$$E = tc^2$$

This model shows the relation between microscopic scale and macroscopic scale and the idea of time and mass in both scales. The equations of energy time equivalence and mass time equivalence are verified. Also we found the equation of cosmic microwave background radiation temperature (CMBRT). The diagram shows the multiverse and how it can be constructed in seven loops and eleven dimensions without a big bang dogma.

Space-time metric

The space-time of 0D scale is zero dimensional Euclidean space + time D(0,1).The line element is

$$\frac{1}{\grave{c}} ds = cdt = d\tau \qquad (1)$$

Where $\grave{c}$ has dimension of $[L]$ and c has dimension of $\left[\frac{1}{t}\right]$ and the proper time is dimensionless.

$$\frac{ds}{dt} = \grave{c}c \equiv c^2 \text{ , } c^2 \equiv \left[\frac{L}{t}\right] \text{ and } \frac{d\tau}{dt} = c \equiv \left[\frac{1}{t}\right] \qquad (2)$$

The transformation speed of vacuum is c^2 and the number of space quanta is

$$N = \sqrt{\frac{2G\hbar^3}{c^5}} \Big/ \frac{2\hbar^2 G}{c^4} = \frac{1}{L_P} \qquad (3)$$

Therefore, the elapsed time,

$$\Lambda t = \frac{1}{L_P c^2} \qquad (4)$$

Where Λ has dimension of $[L]^{-2}$. When $L_P = 2.285650545 \times 10^{-35}\, m$ and $\Lambda = 1$ the time is

$$t = \frac{1}{L_P c^2} = 4.861246675 \times 10^{17} s = 15.40470285 \times 10^9 year.$$

Gravitational radius

Matter combines space (vacuum) at all and we cannot distinct them. Then vacuum shared matter with mass of dark matter. As the gravitational radius is measured by mass, this means we should combine the matter and vacuum when we measure any gravitational radius for any object. Here we assume the gravitational radius of vacuum is measured with Compton length.

Therefore, the gravitational radius for an object of mass M should be measured with

$$R = \frac{GM}{C^2} + \frac{\hbar}{Mc} \qquad (5)$$

when we are in macroscopic world the term $\frac{GM}{C^2}$ is dominant. While approaching the microscopic world the limit of $\frac{GM}{C^2}$ approaches the minimum length in microscopic world ($\alpha = 1$), $R = \frac{\hbar}{mc}$, $\lim_{M \to m} \frac{GM}{C^2} = \frac{\hbar}{mc}$, where m is microscopic world mass scale. Or $\frac{GM}{C^2} = \frac{\hbar}{Mc}$.

Therefore, the gravitational radius at the minimum limit of macroscopic world is

$$R = \frac{2GM}{C^2} = R_s \qquad (6)$$

Where R_s is Schwarzschild radius.

On the other hand, the gravitational radius in microscopic world is measured with Compton length. That means in microscopic world the vacuum is dominant.

$$\lambda_c = \frac{\hbar}{mc} \qquad (7)$$

When microscopic mass approaches the maximum mass in microscopic scale ($\alpha = 1$) it should departures for macroscopic world.at this limit both gravitational radiuses are equal,

$$\lambda_c = R_s \quad , \text{or} \ \frac{2GM}{C^2} = \frac{\hbar}{mc} \qquad (8)$$

This equation can be reached by using the following transformation,

$$\frac{\alpha\hbar}{mc} \to \frac{GM}{c^2} \qquad (9)$$

Applying the transformation (9) on equation (8), we find

$$m = M \qquad (10)$$

Substituting equation (10) in equation (8) and solving for the mass , one gets

$$m = \sqrt{\frac{\alpha\hbar c}{G}} = m_P \qquad (11)$$

The threshold mass in macroscopic scale is equal to the microscopic mass. This result explains why the relativistic mass m became equal to the rest mass when the interaction radius equals the Schwarzschild radius in the relativistic relation

$$v^2 = c^2 \left[1 \pm \sqrt{1 - \frac{m_0}{m}\frac{R_S}{r}}\right] \qquad (12)$$

At the limit when $r \to \frac{2GM}{c^2}$ and $v \to c$ in equation (12), the relativistic mass becomes equal to the initial mass $m = m_0$.

This means the object has equal radius for matter and vacuum in macroscopic scale as explained in equation (6). But equation (6) is threshold mass in macroscopic world and dose not equal the microscopic mass at all. Thus, the equality between Schwarzschild radius and Compton length is hold for the resultant value between them not for masses. Thus we can write in microscopic scale

$$\frac{GM}{C^2} = \frac{\alpha\hbar}{mc} \to \sqrt{Mm} = \sqrt{\frac{\alpha\hbar c}{G}} \qquad (13)$$

In macroscopic scale we have

$$\frac{GM}{\alpha C^2} = \frac{\hbar}{mc} \to \sqrt{Mm} = \sqrt{\frac{\alpha\hbar c}{G}} \qquad (14)$$

We write the mass in term of combination of M and m instead of m_P.

Equations (13) and (14) confirm the mass duality between macroscopic scale and microscopic scale as

$$M \to \frac{\beta}{m} \qquad (15)$$

Where $\beta = \frac{\alpha\hbar c}{G}$ (16)

Using the same analyzing we find the region between microscopic scale and radiation scale.

In microscopic scale we have Compton length, $\lambda_c = \frac{\hbar}{mc}$, is equivalent to

$$\lambda = \frac{\hbar c}{E} \qquad (17)$$

At the limit when $\lambda = 1$ we find $\frac{c^2}{E} = \frac{1}{m}$ or $E = mc^2$.

The limit where $\lambda = 1$ represents the threshold region between microscopic scale and radiation scale, where the unification can be occurred. To this end we find

$$E = mc^2 = \sqrt{\Lambda}\hbar c \qquad (18)$$

Where Λ has dimension of $[L]^{-2}$.

Consequently, the region between radiation scale and vacuum scale is given by using that, the vacuum scale is zero dimensional Euclidean space. Therefore, the length is measured by time dimension $[L] = [T]$.

And the transformation speed of the vacuum v_v is given by

$$v_v = \frac{ds}{dt} = c^2 \qquad (19)$$

The minimum energy E_{min} of radiation scale is given by

$$\alpha E_{min} = \frac{E_{max}}{\gamma} \qquad (20)$$

Where, $\alpha.\gamma$ is dimensionless, and

$$\sqrt{\gamma} = \frac{d\tau}{dt} = c \qquad (21)$$

Hence, the minimum radiation energy, $\alpha = 1$, represents the limit energy between radiation scale and vacuum scale

$$E = \frac{\sqrt{\Lambda}\hbar}{c} \qquad (22)$$

From above we can sketch the limit of macroscopic, microscopic and radiation scales.

Figure (1) summarizes the relations between the scales.

We can notice from the diagram

1. $M(0D) \times M(6D) = {m_P}^2$, $M(1D) \times M(5D) = {m_P}^2$, $M(3D) \times M(3D) = {m_P}^2$ and $M(2D) \times M(4D) = {m_P}^2$
2. And speed multiplication is

$v(0D) \times v(6D) = c^2$, $v(1D) \times v(5D) = c^2$, $v(3D) \times v(3D) = c^2$ and

$v(2D) \times v(4D) = c^2$

3. The transformation between scales has the form of

$$0D \to 6D \, , \, \frac{\hbar^2 G}{c^4 m} \to \left(\frac{c^5}{\hbar G^2 m} \qquad\right)^{-1}$$

4. This leads to

$$R_0 = \sqrt[3]{\frac{\hbar^2 G}{c^4 m}} = \sqrt[3]{\lambda_c {L_P}^2} \to R_6 = \sqrt[3]{\frac{\hbar G^2 m}{c^5}} = \sqrt[3]{R{L_P}^2}$$

$$1D \to 5D \, , \, \sqrt{\frac{G\hbar^3}{c^5}} \Big/ m \to \left(\sqrt{\frac{c^7}{\hbar G^3}} \Big/ m \right)^{-1} , R_1 = \sqrt{\lambda_c L_P} \to R_5 = \sqrt{R L_P}$$

$$2D \to 4D \, , \, \frac{\hbar}{c} \Big/ m \to \left(\frac{c^2}{G} \Big/ m \right)^{-1} , R_2 = \lambda_c = \frac{\hbar}{mc} \to R_4 = R = \frac{Gm}{c^2}$$

We can replace $R_D \to a^2$, $(R \; or \; \lambda_c) \to {a_N}^2$ and $L_P \to {a_0}^2$.

This replacement gives MOND acceleration.

We can calculate the dimensions as,$0D + 1D = 1d$,$1D + 2D = 3d$,$2D + 3D = 5d$, $3D + 4D = 7d$,$4D + 5D = 9d$ and $5D + 6D = 11d$. This means there is no even dimensions, except zero, like 2d or 4d,… .

Energy time equivalence

in 6D one finds the natural units emerged naturally. In this units ,the dimension of energy is

$$[E] = \left[\frac{1}{L}\right] = \left[\frac{1}{t}\right] = [M] \qquad (23)$$

Therefore, in natural units the mass energy equivalence $E = mc^2$ becomes in 6D;

$$E' = \alpha t c^2 \qquad (24)$$

Duality says

$E \rightarrow \frac{\alpha}{E'}$, where $[\alpha] = [E]^2$, one finds $mc^2 \rightarrow \frac{1}{\alpha t c^2}$,and the mass $m \rightarrow \frac{1}{\alpha t c^4}$.

This means the mass in 6D is given by;

$$m' = \alpha t c^4 \qquad (25)$$

We can check this relations,

Estimating age of the universe is $(13.798 \pm 0.037) \times 10^9$ years,then its energy is $(\alpha = 1)$

$E' = 3.918798956 \times 10^{34}\ s^{-1}$, this equivalent to $\frac{1}{L}$,which gives the value of

$L = 2.551802252 \times 10^{-35}\ m$,which is comparable to Planck length.

Also one finds the mass density of the universe by using,$E = \hbar\omega$, applying the transformation for ω is

$$\omega = \frac{\alpha t c^2}{2\pi} = \frac{2\pi}{T} \qquad (26)$$

Where $[\alpha] = \left[\frac{1}{t^2}\right] = \left[\frac{1}{L^2}\right]$

and $[E] = [M]$ one finds,

$$\Omega_m = \frac{\hbar \alpha t c^2}{2\pi} \qquad (27)$$

When $= \frac{1}{2}$, we find $\Omega_m = 0.328865663$

When $\Omega_m = 1$, this gives age of , $t = 4.195634119 \times 10^{10}$ year.

The ratio between the age where, $\Omega_m = 1$ and the present age of universe, represents the value that we get when we measure the cosmic microwave background radiation temperature (CMBRT) ,

$$T = \frac{t}{t_0} \times 1k = \frac{4.195634119 \times 10^{10}}{1.540470285 \times 10^{10}} \times 1k = 2.723606\ k$$

Or it can be written as

$$T_0(k) = 2^3 \sqrt{\frac{G}{h} \cdot \left(\frac{\pi}{c}\right)^3} \qquad (28)$$

The inverse of this ratio is mass density of universe; $\Omega_m = 0.367160301$.

Now one can construct a relation that gives the temperature at any scale;

$$T(k) = 2^3 \left(\frac{G}{h}\right)^{\frac{1}{2}} \left(\frac{\pi}{c}\right)^{1\frac{1}{2}} \cdot 2^7 \left(\frac{G}{h}\right)^{2\frac{1}{2}} \left(\frac{\pi}{c}\right)^{3\frac{1}{2}} \cdots 2^n (O)^{\frac{n}{2}} \cdot 2^{n_J} \qquad (29)$$

Where n is (0,1,3,5,…) and h Planck constant. n_J represents the missed order in power 2,e.g in n=11 the $n_J = 4\ (0,1,5,9)$

For n=11 ,$T = 1.8169856 \times 10^{92} k$. if we apply $mc^2 = kT$ we find,

$m = 2.786044587 \times 10^{52}\ kg.$

Now we can estimate the time of this mass by $M = tc^4$ gives $t = 3.439561218 \times 10^{18}\ s = 108.9955356\ \times 10^9\ year$.This represents the total age of the universe (or the 7 loops age) until recycling. One loop age is $t = 1.55707908 \times 10^{10}\ year.$

This identify n as the number of the dimensions and, $\alpha = 2^{-n}$.

Now one can check Schwarzschild radius and Compton length , Schwarzschild radius equal Compton length in Planck mass ($m_P = \sqrt{\frac{\alpha \hbar c}{G}} = 2.17651 \times 10^{-8}\ kg, \alpha = 1$) ,therefore,the transformation

$\frac{GM}{\alpha C^2} \rightarrow \frac{\hbar}{mc}$ (from macroscopic to microscopic scale) or $\frac{GM}{C^2} \leftarrow \frac{\alpha\hbar}{mc}$ (from microscopic to macroscopic scale)

This can be written as

$$2^n \frac{GMC^2}{C^4} \rightarrow \frac{1}{mc^2/\hbar c} \quad \text{or} \quad \frac{GMC^2}{C^4} \leftarrow \frac{1}{2^n mc^2/\hbar c} \qquad (30)$$

Where $\mathcal{M}_n c^2 \rightarrow \frac{1}{\tau c^2}$; $\mathcal{M}_n = \frac{1}{\acute{\mathcal{M}_n}} = 2^n \frac{GM}{C^4}$ and $\tau_n = 2^n \frac{m}{\hbar c}$ (31)

When $m = m_P$, one finds the time of Planck mass when $\alpha = \frac{1}{2}$ is,

$\tau = 4.864620905 \times 10^{17}\ s.$

Mass time equivalence

The time τ is equal to $\acute{\mathcal{M}}$,because when ($\hbar = c = G = 1$),we find $\alpha\tau_n = m$ and$\mathcal{M}_n = M = \frac{1}{\acute{\mathcal{M}_n}}$ and the transformation is $M \rightarrow \frac{\alpha}{m}$ gives $\mathcal{M}_n = M = \frac{1}{\acute{\mathcal{M}_n}} \rightarrow \frac{1}{m} = \frac{1}{\tau_n}$, gives

$$\alpha\tau_n = \acute{\mathcal{M}_n} \qquad (32)$$

To make sense of the equation , we take the $p \rightarrow \mu^+ K^0$ decay life time is $1.6 \times 10^{33}\ year$.

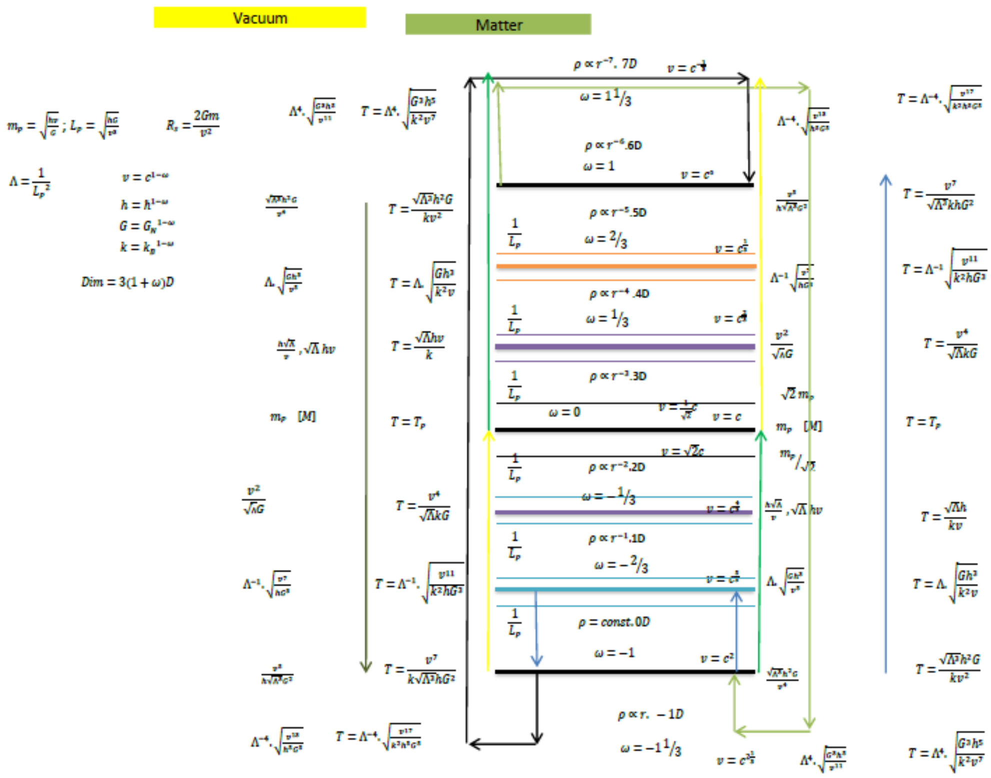
We use $\tau_n = 2^n \frac{m}{\hbar c}$, n=0, $m = 1.59739 \times 10^{15} kg$, this mass equal to time $t = 1.59739 \times 10^{15}\ s = 5.061936 \times 10^7\ year$.($1\ year = 3.15569 \times 10^7\ s$)

This time is equal to mass in macroscopic scale, where $M = tc^4$,we find $M = 1.2938859 \times 10^{49} kg$.

For Planck time $m = t_p \hbar c = 1.705575 \times 10^{-69}$,this mass is equal to time in macroscopic scale .this time gives mass of $M = tc^4 = 1.3815 \times 10^{-35} kg.$

This leads to appoint that, the requires energy that needed to construct an electron is larger than that used to construct a proton, which explains the inverse proportionality of energy with mass in quantum mechanics.

It is obviously clear that the transformation gives the exact values for age and mass of the universe.



Vacuum
Matter