symmetry , it is suggested that there are in fact three directional orthogonal (free energy dominated E_{qf}) waves and three orthogonal directional (constrained energy dominated E_{qc}) waves in (x, y, z) directions and not just one wave of each type

(since one three dimensional wave of each type will not satisfy the dimensional energy symmetry)

the free energy dominated wave which varies along x axis is

represented by $E_{qf}(x) = E_{qfo}(x) \; e^{j(\frac{\pi x}{r_q}-\omega t)} = \frac{E_{qfo}\, e^{j(\frac{\pi x}{r_q}-\omega t)}}{\sqrt{3}}$ **(1-26)**

where $E_{qfo} = \sqrt{(E_{qfo}(x))^2 + (E_{qfo}(y))^2 + (E_{qfo}(z))^2}$ **(2-26)**

$E_{qf}(x)$ **represents variation of free dominated energy orthogonal to the travel direction of the wave (in the y-z plane) , which represents variation of energy in space and time** k_x **x=** $\frac{\pi x}{r_q}$ **,**

the variation of field along x- axis and the subsequent variation of the orthogonal field in the (y-z plane representing $E_{qf}(x)$

Define the directional sub components for the wave $E_{qf}(x)$ **which are equivalent to the vector length in each direction**

$E_{qf}(x)$**=** E_{sfyz} E_{tc} **(sub component energies in y,z plane while propagating along x- direction)**

$$E_{sfy}(x)\ E_{tc} = \frac{(K_q D_{sf})(K_q D_{tc})}{\sqrt{2}\sqrt{3}}\ e^{j(\frac{\pi x}{r_q})}\ \sin(-\omega t) \qquad \textbf{(3-26)}$$

$$E_{sfz}(x)\ E_{tc} = \frac{(K_q D_{sf})(K_q D_{tc})}{\sqrt{2}\sqrt{3}}\ e^{j(\frac{\pi x}{r_q})}\ \cos(-\omega t)\ , \qquad \textbf{(4-26)}$$

$$E_{sfyz}\ (x) = \sqrt{{E_{sfy}}^2(x) + {E_{sfz}}^2(x)} \qquad \textbf{(5-26)}$$

$$E_{qf}(x) = E_{qfo}(x)\ e^{j(\frac{\pi x}{r_q})}\ e^{-j\omega t} = \frac{(K_q D_{sf})(K_q D_{tc})}{\sqrt{3}}\ e^{j((\frac{\pi x}{r_q})-\omega t)} \qquad \textbf{(6-26)}$$

where Φ = $\omega\, t$, the variation of the field in the (y- z) plane

can be seen as the source of the time varying behaviour

The variation of energy in space is linked to variation of energy in

time by the relations $k_x = \frac{2\,\pi}{\lambda} = \frac{\pi}{r_q}$, $\omega = \frac{2\,\pi}{T}$, $k_x\, \lambda = 2\,\pi = \omega\, T$,

$\frac{\omega}{k_x} = \frac{\lambda}{T} = c$, $\lambda = 2\, r_q$

as this wave like is stationary , it has no kinetic degrees of freedom

since when viewed from the point of reference (chosen to be the

centre of the quanton) ,

the sub components for the free space varying energy fields

$E_{sfx} = E_{sfx}\,(y) + E_{sfx}\,(z)$, $E_{sfy} = E_{sfy}\,(x) + E_{sfy}\,(z)$ **(7,8-26)**

$E_{sfz} = E_{sfz}\,(x) + E_{sfz}\,(y)$, $E_{sf} = \sqrt{E_{sfx}{}^2 + E_{sfy}{}^2 + E_{sfz}{}^2}$ **(9,10-26)**

$E_{tc} = K_{tc} D_{tc} = K_q\, D_{tc}$ **(11-26)**

$E_{qf}(x) = E_{qfo}\,(x)\; e^{j(\frac{\pi x}{r_q})}\; e^{-j\omega t} = \frac{K_q{}^2 D_{sf}\, D_{tc}}{\sqrt{3}}\; e^{j(\frac{\pi x}{r_q} - \omega t)}$ **(12-26)**

$$= \frac{1}{\sqrt{3}} \sqrt[2]{\left(\frac{3\,h}{8\,\pi^5\,c^3}\right)}\, k^2\ c^{2.5}\ e^{j((\frac{\pi x}{rq})-\omega\ t)}$$

and along the y direction

$$E_{qf}(y) = E_{qfo}\,(y)\ e^{j((\frac{\pi y}{rq})-\omega\ t)} = \frac{1}{\sqrt{3}}(\,K_q{}^2 D_{sf}\ D_{tc}\,)\ e^{j((\frac{\pi y}{rq})-\omega\ t)}$$

And along the z direction

$$E_{qf}(z) = E_{qfo}\,(z)\ e^{j((\frac{\pi z}{rq})-\omega\ t)} = \frac{1}{\sqrt{3}}(\,K_q{}^2 D_{sf}\ D_{tc})\ e^{j((\frac{\pi z}{rq})-\omega\ t)}$$

$$E_{qfo} = \sqrt{E_{qfo}\,(x)^2 + E_{qfo}\,(y)^2 + E_{qfo}\,(z)^2} = K_q{}^2 D_q{}^{2.5}$$

$$= \sqrt[2]{\left(\frac{3\,h}{8\,\pi^5\,c^3}\right)}\, k^2\ c^{2.5} = \sqrt[2]{\left(\frac{3\,h}{8\,\pi\ c^3}\right)}\ \ \frac{c^{2.5}}{r_q{}^2} \qquad \textbf{(13-26)}$$

for the constrained energy dominated waves , we can follow the similar approach to determine their sub components

$$E_{qc}(x) = E_{qco}(x) e^{-j(\left(\frac{\pi x}{r_q}\right)-\omega\ t)} = \frac{(K_q D_{sc}\,)(K_q D_{tf})}{\sqrt{3}}\ \ e^{-j(\left(\frac{\pi x}{r_q}\right)-\omega\ t)} \qquad \textbf{(14-26)}$$

$$E_{qc}(x) = E_{scyz}\,(\mathrm{x})\ \ E_{tf} \qquad \textbf{(15-26)}$$

$$E_{scy}(x)\ E_{tf} = \frac{(K_q D_{sc}\,)(K_q D_{tf})}{\sqrt{2}\sqrt{3}}\ \ e^{-j(\frac{\pi x}{r_q})}\ \ \sin(\,\omega t) \qquad \textbf{(16-26)}$$

$$E_{scz}(x)\ E_{tf} = \frac{(K_q D_{sc})(K_q D_{tf})}{\sqrt{2}\sqrt{3}}\ e^{-j(\frac{\pi x}{r_q})}\ \cos(\omega t)\ , \qquad (17\text{-}26)$$

$$E_{scyz}(x) = \sqrt{E_{scy}{}^2(x) + E_{scz}{}^2(x)} \qquad (18\text{-}26)$$

$$E_{sc} = \sqrt{E_{sc}(x)^2 + E_{sc}(y)^2 + E_{sc}(z)^2} = K_q D_{sc} \qquad (19\text{-}26)$$

$$E_{scx} = E_{scx}(y) + E_{scx}(z) \quad , \quad E_{scy} = E_{scy}(x) + E_{scy}(z) \qquad (20,21\text{-}26)$$

$$E_{scz} = E_{scz}(x) + E_{scz}(y) \quad , \quad E_{tf} = K_{tf} D_{tf} = K_q\, D_{tf} \qquad (21,22\text{-}26)$$

$$E_{qc}(x) = E_{qco}(x)\ e^{-j(\left(\frac{\pi x}{r_q}\right) - \omega\, t)} = \frac{K_q{}^2\, D_{sc} D_{tf}}{\sqrt{3}}\ e^{-j(\left(\frac{\pi x}{r_q}\right) - \omega\, t)} \qquad (23\text{-}26)$$

and along the y direction

$$E_{qc}(y) = E_{qco}(y)\ e^{-j(\left(\frac{\pi y}{r_q}\right) - \omega\, t)} = \frac{1}{\sqrt{3}}(K_q{}^2 D_{sc} D_{tf})\ e^{-j(\left(\frac{\pi y}{r_q}\right) - \omega\, t)}$$

And along the z direction

$$E_{qc}(z) = E_{qco}(z)\ e^{-j(\left(\frac{\pi z}{r_q}\right) - \omega\, t)} = \frac{1}{\sqrt{3}}(K_q{}^2 D_{sc} D_{tf})\ e^{-j(\left(\frac{\pi z}{r_q}\right) - \omega\, t)}$$

$$E_{qco} = \sqrt{E_{qco}(x)^2 + E_{qco}(y)^2 + E_{qco}(z)^2} = K_q{}^2 D_{sc} D_{tf} \qquad (24\text{-}26)$$

$$= \sqrt[2]{\frac{3\,h}{8\,\pi^5\ c^3}}\ k^2\ c^{1.5} = \sqrt[2]{\frac{3\,h}{8\,\pi\ c^3}}\ \frac{c^{1.5}}{r_q{}^2}$$

to note that 1-each free / constrained directional wave pair behaves as sub quanton with Dof= 4 , while the overall quanton energy content follows the square root rule of the three pairs

<u>26.b. why quanton waves do not leave the quanton ?</u>

1-Free and constrained energy dominated waves E_{qf} and E_{qc} are interacting through a- energy constraining

b- free / constrained energy fields interaction

this interaction creates a binding relationship that maintains the integrity of the quanton

2- any energy that leaves the quanton must be have four degrees of energy freedom (transmission of energy through space can only take place while varying energy in space and time)

under such a condition , no individual wave like can leave the quantton independently , instead , both waves can leave the

quanton conjointly in the form of electromagnetic waves

27.wave model inside the quanton

a model for the energy fields interaction inside the quanton takes

the form $E_{wf} = \frac{1}{2}(E_{qf} + c\, E_{qc})$, $E_{wc} = \frac{1}{2}(E_{qc} + \frac{1}{c} E_{qf})$ **(1-27)**

$$E_{wf} = \frac{1}{2}(D_{sf}D_{tc} + c\, D_{sc}D_{tf}) = \frac{1}{2} K_q{}^2 c^{2.5} \cos(\left(\frac{\pi x}{r_q}\right) - \omega\, t) \quad \textbf{(2-27)}$$

$$E_{wc} = \frac{1}{2}(D_{sc}D_{tf} + \frac{1}{c} D_{sf}D_{tc}) = \frac{1}{2} K_q{}^2 c^{1.5} \cos(\left(\frac{\pi x}{r_q}\right) - \omega\, t) \quad \textbf{(3-27)}$$

and for anti quanton $E_{wc} = \frac{1}{2}(E_{qc} + c\, E_{qf})$, $E_{wf} = \frac{1}{2}(E_{qf} + \frac{1}{c} E_{qc})$

(4-27)

$$E_{wc} = \frac{1}{2}(D_{sc}D_{tf} + c\, D_{sf}D_{tc}) = \frac{1}{2} c^{2.5} K_q{}^2 \cos(\left(\frac{\pi x}{r_q}\right) - \omega\, t) \quad \textbf{(5-27)}$$

$$E_{wf} = \frac{1}{2}(D_{sf}D_{tc} + \frac{1}{c} D_{sc}D_{tf}) = c^{1.5} K_q{}^2 \cos(\left(\frac{\pi x}{r_q}\right) - \omega\, t) \quad \textbf{(6-27)}$$

At first look $(E_{wf})_{quanton} = (E_{wc})_{anti\ quanton}$ **and**

$(E_{wc})_{quanton} = (E_{wf})_{anti\ quanton}$ **, so the quanton and might be seen**

To be identical however , they behave differently due to the

difference in interaction between free and constrained energy as

will be discussed in the section : space fabric interactions

28.Electromagnetic waves as space and time energy fields

The difference between quanton electromagnetic waves lie in the fact that electromagnetic waves propagate in linear directions, and consequently, one degree of space varying energy degrees freedom becomes a (kinetic degree of freedom) and as a result the free and the constrained waves have one half of Dof less each for the case of electromagnetic waves in comparison to quanton waves thermal (electromagnetic) energy is released from the quanton in the following 3 dimensional form

1-Propagation of electromagnetic energy long the x- direction

The formulation of electromagnetic waves in terms of energy fields Depends on the system of units

Under the (Esu) system U (volumetric electromagnetic energy density) = E^2 **=** $c^2\ B^2$

(ε)= 1 , $\mu = \frac{1}{c^2}$, under such system

electric and the magnetic fields are defined as follows

$$E_f(x) = \frac{E_{qf}(x)}{\sqrt{c}} = \frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} \quad , \quad B_c\ (x) = \frac{E_{qc}(x)}{\sqrt{c}} = \frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} \qquad \textbf{(1-28)}$$

where $E_f(x)$ is the electric field due to the free energy dominated

wave , $B_c(x)$ is the magnetic field due to the constrained energy

dominated wave which propagate along x- axis

given that cos(kx-ωt) = $\frac{1}{2}$ ($e^{j(kx-\omega t)}$ + $e^{-j(kx-\omega t)}$)

define the electromagnetic (sinusoidal waves) as $E\ (x)$, $B\ (x)$

$$E\ (x) = \frac{1}{2}(\ E_f(x) + c\ B_c(x)\ ) = \frac{1}{2}\left(\frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} + \sqrt{c}\ E_{scyz}(x)\ \ E_{tf}\ \right) \qquad \textbf{(2-28)}$$

$$B\ (x) = \frac{1}{2}(B_c(x) + \ \frac{1}{c}\ E_f(x)) = \frac{1}{2}\left(\frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} + \frac{1}{c}\ \frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}}\right) \qquad \textbf{(3-28)}$$

while for the case the circularly polarized electromagnetic wave

$$e^{j(kx-\omega t)} = \frac{1}{2}\ (\cos(kx-\omega t) + \sin(kx-\omega t)) \qquad \textbf{(4-28)}$$

$$\sin(kx-\omega t) = \cos(kx-\omega t+\frac{\pi}{2}) \qquad \textbf{(5-28)}$$

while for the (si) system of units

$$U= \frac{1}{2}\,\varepsilon_o\, E^2 = \frac{1}{2}\,\frac{1}{\mu_o}\, B^2$$

$$E_f(x) = \frac{E_{qf}(x)}{\sqrt{c}} = \frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} \quad , \quad B_c\,(x) = \frac{E_{qc}(x)}{\sqrt{c}} = \frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} \qquad (6\text{-}28)$$

define the electromagnetic (sinusoidal waves) as $E\,(x)$, $B\,(x)$

$$E\,(x) = \frac{1}{2}\,\frac{1}{\sqrt{\varepsilon_o}}\,(\,E_f(x) + c\,B_c(x)\,) = \frac{1}{2}\,\frac{1}{\sqrt{\varepsilon_o}}\,(\frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} + \sqrt{c}\,E_{scyz}(x)\ E_{tf}\,) \qquad (7\text{-}28)$$

$$E\,(x) = \frac{1}{2}\,(\frac{E_{qf}(x)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\,E_{qc}(x)}{\sqrt{\varepsilon_o}}) \qquad (8\text{-}28)$$

$$B\,(x) = \frac{1}{2}\,\frac{1}{\sqrt{\varepsilon_o}}\,(B_c(x) + \frac{1}{c}\,E_f(x)) = \frac{1}{2}\,\frac{1}{\sqrt{\varepsilon_o}}\,(\frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} + \frac{1}{c}\,\frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}}) \qquad (9\text{-}28)$$

$$B\,(x) = \frac{1}{2}\,(\frac{E_{qc}(x)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\,\frac{E_{qf}(x)}{\sqrt{c}}) \qquad (10\text{-}28)$$

And as a magnitude , E_o (x) =$(\sqrt{\frac{3\,h}{8\,\pi^5\ c^3}}\,)\ (k^2\ c^2)$ $(Dof = 2)$ (11-28)

B_o (x) =$(\sqrt{\frac{3\,h}{8\,\pi^5\ c^3}}\,)\ (k^2\ c\,)$ (Dof = one) (12-28)

2-Along the y- direction

$$E_f(y) = \frac{E_{qf}(y)}{\sqrt{c}} = \frac{E_{sfxz}(y)\ E_{tc}}{\sqrt{c}} \quad , \quad B_c\,(y) = \frac{E_{qc}(y)}{\sqrt{c}} = \frac{E_{scxz}(y)\ E_{tf}}{\sqrt{c}}$$

$$E(y) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(E_f(y) + c\, B_c(y) \right) = \frac{1}{2}\left(\frac{E_{qf}(y)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\, E_{qc}(y)}{\sqrt{\varepsilon_o}}\right)$$

$$B(y) = \frac{1}{2}\left(B_c(y) + \frac{1}{c} E_f(y)\right) = \frac{1}{2}\left(\frac{E_{qc}(y)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qf}(y)}{\sqrt{c}}\right)$$

3-Along the z- direction

$$E_f(z) = \frac{E_{qf}(z)}{\sqrt{c}} = \frac{E_{sfxy}(z)\ E_{tc}}{\sqrt{c}} \quad , B_c(z) = \frac{E_{qc}(z)}{\sqrt{c}} = \frac{E_{scxy}(z)\ E_{tf}}{\sqrt{c}}$$

$$E(z) = \frac{1}{2}\left(E_f(z) + c\, B_c(z) \right) = \frac{1}{2}\left(\frac{E_{qf}(z)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\, E_{qc}(z)}{\sqrt{\varepsilon_o}}\right)$$

$$B(z) = \frac{1}{2}\left(B_c(z) + \frac{1}{c} E_f(z)\right) = \frac{1}{2}\left(\frac{E_{qc}(z)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qf}(z)}{\sqrt{c}}\right)$$

For release of electromagnetic radiation from anti quanton

1-Along the x- direction

$$E_c(x) = \frac{E_{qc}(x)}{\sqrt{c}} = \frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} \quad , B_f(x) = \frac{E_{qf}(x)}{\sqrt{c}} = \frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} \qquad \text{(13-28)}$$

electromagnetic E (x) , $B(x)$ is defined as

$$E(x) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(E_c(x) + c\, B_f(x)\right) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}} + \sqrt{c}\ E_{sfyz}(x)\ E_{tc}\right)$$

(14-28)

$$E\,(x) = \frac{1}{2}\left(\frac{E_{qc}(x)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\,E_{qf}(x)}{\sqrt{\varepsilon_o}}\right) \quad (15\text{-}28)$$

$$B\,(x) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(B_f(x) + \frac{1}{c}E_c(x)\right) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sfyz}(x)\ E_{tc}}{\sqrt{c}} + \frac{1}{c}\frac{E_{scyz}(x)\ E_{tf}}{\sqrt{c}}\right) \quad (16\text{-}28)$$

$$B\,(x) = \frac{1}{2}\left(\frac{E_{qf}(x)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qc}(x)}{\sqrt{c}}\right) \quad (17\text{-}28)$$

2-Along the y- direction

$$E_c(y) = \frac{E_{qc}(y)}{\sqrt{c}} = \frac{E_{scxz}(y)\ E_{tf}}{\sqrt{c}} \quad , \quad B_f\,(y) = \frac{E_{qf}(y)}{\sqrt{c}} = \frac{E_{sfxz}(y)\ E_{tc}}{\sqrt{c}}$$

$$E\,(y) = \frac{1}{2}\left(E_c(y) + c\ B_f(y)\right) = \frac{1}{2}\left(\frac{E_{qc}(y)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\,E_{qf}(y)}{\sqrt{\varepsilon_o}}\right)$$

$$B(y) = \frac{1}{2}\left(B_f(y) + \frac{1}{c}E_c(y)\right) = \frac{1}{2}\left(\frac{E_{qf}(y)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qc}(y)}{\sqrt{c}}\right)$$

3-Along the z- direction

$$E_c(z) = \frac{E_{qc}(z)}{\sqrt{c}} = \frac{E_{scxy}(z)\ E_{tc}}{\sqrt{c}} \quad , \quad B_f(z) = \frac{E_{qf}(z)}{\sqrt{c}} = \frac{E_{sfxy}(z)\ E_{tc}}{\sqrt{c}}$$

$$E\,(z) = \frac{1}{2}\left(E_c(z) + c\ B_f(z)\right) = \frac{1}{2}\left(\frac{E_{qc}(z)}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\,E_{qf}(z)}{\sqrt{\varepsilon_o}}\right)$$

$$B\,(z) = \frac{1}{2}\left(B_f(z) + \frac{1}{c}E_c(z)\right) = \frac{1}{2}\left(\frac{E_{qf}(z)}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qc}(z)}{\sqrt{c}}\right)$$

To note that

1-as space and time varying energy leaves the quanton in the form of electromagnetic (radiation) energy , and since there is no energy field along the direction of the wave propagation , which translates into a kinetic degree of freedom which is subtracted from the free and constrained dominated wave Dof's ,in other words $Dof_{electric\,field}$ +$Dof_{magnetic\ field}$ + $Dof_{kinetic}$ = 3+1 = 4

2 -energy leaves the quanton in the form of an energy packet E =$E_s\ E_t$, and the expansion of this energy packet in space Is different from that inside the quanton

While energy expansion inside the quanton is in the form

$\frac{\partial}{\partial s}(E_s\ E_t) = E_q = E_{sf}\ E_{tf}\ E_{sc}\ E_{tc}$ **, while outside the quanton**

it takes the form E_q =$\frac{\partial}{\partial s}$ ($E_s\ E_t$)=c $\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\right)$ =c ($E\quad B$)

this means that as one degree of energy freedom became a kinetic

degree of freedom , and so the quanton instead of being stationary becomes relativistic quanton

4-electromagnetic waves leave quanton under two constraints

a-Integrity of the energy is maintained (no dispersion or 3 dimensional wave forms)

b-free and constrained energies (E_{qf} , E_{qc}) cannot leave the qunaton independently as the electromagnetic waves are the mechanism of transmission of energy through 3D space , they must be transmitted through space by having energy fields varying in space and time whose energy Dof = 4 (one of them a kinetic Dof) this is achieved by cross linking free and constrained energies of the form for sinusoidal waves

$E(x) = (E_f + c B_c)$, $B(x) = (B_c + \frac{1}{c} E_f)$

5- electromagnetic waves in the form

$E_q = \frac{1}{2}((E_{sf}\ E_{tc})(E_{sc}\ E_{tf})) = \frac{1}{2} c\ \varepsilon_o(E\ \ B$) can be seen as a relativistic

Two dimensional quanton , where one energy degree of freedom is

replaced by a kinetic energy degree of freedom as the waves are

formed ,

6-by definition $E_q = \frac{1}{2}\ \varepsilon_o$ c E B and given that

$E = \frac{1}{2} (E_f + c\ B_c) = \frac{1}{2} (\frac{E_{qf}}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}\ E_{qc}}{\sqrt{\varepsilon_o}})$

$B = \frac{1}{2}(B_c + \frac{1}{c} E_f = \frac{1}{2} (\frac{E_{qc}}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qf}}{\sqrt{c}})$, substituting for E_q

$E_q = \frac{1}{2}\ \varepsilon_o$ cEB $= c\ \frac{1}{2}(\frac{E_{qf}}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{c}\ \frac{E_{qc}}{\sqrt{\varepsilon_o}})\ \frac{1}{2}\ (\frac{E_{qc}}{\sqrt{\varepsilon_o}\sqrt{c}} + \sqrt{\mu_o}\ \frac{E_{qf}}{\sqrt{c}})$

$= c\ \ \varepsilon_o \frac{1}{2} (2\ \frac{E_{sf}E_{tc}}{\varepsilon_o\sqrt{c}} \frac{E_{sc}E_{tf}}{\sqrt{c}}) = \frac{1}{2} E_{sf}E_{tc}\ E_{sc}E_{tf} = E_q$

As it will be discussed later that free and constrained

($E_{qf}\ E_{qc}$) energy fields Interact to create a binding interaction ,

while similar fields (free/ free) or (constrained / constrained)

create a repulsive interaction ,it will be shown see that for the case

of electromagnetic waves that both the binding and the repulsive interactions are present at the same time

this repulsive interaction for the case of electromagnetic waves takes the form of thermal degradation and the following red shift

both energy constraining and (free /constrained) energy field interaction are present for the case of electromagnetic waves , so we should expect (according to the second law of thermodynamics) energy loss in the form of thermal degradation as the two dimensional quanton which has 3 Dof's expands (2+1 D space and time varying fields) and as a result the wave length of the traveling wave suffers a red shift (in addition to galactic recessional speeds)

<u>dimensional analysis ,</u>

based on free and constrained energy field dimensions , we can arrive at the dimensions of

the electric field [E] = $M^{+.5}\ L^{-.5}\ T^{-1}$

and the magnetic field [B] = $M^{+.5}\ L^{+1.5}\ T^{00.0}$

[U] = electromagnetic energy density = $[\frac{E}{V}]$ **=[** $\frac{1}{2}$ **ε** $E^2]$ **= M** $L^{-1}\ T^{-2}$

(ε : can be chosen according to a system of units to be = 1)

U= $\frac{1}{2}\ (E_f\ +\ \text{c}\ B_c)^{\ 2}$ **=** $\frac{1}{2}\ (\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\ + \sqrt{c}\ E_{sc}\ E_{tf})^{\ 2}$

[U] = $\frac{1}{2}(\sqrt{\frac{3\ h}{8\ \pi^5\ c^3}}\quad)^{\ 2}\ (k^2\ c^2))^{\ 2}$**= (** $\frac{3\ hkc}{8\ \pi^5}$ **)** k^3 **=[** $\frac{E}{V}] = $ **M** $L^{-1}\ T^{-2}$

For magnetic field

$[\frac{E}{V}]$ **=** $\frac{1}{2}\ \frac{B^2}{\mu}$ **= M** $L^{-1}\ T^{-2}$

[U]= $\frac{1}{2}\ c^2\ (B_c\ +\ \frac{1}{c}\ E_f)^{\ 2}$ **=** $\frac{1}{2}\ c^2(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\ + \frac{1}{c}\ \frac{E_{sf}\ E_{tc}}{\sqrt{c}})^{\ 2}$

(μ **: chosen according to a system of units to be =** $\frac{1}{c^2}$ **)**

U= $\frac{1}{2}\ c^2(\sqrt{\frac{3\ h}{8\ \pi^5\ c^3}}\ )^{\ 2}\ (k^2\ c\ ))^{\ 2}$ **=** $\frac{3\ hkc}{8\ \pi^5}\quad k^3$ **=[** $\frac{E}{V}] = $ **M** $L^{-1}\ T^{-2}$

	Dof_x (kinetic)	Dof_{yz}	Dof_t	*Total Dof*
E (x)	0.5	$E_{sfyz}(x)$=1.50	E_{tc}=0.5	*2.00*
B (x)	0.5	$E_{scyz}(x)$=0.50	E_{tf}=0.5	1.00
total	1.00	2.00	1.00	

How degrees of freedom of freedom are shared among the different energy fields for the case of electromagnetic waves

28.b. Differences between quanton and electromagnetic waves

	Quanton waves	electromagnetic
Kinetic degrees of freedom	none	one
Wave nature	represented by three pairs of free and constrained dominated orthogonal wave-likes	One pair of free and constrained energy dominated energy wave-likes
Dof_{sf} , Dof_{sc}	2, 1	1.5 , 0.5
Energy field dimensions	Three dimensional (3 pairs of two dimensional fields)	One pair of two dimensional fields (excluding propagation direction)
Energy field density	4-Dimensional	3D+relativistic Dof
Wave vector propagation	periodic only	Periodic +one directional translation
Viewed as	Static quanton	Relativistic two dimensional quanton

Comparison between quanton (free /constrained) waves and electromagnetic waves

29.Maxwell equations of energy fields

As energy variations in space and time creates dynamic fields, so

we can relate the four Maxwell equations for electromagnetism to

their original form for energy fields

we have defined the electromagnetic waves as the relativistic

expansion of an energy quantons / anti quantons that are

travelling through space at velocity (c) in the form

$$E = \frac{1}{2}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}}\right)_q + \left(\frac{\sqrt{c}\,E_{sc}\ E_{tf}}{\sqrt{\varepsilon_o}}\right)_q\right) \quad \text{or}$$

$$E = \frac{1}{2}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}}\right)_{aq} + \left(\frac{\sqrt{c}E_{sf}\ E_{tc}}{\sqrt{\varepsilon_o}}\right)_{aq}\right)$$

$$B = \frac{1}{2}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}}\right)_q + \left(\frac{\sqrt{\mu_o}\,E_{sf}\ E_{tc}}{\sqrt{c}}\right)_q\right) \quad \text{or}$$

$$B = \frac{1}{2}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}}\right)_{aq} + \left(\frac{\sqrt{\mu_o}E_{sc}\ E_{tf}}{\sqrt{c}}\right)_{aq}\right)$$

substituting in the four Maxwell equations with the constituent

energy fields corresponding to the electric and magnetic

fields

<u>1-Gauss law of electric field</u>

∇.E $= \frac{\varrho_c}{\varepsilon_o}$

ϱ_c : charge density

a-For quantons

∇.E $=\nabla.\ (\frac{1}{2}\left(\frac{E_{sf}\ \ E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}}\right)+\left(\frac{\sqrt{c}\,E_{sc}\ \ E_{tf}}{\sqrt{\varepsilon_o}}\right) =2\left(\frac{\varrho_c}{\varepsilon_o}\right)$ **(1-29)**

$E_{tc}\ \nabla.\ E_{sf}\ +\ c\ \ E_{tf}\ \nabla.\ E_{sc}=0$ **(for electromagnetic waves and space fabric case)**

Where $\nabla.\ E_{tf}=0$ **,** $\nabla.\ E_{tc}=0$ **(** E_{tf} , E_{tc} **are function of time only)**

Or $\nabla.\ E_{sf}=-\ c\ \frac{E_{tf}}{E_{tc}}\ \nabla.\ E_{sc}$ **(2-29)**

b-For anti quantons

$\frac{E_{tf}}{\sqrt{c}}\ \nabla.\ E_{sc}+\sqrt{c}\ E_{tc}\ \nabla.\ E_{sf}=\ 0$ **(3-29)**

Or $\nabla.\ E_{sc}=-\ c\ \frac{E_{tc}}{E_{tf}}\ \nabla.\ E_{sf}$ **(4-29)**

2-Gauss law of magnetic field

∇.B $=0$

a-For quantons

$$\frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}}\nabla.\ E_{sc} + \frac{\sqrt{\mu_o}\,E_{tc}}{\sqrt{c}}\ \nabla.E_{sf} = 0$$ **(for electromagnetic waves)**

(5-29)

$$\nabla.E_{sf} = -\frac{1}{\sqrt{\varepsilon_o\mu_o}}\frac{E_{tf}}{E_{tc}}\nabla.\ E_{sc} = -c\frac{E_{tf}}{E_{tc}}\nabla.\ E_{sc} \quad \textbf{(6-29)}$$

(same as Gauss law for electric field)

b-anti quantons

$$\frac{E_{tc}}{\sqrt{c}\sqrt{\varepsilon_o}}\ \nabla.\ E_{sf} + \frac{\sqrt{\mu_o}\ E_{tf}}{\sqrt{c}}\ \nabla.E_{sc} = 0$$ **(for electromagnetic waves)**

(7-29)

$$\nabla.E_{sc} = -\frac{1}{\sqrt{\varepsilon_o\mu_o}}\frac{E_{tc}}{E_{tf}}\nabla.\ E_{sf}$$ **(again same as Gauss law for electric field)**

(8-29)

3-farday's law for electric field

$$\nabla \times E = -\frac{\partial B}{\partial t}$$

a-For quantons

$$\nabla \mathrm{x} E = \nabla \mathrm{x}\ (E_{sf}\ \frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}})_q + \nabla \mathrm{x}(E_{sc}\ \frac{\sqrt{c}\ E_{tf}}{\sqrt{\varepsilon_o}})\ ) \quad \textbf{(9-29)}$$

$$=(\nabla \mathrm{x}\ E_{sf})\frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}} + \frac{\sqrt{c}}{\sqrt{\varepsilon_o}}\ E_{tf}\ (\nabla \mathrm{x} E_{sc}) \quad \textbf{(10-29)}$$

$$-\frac{\partial B}{\partial t} = -\frac{\partial}{\partial t}\ (E_{sc}\ \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}})_q = \frac{\partial}{\partial t}\ (E_{sf}\ \frac{\sqrt{\mu_o}\,E_{tc}}{\sqrt{c}}) \quad \textbf{(14-29)}$$

$$= -\frac{E_{sc}}{\sqrt{\varepsilon_o}\sqrt{c}}\frac{\partial E_{tf}}{\partial t} - \frac{\sqrt{\mu_o}\,E_{sf}}{\sqrt{c}}\frac{\partial E_{tc}}{\partial t}$$

We get $E_{tc} \nabla x\, E_{sf} = -\sqrt{\varepsilon_o\, \mu_o}\; E_{sf}\, \frac{\partial E_{tc}}{\partial t}$ **or**

$$\nabla x\, E_{sf} = -\frac{1}{c}\; \frac{E_{sf}}{E_{tc}}\, \frac{\partial E_{tc}}{\partial t}$$ **and** **(12-29)**

$$\nabla x\, E_{sc} = -\frac{1}{c}\frac{E_{sc}}{E_{tf}}\; \frac{\partial E_{tf}}{\partial t}$$ **(13-29)**

Where $\frac{\partial}{\partial t}\;(E_{sf}) = 0$ **,** $\frac{\partial}{\partial t}\;(E_{sc}) = 0$

(E_{sf} **,** E_{sc} **are function of space only)**

<u>b-For anti quantons</u>

$$\nabla xE = \nabla x\; ((E_{sc}\; \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}}) + (E_{sf}\; \frac{\sqrt{c}\, E_{tc}}{\sqrt{\varepsilon_o}}))$$

$$= \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}}\, \nabla x\, E_{sc} + \frac{\sqrt{c}\, E_{tc}}{\sqrt{\varepsilon_o}}\, \nabla x\, E_{sf}$$ **(14-29)**

$$-\frac{\partial B}{\partial t} = -\frac{\partial}{\partial t}\; ((E_{sf}\; \frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}}) + (E_{sc}\; \frac{\sqrt{\mu_o}\, E_{tf}}{\sqrt{c}}))$$

$$= -\frac{E_{sf}}{\sqrt{\varepsilon_o}\sqrt{c}}\frac{\partial E_{tc}}{\partial t} - \frac{\sqrt{\mu_o} E_{sc}}{\sqrt{c}}\frac{\partial E_{tf}}{\partial t}$$

We get $E_{tf}\, \nabla x\, E_{sc} = -\sqrt{\varepsilon_o \mu_o}\, E_{sc}\; \frac{\partial E_{tf}}{\partial t}$ **or**

$$\nabla x\, E_{sc} = -\frac{1}{c}\; \frac{E_{sc}}{E_{tf}}\, \frac{\partial E_{tf}}{\partial t}$$ **and** **(15-29)**

$$c\, E_{tc} \nabla x\, E_{sf} = -E_{sf}\, \frac{\partial E_{tc}}{\partial t}$$ or

$$\nabla x\, E_{sf} = -\frac{1}{c}\, \frac{E_{sf}}{E_{tc}}\, \frac{\partial E_{tc}}{\partial t} \qquad (16\text{-}29)$$

4-ampere's law for magnetic field

$$\nabla xB = \mu_o \left(j + \varepsilon_o \frac{\partial E}{\partial t} \right)$$

Where $\mu_o\, \varepsilon_o = \frac{1}{c^2}$

a-For quantons

$$\nabla xB = \nabla x \left(\left(E_{sc}\, \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}} \right) + \left(E_{sf}\, \frac{\sqrt{\mu_o}\, E_{tc}}{\sqrt{c}} \right) \right)$$

$$= \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}} \nabla x\, E_{sc} + \frac{\sqrt{\mu_o}\, E_{tc}}{\sqrt{c}}\, \nabla x\, E_{sf} \qquad (17\text{-}29)$$

$$\frac{1}{c^2} \frac{\partial E}{\partial t} = \frac{1}{c^2}\, \frac{\partial}{\partial t} \left(\left(E_{sf}\, \frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}} \right) + \left(E_{sc}\, \frac{\sqrt{c}\, E_{tf}}{\sqrt{\varepsilon_o}} \right) \right)$$

$$= \frac{1}{c^2} \left(\frac{E_{sf}}{\sqrt{\varepsilon_o}\sqrt{c}} \frac{\partial E_{tc}}{\partial t} + \frac{\sqrt{c}\, E_{sc}}{\sqrt{\varepsilon_o}} \frac{\partial E_{tf}}{\partial t} \right)$$

we get $\frac{\sqrt{\mu_o}\, E_{tc}}{\sqrt{c}}\, \nabla x\, E_{sf} = \frac{1}{c^2} \frac{E_{sf}}{\sqrt{\varepsilon_o}\sqrt{c}} \frac{\partial E_{tc}}{\partial t}$ or

$$\nabla x\, E_{sf} = \frac{1}{c}\, \frac{E_{sf}}{E_{tc}}\, \frac{\partial E_{tc}}{\partial t}$$ and (18-29)

$$\frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}} \nabla x\, E_{sc} = \frac{1}{c^2} \; \frac{\sqrt{c} E_{sc}}{\sqrt{\varepsilon_o}} \frac{\partial \; E_{tf}}{\partial t}$$ **or**

$$\nabla x\, E_{sc} \quad = \frac{1}{c} \quad \frac{E_{sc}}{E_{tf}} \; \frac{\partial\, E_{tf}}{\partial t} \qquad \textbf{(19-29)}$$

Which is the same results obtained from Faraday's law

of electric field without the minus sign

<u>b-For anti quantons</u>

$$\nabla xB = \nabla x \left(E_{sf} \; \frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}} \right) + \left(E_{sc} \; \frac{\sqrt{\mu_o}\, E_{tf}}{\sqrt{c}} \right)$$

$$= \frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}} \nabla x\, E_{sf} \; + \; \frac{\sqrt{\mu_o}\, E_{tf}}{\sqrt{c}} \nabla x\, E_{sc}$$

$$\mu_o \; \varepsilon_o \; \frac{\partial\, E}{\partial t} \; = \frac{1}{c^2} \; \frac{\partial}{\partial t} \left(\left(E_{sc} \; \frac{E_{tf}}{\sqrt{\varepsilon_o}\sqrt{c}} \right) \; + \left(E_{sf} \; \frac{\sqrt{c}\, E_{tc}}{\sqrt{\varepsilon_o}} \right) \right)$$

$$= \frac{1}{c^2} \; \frac{E_{sc}}{\sqrt{\varepsilon_o}\sqrt{c}} \frac{\partial \; E_{tf}}{\partial t} + \frac{1}{c^2} \; \frac{\sqrt{c}\, E_{sf}}{\sqrt{\varepsilon_o}} \frac{\partial \; E_{tc}}{\partial t}$$

We get $\frac{E_{tc}}{\sqrt{\varepsilon_o}\sqrt{c}} \nabla x\, E_{sf} = \frac{1}{c^2} \frac{\sqrt{c}\, E_{sf}}{\sqrt{\varepsilon_o}} \frac{\partial \; E_{tc}}{\partial t}$ **or**

$$\frac{\nabla x\, E_{sf}}{E_{sf}} = \frac{1}{c} \; \frac{E_{sf}}{E_{tc}} \frac{\partial \; E_{tc}}{\partial t}$$ **and** **(20-29)**

$$\frac{\sqrt{\mu_o}\, E_{tf}}{\sqrt{c}} \; \nabla x\, E_{sc} \; = \; \frac{1}{c^2} \frac{E_{sc}}{\sqrt{\varepsilon_o}\sqrt{c}} \frac{\partial \; E_{tf}}{\partial t}$$ **or**

$$\nabla \text{x E}_{sc} = \frac{1}{c} \frac{\text{E}_{sc}}{\text{E}_{tf}} \frac{\partial \text{ E}_{tf}}{\partial t} \qquad (21\text{-}29)$$

Again , the same results obtained from Faraday's law

of electric field without the minus sign ,<u>to summarize</u>

<u>a-Quantons case</u>

$$1\text{-}\nabla.\ \text{E}_{sf} = -c\frac{\text{E}_{tf}}{\text{E}_{tc}}\ \ \nabla.\text{E}_{sc} \qquad (22\text{-}29)$$

$$2\text{-}\ \nabla \text{x E}_{sf} = -\frac{1}{c} \frac{\text{E}_{sf}}{\text{E}_{tc}} \frac{\partial \text{ E}_{tc}}{\partial t} \qquad (23\text{-}29)$$

$$3\text{-}\ \nabla \text{x E}_{sc} = -\frac{1}{c} \frac{\text{E}_{sc}}{\text{E}_{tf}} \frac{\partial \text{ E}_{tf}}{\partial t} \qquad (24\text{-}29)$$

<u>For anti quantons</u>

$$1\text{-}\nabla.\ \text{E}_{sc} = -c\frac{\text{E}_{tc}}{\text{E}_{tf}}\ \ \nabla.\text{E}_{sf} \qquad (25\text{-}29)$$

$$2-\ \nabla \text{x E}_{sf} = -\frac{1}{c} \frac{\text{E}_{sf}}{\text{E}_{tc}} \frac{\partial \text{ E}_{tc}}{\partial t} \qquad (26\text{-}29)$$

$$3\text{-}\nabla \text{x E}_{sc} = -\frac{1}{c} \frac{\text{E}_{sc}}{\text{E}_{tf}} \frac{\partial \text{ E}_{tf}}{\partial t} \qquad (27\text{-}29)$$

It is worth noting that

1- the equations (2 , 3) can be put in the following form

$$-\frac{\partial\ E_{tf}}{\partial t}\ \frac{1}{\nabla x\ E_{sc}}\ \frac{E_{sc}}{E_{tf}} = c\ ,\quad -\frac{\partial\ E_{tc}}{\partial t}\ \frac{1}{\nabla x\ E_{sf}}\ \frac{E_{sf}}{E_{tc}} = c \qquad (28\text{-}29)$$

which is another expression for the energy degrees of freedom

2- Maxwell equations remain invariant under relativistic effects

30.Role of Maxwell equations in the evolution of the quanton
For the quanton case

1-the basic energies during the primordial time were in the form

E_{sf} , E_{tf} **(free energy that varies in space and free energy that varies in time)**

2-while there is nothing in theory that prevents free energies

E_{sf} ($and\ E_{tf}$) **from generating quanton (or anti quanton) energy system independently , after the formation of the quanton (anti quanton) , as had been discussed in the energy constraining section , given the minuscule scale and the enormity of the temperatures involved in the process , it is extremely hard to imagine that those two energies could not be enclosed into a**

single entity (pre- quanton , and pre -anti quanton),hence a more realistic approach is to suggest the coexistence of those two energies instead of the complete separation between them ,

In fact the two scenarios did coexist

a-quanton (or anti quanton) evolution through independent

E_{sf} ($or\ E_{tf}$)

b-quanton (anti quanton) evolution through coexistence of

Both E_{sf} and E_{tf} , here we will discuss the second scenario ,so the available types

a- (E_{sf} E_{tc}) - E_{sf} dominated and

b-(E_{sc} E_{tf}) - E_{tf} dominated

3-the ratio between space and time varying energies E_{sf} , E_{tf} energies is not equitable but governed by dimensional energy symmetry, which means that energy is split equally among

expanded dimensions , and this suggests a ratio of thee to one

Energy field type	Prevalence (Percentage of the total energy in the primordial universe)	Ratio of $E_{sf}\,E_{tc}$	Ratio of $E_{tf}E_{sc}$
E_{sf-}dominated (pre quanton)	75%	75%	25%
E_{tf-}dominated (pre anti quanton)	25%	25%	75%

4-as energy expands by varying in space E_{sf} , it creates a time varying field E_{tc} that interacts with the field of free space varying energy E_{sf} in a way that the rate of variation of E_{tc} would be equivalent to the curl of E_{sf} such that $\nabla \mathrm{x}\, E_{\,sf} = \frac{1}{c}\frac{E_{\,sf}}{E_{\,tc}}\frac{\partial\, E_{\,tc}}{\partial t}$

In other words the rate of variation of E_{tc} causes $E_{\,sf}$ to curl into The quanton (anti quanton) as it is formed hence , the energy Fields $E_{\,sf}\;E_{\,tc}$ are constrained into a quanton formation

5- the time varying energy E_{tf} creates a constrained space varying energy E_{sc} , while varying in time , the rate of variation of energy varying in time of E_{tf} induces the formation of a curl in the

constrained space varying field E_{sc} , ***such that***

∇x $E_{sc} = \frac{1}{c}\frac{E_{sc}}{E_{tf}}\frac{\partial E_{tf}}{\partial t}$, so that the energy fields E_{sf} , E_{tf} are

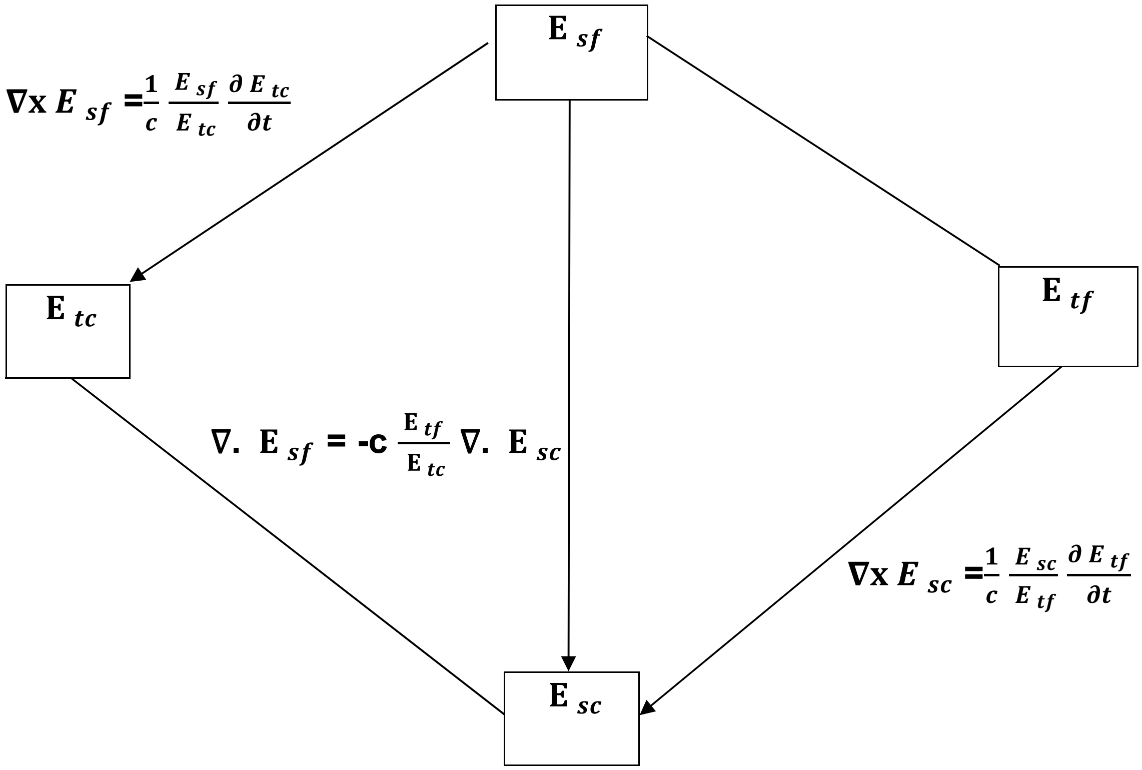
contained in the quanton (anti quanton) as it formed

6- as the free and constrained energy fields (E_{sf} E_{tc}), (E_{sf} E_{tc})

expand they are governed by the relationship

∇. E_{sf} = -c $\frac{\mathrm{E}_{tf}}{\mathrm{E}_{tc}}$ (∇. E_{sc}) for quantons and ∇. E_{sc} = -c $\frac{\mathrm{E}_{tc}}{\mathrm{E}_{tf}}$ (∇. E_{sf})

For anti quantons



Fig(7). Maxwell equations 's role in the evolution of the quanton

31.Lorentez transformation of energy fields

In the previous chapters we have discussed the concept of a relativistic quanton and how it is represented electromagnetic waves in the form of space and time varying fields

Here , the Lorentz transformation will be discussed , for the electromagnetic waves (this time in terms of the quanton Energy fields)

Considering the case when energy fields are seen by an observer traveling at relativistic speed along x axis

2-for Lorentz transformation of electromagnetic waves , and while denoting (') for the case of a moving frame of reference , the transformation takes the form

$E_x{}' = E_x$, $E_y{}' = \gamma\,(E_y + \beta c B_z)$

$E_z{}' = \gamma\,(E_z + \beta c B_y)$, $B_x{}' = B_x$

$B_y{}' = \gamma\,(B_y - \frac{v\,E_z}{c^2})$, $B_z{}' = \gamma\,(B_z - \frac{v\,E_y}{c^2})$

In this case the electric field is represented by the field $E_y(x)$ **and the magnetic field is represented by the field** B_z**(x)**

Using the same transformation for the case of free and constrained energy dominated system , where

$E = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\,(E_f + c\,B_c) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\,(\frac{E_{sf}\;E_{tc}}{\sqrt{c}} + c\,\frac{E_{sc}\;E_{tf}}{\sqrt{c}})$ **for quantons , or**

$E = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\,(E_c + c\,B_f) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\,(\frac{E_{sc}\;E_{tf}}{\sqrt{c}} + c\,\frac{E_{sf}\;E_{tc}}{\sqrt{c}})$ **for anti quantons**

$$B = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(B_c + \frac{1}{c}E_f\right) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}} + \frac{1}{c}\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)$$ **for quantons , or**

$$B = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(B_f + \frac{1}{c}E_c\right) = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}} + \frac{1}{c}\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)$$ **for anti quantons**

after substitution , we get for E and B

a- <u>For quantons</u>

$$E_y' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right) + c\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right) + v\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right) + \frac{v}{c}\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\right)$$

$$= \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\left(1 + \frac{v}{c}\right) + c\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\left(1 + \frac{v}{c}\right)\right)$$

$$E_y' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right) + c\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\right)\left(1 + \frac{v}{c}\right) = \sqrt{\frac{\left(1+\frac{v}{c}\right)}{\left(1-\frac{v}{c}\right)}}\ E_y \qquad (1\text{-}31)$$

Where $$\gamma\left(1 + \frac{v}{c}\right) = \frac{\sqrt{\left(1+\frac{v}{c}\right)}\sqrt{\left(1+\frac{v}{c}\right)}}{\sqrt{\left(1+\frac{v}{c}\right)}\sqrt{\left(1-\frac{v}{c}\right)}} = \sqrt{\frac{\left(1+\frac{v}{c}\right)}{\left(1-\frac{v}{c}\right)}} \qquad (2\text{-}31)$$

$$B_z' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right) + \frac{1}{c}\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\right) - \frac{v}{c^2}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right) + c\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\right)$$

$$B_z' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\left(1-\frac{v}{c}\right) + \frac{1}{c}\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\left(1-\frac{v}{c}\right) = \sqrt{\frac{\left(1-\frac{v}{c}\right)}{\left(1+\frac{v}{c}\right)}}\ B_z \qquad (3\text{-}31)$$

Where $\gamma\left(1-\frac{v}{c}\right)=\frac{\sqrt{\left(1-\frac{v}{c}\right)}\sqrt{\left(1-\frac{v}{c}\right)}}{\sqrt{\left(1+\frac{v}{c}\right)}\sqrt{\left(1-\frac{v}{c}\right)}}=\sqrt{\frac{\left(1-\frac{v}{c}\right)}{\left(1+\frac{v}{c}\right)}}$ **(4-31)**

b- For anti quantons

$$E_y{}' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)+c\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)+v\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)+\frac{v}{c}\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\right)$$

$$=\frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\left(1+\frac{v}{c}\right)+c\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\left(1+\frac{v}{c}\right)\right)$$

$$E_y{}' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)+c\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\right)\left(1+\frac{v}{c}\right) = \sqrt{\frac{\left(1+\frac{v}{c}\right)}{\left(1-\frac{v}{c}\right)}}\ E_y \quad \textbf{(5-31)}$$

$$B_z{}' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)+\frac{1}{c}\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)-\frac{v}{c^2}\left(\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)-c\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\right)\right)$$

$$B_z{}' = \frac{\gamma}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\left(\frac{E_{sf}\ E_{tc}}{\sqrt{c}}\right)\left(1-\frac{v}{c}\right)+\frac{1}{c}\left(\frac{E_{sc}\ E_{tf}}{\sqrt{c}}\right)\left(1-\frac{v}{c}\right)\right)=\sqrt{\frac{\left(1-\frac{v}{c}\right)}{\left(1+\frac{v}{c}\right)}}\ B_z \quad \textbf{(6-31)}$$

For a comoving frame of reference at v where $\beta=\frac{v}{c}$ and $\gamma=\frac{1}{\sqrt{1-\beta^2}}$

The energy fields themselves as viewed by moving observer

are $E' = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sf}{}'\ E_{tc}{}'}{\sqrt{c}}+c\ \frac{E_{sc}{}'\ E_{tf}{}'}{\sqrt{c}}\right) = \frac{1}{\sqrt{\varepsilon_o}}\sqrt{\frac{1+\beta}{1-\beta}}\ K_q{}^2\ c^2\cos(k'r'-\omega' t')$

$$B' = \frac{1}{2}\frac{1}{\sqrt{\varepsilon_o}}\left(\frac{E_{sc}{}'\ E_{tf}{}'}{\sqrt{c}}+\frac{1}{c}\ \frac{E_{sf}{}'\ E_{tc}{}'}{\sqrt{c}}\right) = \frac{1}{\sqrt{\varepsilon_o}}\sqrt{\frac{1-\beta}{1+\beta}}\ K_q{}^2\ c\ \cos(k'r'-\omega' t')$$

Where $k' = \sqrt{\frac{1-\beta}{1+\beta}}$ **k** , $r' = \sqrt{\frac{1-\beta}{1+\beta}}$ **r**

$\omega' = \sqrt{\frac{1-\beta}{1+\beta}}\ \omega$, $t' = \sqrt{\frac{1-\beta}{1+\beta}}\ t$

to note that the product $E_y{}'\ B_z{}'$ = $\sqrt{\frac{\left(1+\frac{v}{c}\right)}{\left(1-\frac{v}{c}\right)}}\ E_y\ \sqrt{\frac{\left(1+\frac{v}{c}\right)}{\left(1+\frac{v}{c}\right)}}\ B_z$

= $E_y\, B_z = constant$, **irrespective of the frame of reference**

32. some concepts behind space fabric

1-Dimensional energy symmetry (with respect to time and space variation of energy)

2- field interaction , no silent energy field , energy fields of different types (free / constrained) interact with other energy fields of different or similar nature to create a binding or repulsive interaction

3-Preservation of space fabric integrity (in the form of space fabric

Binding and retaining interactions)

4-energy fields are expressed at all the scales (energy fields are infinite in range)

33.Interactions of energy fields

1-Energy as it varies in space or time creates associated dynamic fields that exist inside as well as outside the quantons

2-the nature of the field and its interaction depends on the nature of the energy (free or constrained energy)

3- energy field interaction is according to following manner

a-Interaction of energy fields of similar type (free or constrained) is repulsive in nature

b-interaction energy fields of different type creates a binding interaction

4-an energy field can interact with another energy field only if they have the same field strength (they both have the same *Dof*'s)

(necessity condition)

5- same energy field can self interact to generate a repulsive reaction

6-energy fields are infinite in range of action but this range can still be divided into 3 main zones

a-inside quantons b- outside quantons :short range

c-outside quantons : long range

<u>34.Bound and nonbinding energies</u>

1-interaction between energy fields of different nature (free-constrained) generates a binding interaction and those energy fields which are involved in such an interaction are said to be bound energies , while energy fields that do not generate such interactions are said to be non-binding energies

2-for quantons free energy fields are split into two parts :

bound and nonbinding part or D_{sfb}, D_{sfn} , and the free energy fields now become E_{sf} = K_{sf} (D_{sfb} D_{sfn}), E_{tf} = K_{tf} (D_{tfb} D_{tfn}) as fields generated by free energy (E_{sfb} E_{tfb}) fully interact with fields generated by constrained energy (E_{sc} E_{tc}) in a binging interaction, for anti quanton case E_{sc} = K_{sc} (D_{scb} D_{scn}), E_{tc} = K_{tc} (D_{tcb} D_{tcn}) , and the binding interaction is between fields (E_{scb} E_{tcb})$_{binding}$ and (E_{sf} E_{tf})

3-Fields created by free and constrained energies are best described as having flux lines , and the number of those flux lines is not indefinite in number

4- nonbinding energy fields are due to their self-interaction

5-for the space fabric case , binding interaction expresses a state of equilibrium due to the symmetry interacting energy fields (equal in strength and intensity)

6- for an energy system to be under equilibrium , all its energy

fields must be tied in a binding relationships (with other energy fields) at all the scales

7-bound energy fields create binding interactions necessary for the integrity of the space fabric (later they will be called quanton binding (E_b) and retaining (E_t) interactions)

8-all remaining nonbinding energy fields and through the self interaction give rise to quanton inflation , splitting and on larger scale inflationary momentum

35. types Energy fields interaction

the interactions between different energy fields inside and around the quanton are not real energies or nor generate real forces , since the term energy and subsequent force is reserved only for four dimensional Dof's interactions , so we use the term interaction $(E_{ij\ binding})$ to describe the binding or interaction , between two

energy fields (E_{sfi}, E_{scj})while the dimensions of any interaction depend on its degrees of freedom

the interactions between energy fields (E_{sfi}) and (E_{scj}) be assessed as follows :

the binding interaction ($E_{ij\ binding}$) between two fields (eg E_{sfi} , E_{scj}) (represented by shared flux lines between the two fields) is proportional to the generated flux (φ$_{ij}$) between the two energy fields, the flux it self is proportional to the product of those two fields , and this is since

1-the generated interaction is proportional to the summation of energy degrees of freedom of both fields (proportional to the product of field strength of both fields -for example

$D_{ij-binding} = D_{sfi}\ D_{scj}$ **=** $c^{Dof_{sfi}+Dof_{scj}}$**)** **(1-34)**

2- the interaction must be proportional to the product of intensity of both fields as defined by the parameter K_q

(for example $K_{sfbi}K_{tfbi}\ K_{scj}\ K_{tcj}$= $K_q{}^4$)

3- the interaction must be related to true energy , so fractional dimensions of the energy fields intensities must always give a product which represents the real binding energy divided by degrees of freedom in other words interactions must be always in terms of $K_q{}^4$ (equivalent for example to $K_{ij\ binding} = (K_{sf}\ K_{tf}$) $(K_{sc}\ K_{tc}) = K_q{}^4$) as the term $K_q{}^4$ represents an energy density divided by c^4

, the binding relationship for the case of two fields

$$E_{ij\ binding} = \alpha_{ij}\ \frac{\varphi_{ij}}{(\Delta r_{ij})} = \alpha_{ij}\ \frac{(K_{sfi}\ K_{scj})\ (D_{sfi}D_{scj})}{(\Delta r_{ij})} = \alpha_{ij}\ \frac{(E_{sfi}E_{scj})}{(\Delta r_{ij})} \qquad \textbf{(2-34)}$$

α_{ij} : parameter of proportionality , Δr_{ij} : effective distance between Two fields

while E_{sfi} was defined as equal to $K_{sfi}\ D_{sfi}$ (which expresses the energy field as the product of its strength (Dof) and intensity

(in terms of its wave parameters) , the binding interaction can be

put as $E_{ij\ binding}$ = $\alpha_{ij} \frac{\varphi_{ij}}{(\Delta r_{ij})}$ = α_{ij} $(\frac{E_i\ E_j}{(\Delta r_{ij})})$

the dimensions of such an interaction would be $\frac{Energy}{c^{4-(Dof_{total})}\ (\ 3D\ volume\ )}$

where Dof_{total} = Dof_{free} + $Dof_{constrained}$

so only interactions which have four degrees of freedom are

able of generating a binding that has the true dimensions of energy

density, it is noted that stable interactions result in the

cancellation of the wave behaviour

35.a.Simple and complex energy fields interactions

1- energies tend to form higher order interactions whenever

possible (multiple field interactions) (this is true up to *Dof* = 4)

2- hyper interactions (summation of Dof of constituent energies

greater than 4) are inhibited inside and outside quanton

for real interactions , Dofs must be equal or less than 4 weather

it is a simple or complex interaction

(in real spaces only real interactions can be generated)

35.b.interactions due to complex single fields

Interaction between two energy fields which are different in nature (free – constrained) is a simple binding interaction of the type $E_{ij\ binding} = \alpha_{ij} \frac{E_{sfbi}\ E_{scj}}{(\Delta r_{ij})}$

however , when there are more than one energy fields of the same type (free /constrained) inside the quanton , in this case a resultant complex field is generated which has *Dof* equivalent to the summation of Dof's of originating energy fields , an interaction as $E_{ij\ binding} = \alpha_{ij} \ (E_{sfbi}\ E_{tfbi})\ (E_{scj} E_{tcj})\ \frac{1}{(\Delta r_{ij})}$

where the free energy fields (space and time varying) were united to form a single complex energy field of the type $(E_{sfb}\ E_{tfb})$ **and constrained energies** $(E_{sc} E_{tc})$ **form a constrained complex energy field where the degrees of freedom are the same for both type of**

fields Dof_{sfb} +Dof_{tfb} = Dof_{sc} +Dof_{tc}= 1.5 , while the Dof of the binding interaction $Dof_{binding}$ is three

this is based on the conclusion made in the section : bridging the gap between physics and mathematics in energy constraining , where space and time varying energy fields of the same nature (free or constrained) behaved as a one variable

35.c.Multiple simple interactions

as pointed out before , simpler interactions can combine to form a single interaction with higher degrees of freedom (up to 4)

so ,complex field interactions are generated as a result of two simple binding interactions of the type ($E_{sfbi}\ E_{scbj}$) that can combine with another simple interaction ($E_{scbi}\ E_{sfbj}$) to form a complex one of the type $E_{ij\,binding}= \alpha_{ij}\ (E_{sfi}\ E_{sci})(E_{sfj}\ E_{scj})\ \frac{1}{(\Delta r_{ij})}$

which is the case of gravitation

<u>35.d.</u> <u>simple and complex nonbinding (repulsive) interactions</u>

while inside the quanton , the nonbinding energy E_{sfn} (or E_{scn}) for the case of anti quanton) generates field that is self interacting this self interaction gives rise to only simple repulsive interactions inside the quanton , while outside the quanton (anti quanton) the generated self interacting field can be involved in a repulsive interaction as well with either

1-a simple energy field of the same nature (free or constrained)

2-another complex self-interacting field again of the same nature and the generated interaction would always be a repulsive one , as this energy field cannot create a binding interaction with another field with opposing type due to this repulsive self interaction $E_{Ri\,j}$ = $\alpha_{ij}\sqrt{E_{sfni}E_{tfni}}\;\sqrt{E_{sfni}E_{tfni}}\;\frac{1}{(r_{qi})}$

$$=\alpha_{ij}\left(K_q{}^2\sqrt{D_{sfni}D_{tfni}}\right)\left(K_q{}^2\sqrt{D_{sfni}D_{tfni}}\right)\frac{1}{(r_{qi})}$$

$= \alpha_{ij}(K_q{}^4 \; D_{scni} \;) \; \frac{1}{(r_{qi})}$

and once outside the quanton , the fields behave as complex ones

so , they must interact with another field (simple or complex) of

the same energy nature to generate a nonbinding (repulsive)

interaction in both cases

while outside the quanton , complex repulsive interactions take

the form $E_{ij\,R} = \alpha_{ij} \; E_{sfni} \, E_{sfnj} \, \frac{1}{(\Delta r_{ij})}$

36. Space fabric energy fields interactions

36.a-inside quantons

36.a.1The quanton retaining interaction (E_t) (complex binding)

the free and constrained energy fields interact with the energy of

an opposite nature inside the quanton to create the quanton

retaining interaction (E_t)

This is interaction is between (the bound part) of the free

energy field $(E_{sfb}E_{tfb})$ and constrained energy field $(E_{sc}E_{tc})$

the bound part of the free energy that participates in this interaction which has to have the same degrees of freedom as constrained fields (due to the symmetry of Dof's the interaction) and is expressed as

$E_{sf}E_{tf} = (K_{sf}K_{tf})(D_{sfb}D_{tfb})\quad(D_{sfn}D_{tfn})$

$(D_{sf}D_{tf})_{bound} = (D_{sfb}D_{tfb}) = D_{sc}D_{tc}$ **or**

$(D_{sfb}\,D_{tfb}) = (c)(c^{0.5}) = (c^{1.50})$

$(D_{sfn}D_{tfn}) = \frac{E_{sf}E_{tf}}{E_{sc}E_{tc}} = \frac{K_q{}^2\,D_{sf}D_{tf}}{K_q{}^2 D_{sc}D_{tc}} = \frac{D_{sf}D_{tf}}{D_{sc}D_{tc}} = \frac{c^{2.50}}{c^{1.50}} = c$

the generated binding is the retaining interaction (E_t) that maintains the quanton's integrity and prevents it from disintegration, the retaining interaction (E_t) is binding energy type since it is developed between two fields of different nature this interaction takes the following form for a single quanton (q)

$(E_t)_q = \alpha_t\ (E_{sf}E_{tf})_{bound}\,(E_{sc}E_{tc})$ **(1-36)**

= α_t $(K_q{}^2(D_{sfb}\, D_{tfb}\ )$ $(K_q{}^2(D_{sc}D_{tc}\ )$

$$(E_t\,)_q = \alpha_t\ K_q{}^4\ \ c^3 \ = \frac{3\alpha_t h\, k^4}{8\pi^5} = \frac{3\alpha_t h}{8\pi\, r_q{}^4} \qquad \textbf{(2-36)}$$

Where the term $(E_{sf}E_{tf})_{\ bound}$ represents the magnitude of

bound part of the free energy $(E_{sf}E_{tf})$ that interacts with

constrained energy $(E_{sc}E_{tc}\,)$, (r_q) is the quanton radius

α_t : retaining interaction parameter (< 1)

while for anti quanton case the retaining interaction would be

$$(E_t\,)_{aq} = \alpha_t\ (E_{sc}\, E_{tc}\ \ )_{bound}\ (E_{sf}E_{tf}\ ) = \qquad \textbf{(3-36)}$$

$$= \alpha_t\ (K_q{}^2\ \ (D_{scb}\, D_{tcb}\ \ )\ \ \ (K_q{}^2(D_{sf}\, D_{tf}\ \ )$$

$$(E_t\,)_{aq} = \alpha_t\ K_q{}^4\ \ c^3 \ = \frac{3\alpha_t h}{8\,\pi\, r_q{}^4} \qquad \textbf{(4-36)}$$

as for the dimensions of such a energy-like interaction , which has

three Dof's , it should be $[\frac{energy}{volume*c}]$= M $L^{-2}\ T^{-1}$

The same results for the retaining interaction can be obtained

directly from the quanton wave-likes

$E_{wf} = \frac{1}{2}(E_{qf}$ **+ c** $E_{qc})$, $E_{wc} = \frac{1}{2}(E_{qc}$ **+** $\frac{1}{c} E_{qf})$

The interaction between E_{wf} **,** E_{wc} **is in the form** E_q **=** $E_{wf}\, E_{wc}$ **or**

E_q**=** $\frac{1}{2}(E_{qf}$ **+ c** $E_{qc})$ $\frac{1}{2}(E_{qc}$ **+** $\frac{1}{c} E_{qf})$

= $(\frac{1}{2}E_{qf})(\frac{1}{2} E_{qc})$ **+** $(\frac{1}{2c}E_{qf})(\frac{1}{2}\, cE_{qc})$ **=** $\frac{1}{2}$ $E_{qf}E_{qc}$ **(5-36)**

= $\frac{1}{2}\,(E_{sf}E_{tf})$ $(E_{sc}E_{tc})$ **=** $\frac{1}{2}$ $(E_{sf}E_{tf})$ $(E_{sc}E_{tc})$ **as before , for**

Anti quanton case $E_{wc} = \frac{1}{2}(E_{qc}$ **+ c** $E_{qf})$, $E_{wf} = \frac{1}{2}(E_{qf}$ **+** $\frac{1}{c} E_{qc})$

E_{aq}**=** $\frac{1}{2}(E_{qc}$ **+ c** $E_{qf})$ $\frac{1}{2}(E_{qf}$ **+** $\frac{1}{c} E_{qc})$ **(6-36)**

= $(\frac{1}{2}E_{qc})(\frac{1}{2} E_{qf})$ **+** $(\frac{1}{2c}E_{qc})(\frac{1}{2}\, cE_{qf})$ **=** $\frac{1}{2}$ $E_{qf}E_{qc}$ **(7-36)**

= $\frac{1}{2}\,(E_{sf}E_{tc})$ $(E_{sc}E_{tf})$ **=** $\frac{1}{2}$ $(E_{sf}E_{tf})$ $(E_{sc}E_{tc})$

It should be noted that

1-the interaction took place between energy fields of two different

Wave-likes $(E_{qf}$ **or** $E_{qc})$ **and no such an interaction can take place**

between fields within the same wave-like (no self-interaction)

2- the interaction between wave likes DID NOT take the form

$E_q = \frac{1}{2}(E_{qf} + c\, E_{qc}) \ \frac{1}{2}(E_{qc} + \frac{1}{c} E_{qf})$

$= \frac{1}{4\,c} {E_{qf}}^2 + \frac{1}{4} c\, {E_{qc}}^2 + \frac{1}{2} E_{qf}\, E_{qc}$

since the interaction terms $\frac{1}{c} {E_{qf}}^2$, $c\, {E_{qc}}^2$ generate binding degrees of freedom equivalent to 50 % total Dof's , while the interaction term $E_{qf}\, E_{qc}$ generates binding energy which forms 75 % of all Dof's , so as it will be discussed latter , the binding interaction ($E_{qf}\, E_{qc}$)which is more stable takes precedence over less stable repulsive dominated interactions $\frac{1}{c} {E_{qf}}^2$, and $c\, {E_{qc}}^2$

3- for both quanton and anti quanton case

$E_q = E_{aq} = \frac{1}{2} (E_{sf} E_{tf})\ (E_{sc} E_{tc})$, which seem to be identical , but the inflationary energy in case of the quanton is generated by the free energy field $(E_{sf} E_{tf})_{non\, binding}$ self-interaction , while for the anti quanton case the same interaction is generated by the

constrained energy fields $(E_{sc}E_{tc})$ $_{non\ binding}$

4-the same analysis and conclusions apply to the case of the

electromagnetic waves where electromagnetic energy

density E_q= cEB $= c\ \frac{1}{2}(\ \frac{E_{qf}}{\sqrt{c}} + c\,\frac{E_{qc}}{\sqrt{c}})\ \frac{1}{2}\ (\ \frac{E_{qc}}{\sqrt{c}} + \frac{1}{c}\,\frac{E_{qf}}{\sqrt{c}})$

$$= c\ \frac{1}{2}(\ 2\ \frac{E_{sf}E_{tc}}{\sqrt{c}}\ \frac{E_{sc}E_{tf}}{\sqrt{c}}\ ) \ = \frac{1}{2}\,E_{sf}E_{tc}\ E_{sc}E_{tf}\ = \ E_q \qquad (8\text{-}36)$$

36.a.2.quanton inflationary interaction (E_i)
Type : simple nonbinding(repulsive)

Inflationary interaction can be thought of as the result of the

remaining part (nonbinding part) of free energy which is not

involved in the interactions that generate the retaining interaction

(E_t), which is interacting with itself

as a result of this interaction is the appearance of a repulsive

interaction (E_i) that causes quanton to expand ,

the generated quanton inflationary interaction would be in the form

$$(E_i)_q = \alpha_i \left(\sqrt{(E_{sf}\, E_{tf})_{\ nonbinding}} \right)^2 \quad \textbf{(9-36)}$$

$$= \alpha_i \left(K_q{}^2 \sqrt{(D_{sfn}\, D_{tfn})} \right) \quad \left(K_q{}^2 \sqrt{(D_{sfn}\, D_{tfn})} \right)$$

$$(E_i)_q = \alpha_i \ K_q{}^4 \ c \quad = \frac{3\alpha_i h}{8\,\pi\, c^2 r_q{}^4} \quad \textbf{(10-36)}$$

α_i **: inflationary interaction parameter**

the inflationary interaction is at the origin of inflation of quanton and subsequent division , which is a synonym with space fabric expansion , this self-interaction can be thought of as field of energy field of magnitude $\sqrt{\frac{(E_{sf}\, E_{tf})}{(E_{sc}\, E_{tc})}}$ **(=** $\sqrt{(E_{sf} E_{tf})_{\ nonbinding}}$ **) interacting with another energy field of similar magnitude creating the repulsive interaction**

the dimensions of such a energy-like interaction , which has one Dof , it should be [$\frac{energy}{volume * c^3}$ **] = M** $L^{-4}\ T^{+1}$

While for the case of anti quanton , the inflationary energy

$$(E_i)_{aq} = \alpha_i \; \left(\sqrt{(E_{sc}\, E_{tc})_{\;nonbinding}}\right) \quad \sqrt{(E_{sc}\, E_{tc})_{\;nonbinding}} \qquad \textbf{(11-36)}$$

$$= \alpha_i \;\; \left({K_q}^2 \sqrt{(D_{scb}\, D_{tcb})}\,\right)^2 \;\; {K_q}^2 \sqrt{(D_{scb}\, D_{tcb})}\;)$$

$$(E_i)_{aq} = \alpha_i \; {K_q}^4 \; c \quad = \quad \frac{3\alpha_i h}{8\,\pi\, c^2 {r_q}^4} \qquad \textbf{(12-36)}$$

36.b-outside quanton

36.b.1-Space fabric binding interaction (E_b)

Type : complex binding

as energy fields are not limited in range to inside the quanton , the fields of the free energy outside the quanton interact with the fields of the constrained energies of other quantons to generate the binding interaction (E_b) and vice versa

the generated binding interaction (E_b) that is responsible maintaining the space fabric integrity , it is represented by two contributions due to quantons and anti quantons ,

where $(E_{bi})_q$ **is the binding interaction developed between the quanton (** q_i) **and other quantons (** q_j) **and anti quatons** ($aq_{\,j}$) **,**

a-For the quantons case

$$E_{bfi} = E_b(E_{sfbi}E_{tfbi})_q = \alpha_b(((E_{sfi}E_{tfi})_{q-bound} \sum_j^n (E_{scj}E_{tcj})_q) (\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)})$$

$$+((E_{sfi}E_{tfi})_{q-bound} \sum_j^n (E_{scj}E_{tcj})_{aq-bound}))) (\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)})$$

(13-36)

$$= \alpha_b (K_q{}^2((D_{sfbi}D_{tfbi})_q \sum_j^n K_q{}^2 (D_{scj}D_{tcj})_q) ((\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)})) +$$

$$K_q{}^2(D_{sfbi}D_{tfbi})_q \sum_j^n K_q{}^2 (D_{scbj}D_{tcbj})_{aq} (\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}))$$

$$E_{bfi} = \alpha_b K_q{}^4 c^3 (\sum_j^n (\frac{r_q}{(r_i - r_j)_{q-q}}) + (\sum_j^n \frac{r_q}{(r_i - r_j)_{q-aq}}))$$

$$= \frac{\alpha_b h}{2} \frac{1}{\frac{4}{3}\pi r_q{}^3} (\sum_j^n (\frac{1}{(r_i - r_j)_{q-q}}) + (\sum_j^n \frac{1}{(r_i - r_j)_{q-aq}}))$$ **(14-36)**

Where the term $(D_{sfbi}D_{tfbi})_q$) **represents the magnitude of bound part of the free energy** ($E_{sf}E_{tf}$) **that interacts with constrained energy** $(E_{sc}E_{tc})$ **,** $(r_i - r_j)$ **: the distance between quantons (** q_i) **and (** q_j) **or anti quantons (** aq_j) **, (i≠j) ,**

α_b : binding interaction parameter

while the binding interaction due to the energy constrained field

E_{sc} E_{tc} will be in the form

$$E_{bci} = E_{bi}\,(E_{sci}E_{tci})_q = \alpha_b\,(((E_{sci}E_{tci})_q\ \sum_j^n\ (E_{sfj}E_{tfj})_{q-bound}\ )\ (\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)})$$

$$+ (E_{sci}E_{tci})_q\ (E_{sfj}E_{tfj})_{aq}\ )\ (\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}) \qquad \textbf{(15-36)}$$

$$= \alpha_b\, K_q{}^4(\,(D_{sci}D_{tci})_q\ \sum_j^n\ (D_{sfbj}D_{tfbj})_q\ )\ (\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)})\ +$$

$$K_q{}^4\,(D_{sci}D_{tci})_{\,q}\ \sum_j^n\ (D_{sfj}D_{tfj})_{\,aq}\ (\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)})\,)$$

$$= \alpha_b\, K_q{}^4 c^3\,(\sum_j^n\ (\frac{r_q}{(r_i-r_j)_{\,q-q}}\ ) + (\sum_j^n\ \frac{r_q}{(r_i-r_j)_{\,q-aq}}\,)$$

$$E_{bci} = \frac{\alpha_b h}{2}\ \frac{1}{V_q}\ (\sum_j^n\ (\frac{1}{(r_i-r_j)_{\,q-q}}\ ) + (\sum_j^n\ \frac{1}{(r_i-r_j)_{\,q-aq}})\,) \qquad \textbf{(16-36)}$$

which is the same expression as before or E_{bf} (($E_{sfi}E_{tfi}$)) =

E_{bc} (($E_{sci}E_{tci})_q$) and this is due to the symmetry of interactions

of course no one will be counting any quantons , as the

summation can be handled by assessing energy density over an integration volume

as for the factor $\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}$ **, while for a single quanton of a radius** r_q **it has a total binding energy between bound free energy fields** $(E_{sfb}\; E_{tfb})$ **and constrained energy fields** $(E_{sc}\; E_{tc})$ **that is equivalent To** $E_{tp} = \int_{V_q} E_t \; dV \quad = \alpha_t \int_{V_q} (E_{sfb}\; E_{tfb}) \; (E_{sc}\; E_{tc}) \; dV$

$$=\alpha_t \; \frac{3\, h}{8\, (\pi)^5} \, k^{\,4} \, V_q$$

$$= \frac{h}{2\alpha_t} \; \frac{1}{\frac{4}{3}\pi r_q{}^3} \; \frac{1}{r_q} \, V_q = \alpha_t \; \frac{h}{2\, r_q} \frac{1}{V_q} V_q \;\; = \alpha_t \, \frac{h}{2r_q}$$

which says that the binding energy is directly proportional to ($\frac{1}{r_q}$**) , now for the case of a virtual quanton whose radius now becomes** $(r_i - r_j)$ **instead of** r_q**, the binding energy between the two energy fields inside two separate quantons** q_i , q_j **becomes**

$$E_{bp} = \alpha_b \;\; ((\int_{V_{qi}} (E_{sfbi}\; E_{tfbi}) dV \; \int_{V_{qj}} (E_{scj}\; E_{tcj}) \;\; dV \;\; \frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}$$

$$=\alpha_b\ K_{qi}{}^{2}\ \ (D_{sfbi}\ D_{tfbi})\ \ K_{qj}{}^{2}\ \ \ (D_{scj}\ D_{tcj})V_q\ \ \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}$$

$$=\ \alpha_b\ \ c^3\ \ \sqrt[2]{\frac{h}{2\,c^3\,V_{qi}\,r_{qi}}}\ \ \sqrt[2]{\frac{h}{2\,c^3\,V_{qj}\,r_{qj}}}\ \ \ V_q\ \ \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}$$

$$=\ \ \frac{\alpha_b\ h}{2(r_i-r_j)}$$

so , this factor $\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}$ **acts as a conversion factor for the calculation of the binding between any energy fields regardless weather they exist in the same quanton or not**

<u>36.b.2-Quanton repulsive interaction (</u>E_r)

<u>Type : complex repulsive</u>

Out side the quanton , the nonbinding part of the quanton free energy field $(E_{sfni}E_{tfni}\,)_q$ **generates a repulsive interaction with other quantons ' nonbinding free energy** $(E_{sfnj}E_{tfnj})_q$

<u>for quanton</u> (q_i)

$$E_r((E_{sfni}\ E_{tfni})_q\ \ ) =\ \alpha_r\ \ ((E_{sfi}E_{tfi})_{q-nb}\ \sum_j^n(E_{sfJ}E_{tfJ})_{q-nb}\ \left(\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}\right))$$

(17-36)

$$= \alpha_r \, (K_q{}^2 D_{sfni} D_{tfni})_q \;\; \sum_j^n (K_q{}^2 \; D_{sfnj} D_{tfnj})_q \;\;) \left(\left(\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}\right)\right)$$

$$= \alpha_r \, K_q{}^4 \;\; c^2 \sum_j^n \;\; \left(\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)\;_{q-q}}\right)$$

$$= \alpha_r \, c^2 \; \sqrt[2]{\frac{3h}{8\pi \, c^3 r_{qi}{}^4}} \;\;\; \sum_j^n \;\; \sqrt[2]{\frac{3h}{8\pi \, c^3 r_{qj}{}^4}} \;\;\; \left(\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)\;_{q-q}}\right)$$

$$E_r = \;\; \frac{3\, \alpha_r \, h}{8\,\pi\, c\, r_q{}^3} \;\; \sum_j^n \;\; \left(\frac{1}{(r_i - r_j)\;_{q-q}}\right) \qquad \text{(18-36)}$$

α_r : repulsive interaction parameter

The dimensions of such a energy density interaction , which has two Dof's , it should be $[\frac{energy}{volume * c^2}]$ (= M L^{-3} T^0)

<u>For anti quanton </u>(aq_i)

the generated interaction due to nonbinding energy

$(E_{scni} E_{tcni})_{aq}$) outside the anti quanton is also a repulsive in nature

in nature since this energy interacts with the surrounding anti

quantons' nonbinding constrained energy field $(E_{scnj} E_{tcnj})\;_{aq}$ to

generate an repulsive interaction

$$E_{ri}((E_{scni})_{aq}) = \alpha_r((E_{sci}E_{tci})_{nb} \sum_j^n (E_{scj}E_{tcj})_{nb})((\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i - r_j)})) \qquad \textbf{(19-36)}$$

$$= \alpha_r({K_{qi}}^2 D_{scni}D_{tcni})_q \sum_j^n ({K_{qj}}^2 D_{scnj}D_{tcnj})_q \ ) (\left(\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i - r_j)}\right))$$

$$= \alpha_r\, {K_q}^4 \; c^2 \sum_j^n \; \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i - r_j)_{\;aq-aq}})$$

$$= \alpha_r\, c^2 \sqrt[2]{\frac{3h}{8\pi\, c^3 {r_{qi}}^4}} \quad \sum_j^n \sqrt[2]{\frac{3h}{8\pi\, c^3 {r_{qj}}^4}} \quad \left(\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i - r_j)_{\;aq-aq}}\right)$$

$$E_{ri} = \frac{3\,\alpha_r h}{8\,\pi\, c\, {r_q}^3} \sum_j^n \left(\frac{1}{(r_i - r_j)_{\;aq-aq}}\right) \qquad \textbf{(20-36)}$$

the distribution of anti quantons in the space fabric is not according to haphazard, in fact the anti quantons are arranged in a diagonal manner , which ensures the minimization of the relatively weaker quanton repulsive interaction (E_r)

while repulsive interaction does exist between quantons , its effects are overridden by the presence of much stronger binding interaction (E_b) , and ,this is due to that fact that it has (3) Dof's

(more field strength) while the repulsive interaction has only

(2) Dof's

<u>37.How space fabric binding interaction (E_b) is generated</u>

1- energy fields out of the quanton , which generate the quanton binding interaction are also at the origin of dark matter gravitation like effect as well as at the origin of gravitation

if no inter-quanton binding were not present , there would have been no gravitational like effect of dark matter , nor gravitation for normal matter

2-The generated free energy fields out of the quanton are not in the form of ($E_{sf}E_{tf}$) (2.5 Dof's) , instead the free energy field out of the quanton is divided into two parts :

first part which is the binding part which enters into the interaction that forms the retaining interaction (E_t) or $(E_{sf}E_{tf})_{q-bound}$ =

$K_q{}^2 (D_{sfb} D_{tfb})_{\ q}$ **and has (1.5 *Dof*'s) and the second part which generates the quanton inflationary interaction (E_i) namely the non binding part (**$(E_{sfn}\, E_{tfn})_{\ q} \ = K_q{}^2 (D_{sfn} D_{tfn})_{\ q}$ **which has one (0.5+ 0.5)degree of freedom, so we can summarize the energy fields that are generated out of the quanton as follows**

$a - E_{\ sc} E_{\ tc}$ **(1.5 Dof's) (bound constrained energy)**

b- $(E_{\ sf} E_{\ tf})_{\ bound}$ **(1.5 Dof's) (bound free energy)**

$c - (E_{\ sf} E_{\ tf})_{\ nonbinding}$ **(0.5+.05 Dof) (n-b self-interacting free energy) , and for anti quanton case**

$a - E_{\ sf} E_{\ tf}$ **(1.5 Dof's) (bound free energy)**

b- $(E_{\ sc} E_{\ tc})_{\ bound}$ **(1.5 Dof's) (bound constrained energy)**

$c - (E_{\ sc} E_{\ tc})_{\ nonbinding}$**(0.5+0.5 Dof) (n-b constrained energy)**

3-each energy field can interact with an energy field of a similar Energy degrees of freedom but opposite type

4-the free energy field $(E_{sf}E_{tf})_{bound}$ of the quanton or ($E_{sf}E_{tf}$)

of the anti quantons enters in an interaction with the constrained

energy field ($E_{sc}E_{tc}$) of the other quantons or $(E_{sc}E_{tc})_{bound}$ of

the anti quantons which generates a more stable binding energy

rather than the less stable repulsive interaction with an energy

field of the same nature

5- bound energy fields out of the quanton are symmetric to those

out of the anti quanton (1.5 Dof's of each energy type), and they

all the generate a binding interaction (E_b)

<u>38.Dimensions of energy field interactions</u>

While interactions that generate real energy density have 4 Dof's ,

interactions that involve space fabric , have different dimensions

generally , the number of energy Dof's involved in an interaction is

what determines its dimensions

From the previous discussion , we can deduce some rules

regarding the dimensionality of an interaction $(E_{\,i})$ that involves

($Dof_i = x$) degrees of freedom

dimensions of $[E_{\,i}]$ = ($\frac{energy}{volume}$) ($\frac{1}{c^{4-x}}$) =

$Dim\,[E_{\,i}]$ **= M $L^{2-3-4+x}\,T^{-2+4-x}$ = M $L^{x-5}\,T^{2-x}$ =[$\frac{M\,L^{x-2}\,T^{2-x}}{volume}$]**

=$\frac{\text{energy}}{volume}$ ($\frac{T^x}{L^x}$)

For the special case of x= 4 , $[E_{\,D_4}\,]$ = M $L^{-1}\,T^{-2}$ = ($\frac{\text{energy}}{volume}$)

39. <u>energy division between various interactions</u>

For the case of space fabric interactions , the total energy of each interaction inside the quanton can be assessed directly via the volumetric integration

again the relationship between the individual interaction density and the total interaction density inside the quanton is not only volumetric but based on energy dgree of freedom , this time in terms of the constant (c)

total retaining energy inside the quanton can be calculated as

$$E_{tp} = \int_{V_q} E_t \quad dV = E_t \; V_q = \alpha_t \int_{V_q} \frac{E_q}{c} dv \; \text{(dimensions : } \frac{energy}{c}) \quad (1\text{-}39)$$

the inflationary interaction E_{ip}

$$E_{ip} = \int_{V_q} E_i \quad dV , \; = E_i \; V_q \; = \alpha_i \int_{V_q} \frac{E_q}{c^3} dv \text{ (dimensions : } \frac{energy}{c^3}) \quad (2\text{-}39)$$

the binding interaction E_{bp}

$$E_{bp} = \int_{V_q} E_b \, dv \; = E_b \; V_q = \alpha_b \int_{V_q} \frac{E_q}{c} dv \text{ (dimensions : } \frac{energy}{c}) \quad (3\text{-}39)$$

the repulsive interaction E_{ip}

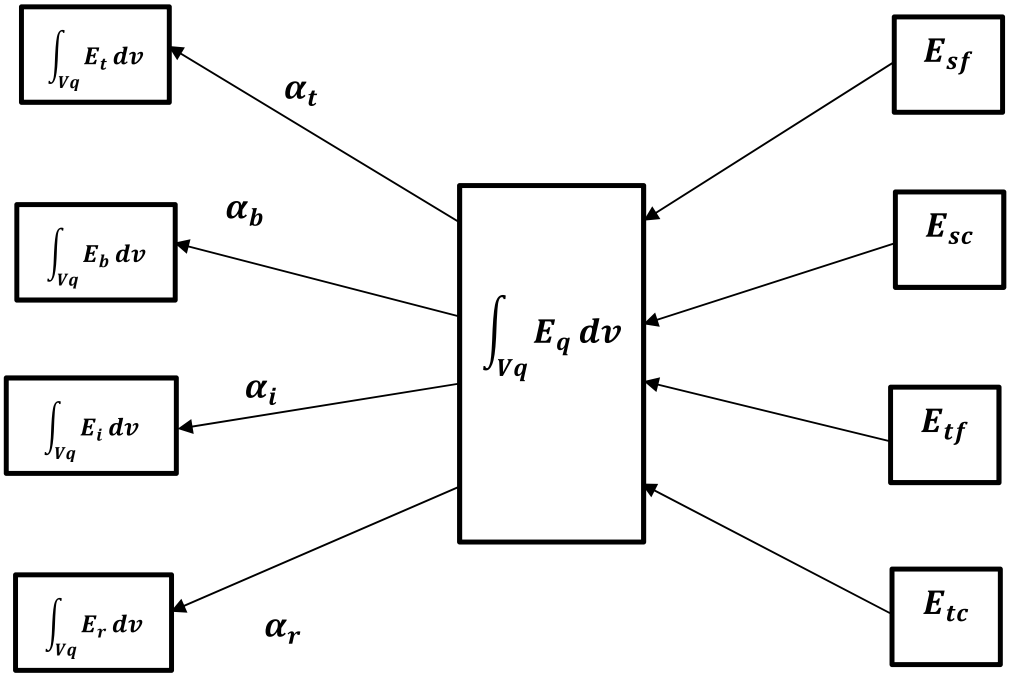
$$E_{rp} = \int_{V_q} E_r \, dv = E_r \; V_q \; = \alpha_r \int_{V_q} \frac{E_q}{c^2} dv \text{ ,(dimensions : } \frac{energy}{c^2}) \quad (4\text{-}39)$$

α_t , α_i, α_b , α_r ….. : interaction dimensionless parameters

In this case where each interaction can be calculated as the result of density integration over the quanton volume is possible compared to the case of individual energy fields $E_{sf}, \ldots$ where it is not possible to calculate individual energy field energies inside the quanton and the reason behind this is that each interaction is in terms of ${K_q}^4$ which is not the case for individual energy fields where integrations of the form $E_{sfp} = \int_{V_q} E_{sf}$ dV are not possible , in general

$$E_p = (cE_{tp} + c^3 E_{ip} + cE_{bp} + c^2 E_{rp} \; .....) \qquad (5\text{-}39)$$

Unfortunately For the interaction parameters α_t , α_i , α_b , α_r and at this moment there is no analytic relationship to determine them directly , however it can be predicted (without mathematical proof) that as r_q increases α_t would decrease , reflecting a weaker internal binding and α_b increases which reflects (leaking) field to the outside of the quanton so as to develop a stronger binding interaction which counteracts the greater inter quanton distances and maintains the space fabric integrity



Fig(8).the relationship between quanton total energy and the total Energy of various interactions

The last relationship allows for the calculation of the interactions

not in terms of density but in terms of $\left(\frac{energy}{c^{4-interaction\ Dof}}\right)$

for the total retaining interaction inside the quanton

$$E_{tp} = \alpha_t \int_{V_q} \frac{E_q}{c}\, dv = \alpha_t \int_{V_q} \frac{E_q}{c}\, dv = \left(\int_{V_q} (E_{sf} E_{tf})_{\ bound} (E_{sc} E_{tc}) \right) dV$$

$$= \alpha_t \left((K_q{}^2 (D_{sfb} D_{tfb}) \ (K_q{}^2 (D_{sc} D_{tc}) \right) V_q \qquad \textbf{(6-39)}$$

$$E_{tp} = \alpha_t K_q{}^4 \ c^3 V_q = \alpha_t \frac{3h\, k^4}{8\pi^5} = \frac{\alpha_t h}{2} \frac{1}{\frac{4}{3}\pi r_q{}^3 r_q} V_q$$

Based on the simplification of spherical quanton and a uniform

field throughout, $V_q=\frac{4}{3}\, r_q{}^3$

$$E_{tp}=\alpha_t\ \frac{h}{2r_q}\quad \textbf{as before} \qquad \textbf{(7-39)}$$

While for the inflationary interaction

$$E_{ip} = \alpha_i \int_{V_q}\left(\sqrt{(E_{sf}\,E_{tf})_{\ nonbinding}}\right)^2\ dV$$

$$= \alpha_i\ \mathrm{c}\ \frac{h}{2V_q r_q c^2} V_q = \alpha_i\ \frac{h}{2\, r_q c^2} \qquad \textbf{(8-39)}$$

for the binding interaction $E_{bp} =$

$$\alpha_b\ ((\int_{V_{qi}}(E_{sfi}E_{tfi})_{q-bound}\sum_j^n\int_{V_{qj}}(E_{scj}E_{tcj})_q\quad \mathrm{dV}\ ))\frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)} +$$

$$\int_{V_{qi}}(E_{sfi}E_{tfi})_{q-bound}\,\mathrm{dV}\quad \sum_j^n\int_{V_{qj}}(E_{scj}E_{tcj})_{aq-bound}\quad \mathrm{dV}\ ))\ \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)}\ )$$

$$=\alpha_b(K_{qi}{}^2(D_{sfbi}D_{tfbi})_q\sqrt{V_{qi}}\quad \sum_j^n K_{qj}{}^2\ (D_{scj}D_{tcj})_q\sqrt{V_{qj}}\quad \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)})$$

$$+K_{qi}{}^2\ (D_{sfbi}D_{tfbi})_q\sqrt{V_{qi}}\ \sum_j^n K_{qj}{}^2\ (D_{scbj}D_{tcbj})_{aq})\sqrt{V_{qj}}\quad \frac{\sqrt{r_{qi}\,r_{qj}}}{(r_i-r_j)})$$

E_{bp}=

$$\alpha_b c^3 \sqrt[2]{\frac{h}{2V_q\, c^3\, r_{qi}}}\sqrt{V_q}\ \left(\sum_j^n \sqrt[2]{\frac{h}{2V_q\, c^3\, r_{qj}}}\ \frac{\sqrt{V_q}\ \sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)_{\ q-q}} + \sum_j^n \sqrt[2]{\frac{h}{2V_q\, c^3\, r_{qj}}}\ \frac{\sqrt{V_{qj}}\ \sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)_{\ q-aq}}\right)$$

$$= \frac{\alpha_b\, h}{2}\ \left(\sum_j^n \left(\frac{1}{(r_i - r_j)_{\ q-q}}\right) + \left(\sum_j^n \frac{1}{(r_i - r_j)_{\ q-aq}}\right)\right) \qquad \textbf{(9-39)}$$

For interactions outside the quanton and due to the symmetry of

Fields (in the form of both fields having the same parameter ($K_q^{\ 2}$)

and the same Dof (x) , this allows for the following integration

which is valid for both inside and outside the quanton

$$E_{binding} = \alpha_b \int_{V_{qi}} E_{sfi}\ \ E_{scj}\ \text{dV} = \int_{V_q} K_{qi}^{\ 2}\ c^x\, \text{dV} \int_{V_{qj}} K_{qi}^{\ 2}\ c^x\, \text{dV}\ \left(\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}\right)$$

$$= \alpha_b\, c^{2x} \int_{V_{qi}} \sqrt[2]{\frac{h}{2\, V_{qi}\, c^3\, r_{qi}}}\ \text{dV} \int_{V_{qj}} \sqrt[2]{\frac{h}{2\, V_{qj}\, c^3\, r_{qj}}}\ \text{dV}\ \left(\frac{\sqrt{r_{qi}\, r_{qj}}}{(r_i - r_j)}\right)$$

$$= \alpha_b\ \frac{h}{2c^{3-2x}}\ \left(\frac{1}{(r_i - r_j)}\right) \qquad \textbf{(10-39)}$$

<u>40.The inverse relationship between wave length / energy – a possible explanation</u>

The quanton retaining (binding) interaction took the form

$E_{\ t}$ **=** $\alpha_t(E_{\ sfb} E_{\ tfb})(E_{\ sc} E_{\ tc})$ **, unlike any other potentials Like**

$U_g = G\frac{M\,m}{r}$ or $U_e = K\,\frac{Q_i\,Q_j}{r}$, do not have the term ($\frac{1}{\Delta r}$)

In fact , the quanton , like any other quantum system has its energy

which is defined as $E_p = \frac{hkc}{2\pi}$, can alternatively be written as

E_p(packet energy) $= \frac{hkc}{2\pi} = \frac{hc}{2\,r_q}$ (where k = $\frac{\pi}{r_q}$)

While $E_{tp} = \int_{V_q} E_t \, dv = E_t\,V_q = \frac{\alpha_t h}{2\,r_q}$

(E_{tp} : total retaining energy inside quanton)

which shows that the quanton radius is inversely proportional to

retaining energy (a binding type interaction) , which already

satisfies the inverse law

as the quanton energy E_p decreases , its retaining energy

decreases and consequently quanon radius and its wave length

increases , this shows that the term $\frac{1}{r_q}$ is inherently present in the

retaining interaction relationship as well as all forms of quanton

interactions and is like any the form of potential and for the

particular case of electromagnetic waves , the inverse relationship between the wavelength and the energy of the wave is an expression of an increased / decreased binding energy and the corresponding change in the relativistic quanton dimensions or the wave length , while there are some other repulsive potentials that exist in the quanton like the inflationary interaction (E_i) and the repulsive interaction (E_r) , the binding type interactions remains the dominant in nature since they possess the greatest number of energy Dof's

41. Quanton stable degrees of freedom- role of symmetry of interactions

The condition of interaction between free and constrained energies

$(E_{sf} E_{tf})_{bound}$ **=** $(E_{sc}\ E_{tc})$ **or** $(D_{sfb} D_{tfb})$ **=** $(D_{sc}\ D_{tc})$

Though necessary , but not sufficient ,

for a stable interaction , the condition becomes

$\frac{E_{sfb}}{E_{tfb}} = \frac{E_{sc}}{E_{tc}}$, which reduces to $\frac{D_{sfb}}{D_{tfb}} = \frac{D_{sc}}{D_{tc}}$ (1-41)

or $(D_{sfb} D_{tc}) = (D_{sc} D_{tfb})$ (2-41)

these are degree of freedom of the energy fields in a wave like Form (E_{qf} and E_{qc} $form$), which define the symmetry of the bound part of free dominated wave like and the constrained dominated part

as the free energy field $(E_{sf}E_{tf})_{bound}$ and the constrained energy $(E_{sc}\ E_{tc})$ become bound together, the individual degrees of freedom of the free and constrained space and time varying energy field go through a rearrangement to achieve the symmetry of the interaction such that

Dof_{tf} = Dof_{tc} , Dof_{sfb} = Dof_{sc} for quantons

Dof_{tf} = Dof_{tc} , Dof_{scb} = Dof_{sf} for anti quanton

this symmetry ensures the stability of the interaction by reducing

the resultant wave behaviour of the generated interacting fields

This rearrangement, which is managed through energy

constraining, takes the following form for the quanton

Energy field	Transient Dof's	Stable Dof's
E_{sfb} E_{tfb} (bound)	1.5	1.50
E_{sfn} E_{tfn} ((nonbinding)	1.00	1.00
E_{sf}	2.25	2.00
E_{tf}	0.25	0.50
E_{sc} (bound)	0.75	1.00
E_{tc} (bound)	0.75	0.50

<u>and for anti quanton</u>

Energy field	Transient Dof's	Stable Dof's
E_{scb} E_{tcb} (bound)	1.5	1.50
E_{scn} E_{tcn} ((nonbinding)	1.00	1.00
E_{sc}	2.25	2.00
E_{tc}	0.25	0.50
E_{sf} (bound)	0.75	1.00
E_{tf} (bound)	0.75	0.50

cancellation of the wave like behaviour between different fields takes place , for retaining interaction

$$E_{t} = \alpha_t (E_{qf})_{bound} (E_{qc})$$

$$= \alpha_t \, (K_{sf} \, K_{tc}) \, (D_{sfb} D_{tc}) \, (\psi_{sf} \psi_{tc}) (K_{sc} \, K_{tfb}) \, (D_{sc} D_{tfb}) \, (\psi_{sc} \psi_{tf})$$

$$= \alpha_t K_q^{\,4} \, (D_{sfb} D_{tfb}) \, (D_{sc} D_{tc}) \, (\psi_{sf} \psi_{sc}) \, (\psi_{tf} \psi_{tc})$$

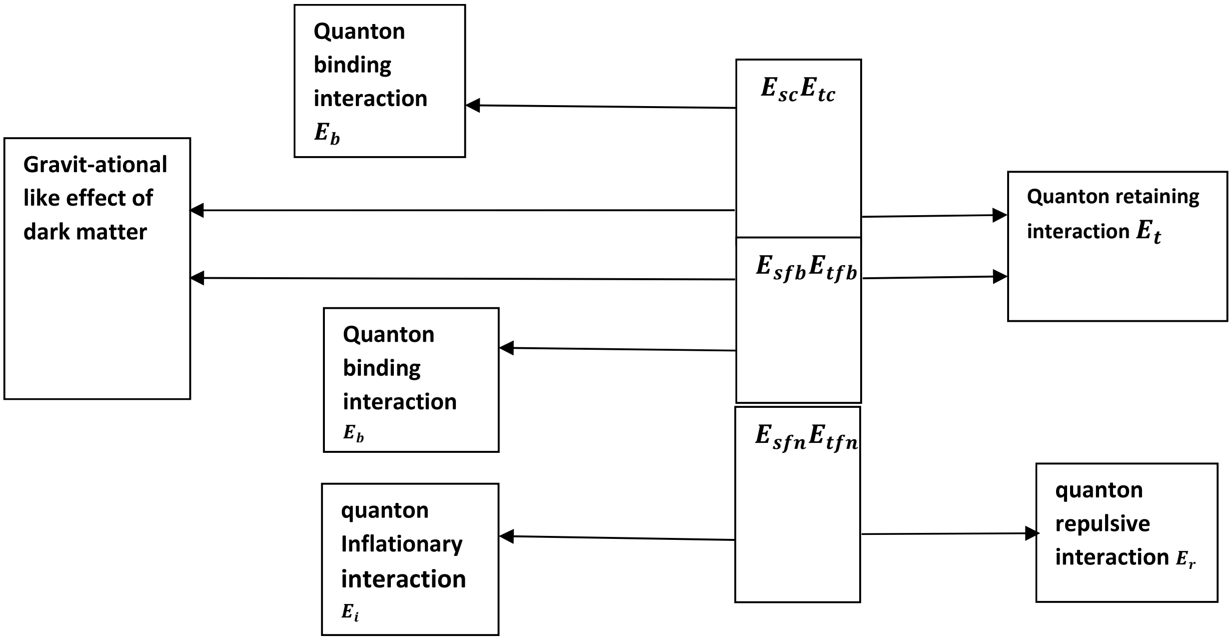
$$= \alpha_t K_q^{\,4} \, (D_{sfb} D_{tfb}) \, (D_{sc} D_{tc})$$

$$E_t = \alpha_t \, (E_{sf} E_{tf})_{bound} (E_{sc} \; E_{tc})$$

42.Role of individual energy fields in the formation of space fabric

Energy field	Role inside quanton	Role outside quanton (short range)	interaction at cosmological scale
E_{sfb} E_{tfb} (bound)	Quanton retaining interaction E_t	Quanton binding interaction E_b	Dark matter gravitational like effect
E_{sc} E_{tc} (bound)	Quanton retaining interaction E_t	Quanton binding interaction E_b	Dark matter gravitational like effect
E_{sfn} E_{tfn} (nonbinding)	Quanton inflationary interaction E_i	Quanton repulsive interaction E_r	Matter distortion of space fabric

summary of the role of individual energy fields and their interactions at Planck and cosmological scale for the quantons of space fabric



Fig(9).Summary of the Planck scale interactions and their energy field of origin for quantons of space fabric

	structure	quanton			Anti quanton		
structure	Energy field	$(E_{sfbj}E_{tfbj})$ (bound)	$E_{scj}E_{tcj}$ (bound)	$E_{sfnj}E_{tfnj}$ nonbinding	$E_{scbj}E_{tcbj}$ (bound)	$E_{sfj}E_{tfj}$ (bound)	$E_{scni}E_{tcnj}$ (nonbinding)
quanton	$(E_{sfbi}E_{tfbi})$ (bound)	N/A	E_b	N/A	E_b	N/A	N/A
	$E_{sci}E_{tci}$ (bound)	E_b	N/A	N/A	N/A	E_b	N/A
	$(E_{sfni}E_{tfni}$ nonbinding)	N/A	N/A	E_r	N/A	N/A	N/A
Anti quanton	$(E_{scbi}E_{tcbi})$ (bound)	E_b	N/A	N/A	N/A	E_b	N/A
	$E_{sfi}E_{tfi}$ (bound)	N/A	E_b	N/A	E_b	N/A	N/A
	$(E_{scni}E_{tcni})$ (nonbinding)	N/A	N/A	N/A	N/A	N/A	E_r

Summary of the generated field interactions outside quanton / anti quanton due to different energy fields

43.Conclusions

Uniformity and homogeneity of CMB testifies to its origin which is the release of radiation from the space fabric as a direct result of the process of free expansion of the universe (second law of Thermodynamics) , this gives a gate way for further understanding of the quanton interactions

44. References

Basic physics