Elastic Time Theory

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Abstract

This theory assumes that space consists of zero space-time points, called z-spots, embedded in time. Specific properties of time are assumed. Time is conserved. By nature time-rhythm differences are distributed inversely proportional to the distance. The natural time-rhythm distribution is inert.

Time and z-spots combine into three elementary, rotating particles. Empty space is filled with z particles. Objects consist as well of t- and t+ particles that have properties as if they emerged from symmetrically split z particles.
The rotation of the elementary particles causes the propagation of particles and waves through empty space. The direction of the movement is determined by the forward polarization of z particles.

A set of associated equations describe electric charge, mass and gravitational force as time-rhythm properties. Using earth and electrons as test objects, the time-rhythm properties have been quantified. Consequently the model is applicable by using known physical quantities.

1 Summary

The idea behind this theory is that in origin there were zero space-time points only. These 'z-spots' were conserved after the addition of one dimension: time. Simultaneously the elastic properties of time caused the space dimensions.

This theory gives a set of equations that describe the elastic properties of time and the properties of the emerged three elementary particles z, t- and t+.

Z particles are the original volumes around z-spots connecting z-spots with zero time-rhythm and the surrounding initial time-rhythm. The particles t+ and t- have properties as if they emerged from symmetrically split z particles.

The time-rhythm difference between z-spots and the surrounding time cause the space dimensions and a rotation.

The tangential speed of the rotation is the propagation speed in empty space. The tangential speed and the rotation speed vary and depend on the local density of z particles. The direction of the movement is determined by the forward polarization of z particles.

By nature time-rhythm differences between points are distributed inversely proportional to the distance between those points. This natural inverse proportionality between time-rhythm and distance is called the time-charge and is comparable with electric charge. Time-rhythm differences are the same phenomenon as electric field strength, pointing from 'fast' (+) to 'slow' (-).

Time inertia is the opposing force exercised by time against changes in the natural (inversely proportional) time-rhythm distribution.

Between the z particles in empty space, the attracting electric force is in equilibrium with the opposing inertia. The number of z particles per unit of volume is called z-density.

Objects are composed of t-, t+ and z particles. An object's composing particles cause changes in the z-density and consequently changes in time-rhythm. The resulting secondary force field is the same phenomenon as the gravitational force field.

This paper is limited to the static properties of elastic time. It concludes with demonstrating how the theorized properties of time connect with the comparable known physical quantities.

Contents

2 Glossary

There are two independent units: b (beats per second) and m (meters). The properties of elastic time are expressed in b m units.

Symbol	Unit	bm-unit	Concept
z-spot	-	-	primordial zero space-time spot
z+spot	-	-	spot with doubled time-rhythm
z particle	-	-	original volume about a z-spot
t- particle	-	-	volume around a z-spot with negative time-charge
t+ particle	-	-	volume around a z+spot with positive time-charge
TR	-	b	time-rhythm in beats per second
FS	-	bm^{-1}	time field strength
TQ	-	bm -	time-charge
TM	-	bm -	time-mass
tq	-	bm -	elementary time-charge
f	-	m^2b^{-1}	time-force field-strength
TF	-	m^2b^{-1}	time-force
Z	-	m^2b^{-1}	time inertia force
TU	-	mb^2	time-energy
TV	-	bm^3	time-volume
ζ	-	bm^{-2}	time inertia constant
ρ_t	-	b	time-mass density
ρ_z	-	m^{-1}	z-density
δ	-	-	z-density change
k_z	-	m^3kg^{-1}	z-density constant
k_d	-	b^{-1}	density constant
k_f	-	m^3b^{-2}	field-force constant
k_g	-	$N.b^{-1}m^{-1}$	time-force constant
k_m	-	$kg.b^{-1}m^{-1}$	time-mass constant
k_q	-	$C.b^{-1}m^{-1}$	time-charge constant

3 Assumptions

1. Space consists of conserved zero space-time spots, 'z-spots', embedded in initially equal time. The initial connections between z-spots and surrounding time are z particles. Two other particles t+ and t- have properties as if they emerged from symmetrically split z particles.
2. Time is future headed and is conserved: time cannot be created or destroyed.
3. A difference in time-rhythm causes a change of volume.
4. Particles rotate with a tangential velocity equal to the propagation speed in empty space.
5. Time force is the attraction of a point towards another point with lower time-rhythm.
6. By nature the distribution of time rhythm between points is inversely proportional to the distance between those points.
7. Time inertia is the opposing force against a deviation from the natural time-rhythm distribution.

4 Definition of time-rhythm

The absolute time-rhythm TR is here defined as the number of beats per second. The unit 'beat' is symbolized by 'b'. The reference is the initial universal time-rhythm at the moment of origination the universe with 1 b (one beat per second).
This definition helps to distinguish the 'duration of time' (seconds elapsed between two events) and the 'velocity of time'. Events happen slower than initially if TR $<$ 1 b and faster than initially if TR $>$ 1 b.

The relative time-rhythm TR_r is defined as the difference between the surrounding local time-rhythm and the absolute time-rhythm:

$$TR_r = TR_L - TR \tag{1}$$

In this paper the following time-rhythm specifications are used:
TR: the absolute time-rhythm, which is 0 at z-pots.
TR_r: the relative time rhythm, which is -1 at z-spots.
TR_I: the initial universal time-rhythm, which is the universal time-rhythm at the origination of the universe.
TR_L: the local time-rhythm is the time-rhythm relative to a referred area. The referred area may vary from a galaxy to a subatomic area.
TR_U: the universal time-rhythm refers to the time-rhythm of 'relaxed' empty space.

5 Definition of time elasticity

The idea behind this theory includes that the three space dimensions, hereafter represented by r_{xyz}, or abbreviated to 'r', are caused by the elastic properties of time. Without the time dimension three-dimensional space would not exist. Neither would space exist if the natural time-elasticity were zero. In other words, the creation of space is the result of the creation of elastic time, while zero time spots, hereafter called 'z-spots', are conserved.

Using an axis system with axis TR and r, particles are described as rotating spheres with their center at (0,0) and with radius r.

A fractional increase dTR of time-rhythm causes a fractional increase dr (> 0) of the radius r of a spherical volume centered at a z-spot. And conversely, a reduction of time-rhythm causes the radius to decrease.

Time-charge TQ is here defined as the product of time-rhythm and radius:

$$TQ = TR.r \tag{2}$$

$units: \ TQ : bm; \ TR : b; \ r : m$

By nature the distribution of time rhythm within particles is inversely proportional to the radius. The natural time-elasticity is expressed by a constant, the elementary time-charge tq, which is larger than zero. If tq were zero, the increase of time-rhythm would not have resulted in an increase of space and no space would have emerged.

$$TR.r = tq \tag{3}$$

$units : TR : b; \ r : m; \ tq : bm$ or

$$TR = tq/r \tag{4}$$

The time-rhythm function of r is valid for $r > 0$.

Apart from the differences in TQ per kind of particle, changes in circumstances may change the value of TQ. More specifically, the value of TQ will change if the local time-rhythm that surrounds a particle changes.

Equations (1) and (4) can be combined into one equation which is not limited to the elementary time-charge tq:

$$TR_r = TR_L - TQ/r \tag{5}$$

$units : TR : b; \ TQ : bm; \ r : m$

Time-rhythm, radius and absolute time-charge can not have negative values.

The condition $r \geq TQ/TR_L$ is required to prevent TR_r from being negative.

6 Other basic definitions

Z particles and t- particles are bridges between z-spots with time-rhythm zero and the local time rhythm TR_L that surrounds the particles. Such bridges could be virtually divided in very small fractions dTR and the related fractional increase in the radius as dr.
The particles t+ and t- have properties as if they have emerged from symmetrically split z particles. As t- particles are centered at z-spots with zero time-rhythm, symmetry demands that t+ particles are centered at spots with a doubled time-rhythm, called z+spots.

The time-field-strength FS_r is here defined as the fractional time-rhythm difference per unit of distance r:

$$FS_r = dTR/dr \tag{6}$$

$units: FS: bm^{-1};\ TR: b;\ r: m$

The time-mass TM_r is here defined as the integral of the relative time-rhythm over a distance:

$$TM_r = \int TR_r.dr \tag{7}$$

$units:\ TM: bm;\ TR: b;\ r: m$

The time-mass density ρ_t is here defined as the quotient of the time-mass and the distance:

$$\rho_{tm} = TM_r/r \tag{8}$$

$units:\ \rho_{tm}: b;\ TM: bm;\ r: m$

A difference in the time-mass density δ_{tm} between two volumes A and B is here defined as the quotient of their time-mass densities:
$\delta_{tm} = \rho_{tmA}\ /\ \rho_{tmA}$ or

$$\delta_{tm} = \frac{TM_A\ r_B}{TM_B\ r_A} \tag{9}$$

$units:\ \delta_{tm}: -;\ TM: bm;\ r: m$

A time-force TF exercised on a time-mass TM causes an time-acceleration TA of that time-mass: TF=TM.TA.
As the unit of time-mass is bm and the unit of acceleration is mb^{-2}, the unit of time-force is m^2b^{-1}.

The time-force field-strength, or time-force f between two points, is here defined as proportional to the quotient of their time-rhythm difference and their distance x:

$$f = k_f \Delta TR/x \quad (10)$$

$units : f : m^2b^{-1};\ k_f : m^3b^{-2};\ TR : b;\ x : m$

or, for two points divided by a fractional distance:

$$f = k_f FS \quad (11)$$

$units : f : m^2b^{-1};\ k_f : m^3b^{-2};\ FS : bm^{-1}$
with the here implicitly defined constant k_f as the field-force constant

The mutual time-force between two volumes A and B is proportional to the product of their time-mass and inversely proportional to the square of their distance x:
$TF = k_f.[\int TR_A.dr]/x.[\int TR_B.dr]/x$

$$TF = k_f.TM_A.TM_B/x^2 \quad (12)$$

$units : TF : m^2b^{-1};\ k_f : m^2b^{-3};\ TM = bm;\ x : m$

The Z force is the inertia of time-rhythm within particles. Time inertia is here defined as the opposing force against a deviation from the natural (inversely proportional) time-rhythm distribution. In other words, the opposing force against changes in the elementary charge. The time inertia gives resistance against both contraction (time-rhythm deceleration) and expansion (time-rhythm acceleration).
The definition of the Z force is based on the common property of elasticity: the proportional relationship between force and strain. Defining the strain as the quotient of the displacement x and the length r (strain=x/r) and defining ζ (zeta) as the inertial constant, the Z force (or time inertia) is here defined as:

$$Z_r = x/r\zeta \quad (13)$$

$units :\ Z : m^2b^{-1};\ \zeta : bm^{-2};\ x : m;\ r : m$

The tangential velocity of a particle has - as here defined - a constant value c, the propagation speed.
In this theory particles are propagated through space by the rotation of the elementary particles. As massless particles travel at the speed of light, the tangential velocity is equal to the speed of light. The tangential displacement at distance r from the center of particles is S_r per beat. As the time rhythm increases from the center outward from 0 to TR_L the displacement S_r increases from 0 to c, which relation is expressed by:

$$S_r = cTR_r \quad (14)$$

$units: \ S : m; \ TR : b; \ c : mb^{-1}$

The time-volume is here defined as the volume integral of the enclosed time-rhythm.

$$TV = \oint_V TR.dV \tag{15}$$

$units: \ TV : bm^3; \ TR : b; \ V : m^3$

The time-energy is here defined as the product of the time-mass TM, time-field strength FS and the distance r:

$$TU = TM \ FS \ r \tag{16}$$

$units: \ TU : mb^2; \ TM : bm;; \ FS : bm^{-1} \ r : m$

The z-density of empty space is here defined as the number of z particles per unit of distance:

$$\rho_z = n/r \tag{17}$$

$units : \rho_z : m^{-1}; \ n : -; \ r : m$

The z-density of an object is here defined as the number of displaced z particles per unit of distance:

$$\rho_m = n/r \tag{18}$$

$units : \rho_z : m^{-1}; \ n : -; \ r : m$

The specific z-density change caused by an object is here defined as:

$$\delta_z = \rho_m/\rho_z \tag{19}$$

$units : \delta_z : -; \ \rho : m^{-1}$

7 Initial properties of z particles

This chapter is about the initial properties of z-particles. The properties under prevailing conditions (changes in z-density) will be addressed in a later chapter.

Z particles connect the zero time-rhythm at z-spots with the surrounding local time-rhythm. If the time-rhythm distribution within z-particles were the natural time-rhythm distribution (or time-charge), then the assumption with respect to time conservation would be violated. In that case a volume with time slower than universal time-rhythm TR_I would have emerged, which would disturb the equilibrium between volumes with slow time and volumes with fast time.

The assumption of time conservation implies that time cannot be created or destroyed. The reference is the initial universal time-rhythm.
A volume with a lower time-rhythm than the initial universal time-rhythm generates a loss of time. Time conservation means that such volume with a reduced time-rhythm cannot exist without the existence of another volume with such an increased time-rhythm that the total of 'lost' and 'won' time-rhythm is zero. This is expressed as:

$$\int_0^\infty TR_r.dr = 0 \tag{20}$$

The left-hand side of this equation has the same form as time-mass; see equation (7).
Consequently, with other words, time conservation means that the sum of all time-masses is zero.

With respect to z particles, the lost time-mass TM_{lost} is the integral of the relative time-rhythm between the center (the z-spot) and a distance r:
$TM_{lost} = \int tq/r.dr$ (for r $0 \rightarrow \infty$)

The time-rhythm function of r is valid for $r > 0$. For the reason of calculus the adjustment is expressed as the sum of two parts.

The first part is the fractional time-rhythm TR_0 at a fractional distance r_0 from the z-spot.
Equations (1) and (4) can be combined into the (unadjusted) function of r for z particles (before adjustment):
$r = tq/(TR_L + TR_r)$
If the time-rhythm on earth were $TR_L = 1$, this function of r demonstrates that, if $TR_r \rightarrow 0$ (approaches the the z-spot), than the radius $r \rightarrow tq/(1 + 0)$, equal to tq. The equation for the time-rhythm adjustment TR_0 of z particles is enabled by setting $TR_0 = 0$ for $r_0 = tq$

The second part is the integral of the time-rhythm $\int TR_L - tq/r.dr$ for r from $tq \rightarrow \infty$.
This is expressed by the difference between the indefinite integral $\int (TR_L - tq/r).dr$ and the same integral for r from $0 \rightarrow r_0$, or
$[TR_L r - tq.ln(r)] - [TR_L r - tq.ln(r_0)]$ which is equal to
$-tq.ln(r/r_0)$

The total of the lost time-mass is the sum of the two parts:
$TM_{lost} = 0 - tq.ln(r/r_0)$ or
$TM_{lost} = -tq.ln(r/r_0)$ (with $r_0 = tq$)

TM_{adj} is equal to $-TM_{lost}$ for each distance r to the center, so $TM_{adj} = -TM_{lost}$

The time-rhythm adjustment TR_{adj} is determined by TM_{lost} and independent from r_{adj}, hereafter R. Consequently TR_{adj} is a constant in relation to R.
The time-charge adjustment is expressed by:
$TM_{adj} = \int TR_{adj}.dR$
As TR_{adj} is independent from R and - in this context - to be considered as a constant:
$TM_{adj} = TR_{adj}.R$

In other words, the time-charge adjustment is the product of the time-rhythm adjustment and the distance R.

Having $TM_{adj} = -TM_{lost}$ and $TM_{adj} = TR_{adj}R$:
$-TM_{lost} = TR_{adj}R$ so
$TR_{adj} = -TM_{lost}/R$
Insertion of $TM_{lost} = -tq.ln(r/r_0))$ gives:
$TR_{adj} = tq.ln(r/r_0)/R$

The time-rhythm of z particles is the sum of the unadjusted time-rhythm and the time-rhythm adjustment:
$TR_z = TR_{unadj} + TR_{adj}$ with R=r:

$$TR_z = TR_L - (1 - ln(r/r_0))tq/r \tag{21}$$

$units : TR : b;\ tq : bm;\ r : m$
with $r_0 = tq$, for $r > r_0$

The field strength of z particles is the derivative of the time-rhythm TR_z:
$FS_z = dTR_z/dr$
Insertion of TR_z gives
$FS_z = d[TR_L - tq/r + tq.ln(r/r_0)/r].dr$
$FS_z = d[TR_L - tq/r^{-1} + tq.ln(r)/r^{-1} - tq.ln(r_0)r^{-1}].dr$
$FS_z = +tq/r^{-2} + tq[ln(r)(-r^{-2}) + (r^{-1}.r^{-1})] - [tq.ln(r_0)(-r^{-2})]$

$$FS_z = (2 - ln(r/r_0))tq/r^2 \tag{22}$$

with $r_0 = tq$
$units : FS : bm^{-1};\ tq : bm;\ r : m$

The field-strength points from 'fast' to 'slow'.

8 Initial properties of t- and t+ particles

This chapter is about the initial properties of t- and t+ particles. Per definition t+ and t- particles are particles with properties as if they emerged from symmetrically split z particles. Having the initial properties +f t- and t+ particles defined in this chapter, in the next chapter these initial properties will be adjusted for contraction and expansion by force of the their own force-fields.

In the initial situation, the reference of the relative time-rhythm is the initial universal time-rhythm. Furthermore, in the initial situation, the natural distribution of time-rhythm prevails, as expressed by equation (3).

Consequently the time-rhythm at r is the initial universal time-rhythm TR_I minus (or plus for z+ particles) the elementary time-charge tq divided by the distance r.

$$TR_r = TR_I \pm tq/r \tag{23}$$

$units : TR : b;\ TR_L : b;\ tq : bm;\ r : m$

This equation is valid only for the initial situation of t- and t+ particles.

Having the time-rhythm distribution, the time-field-strength of t- and t+ particles is derived by differentiation:

$$FS_r = dTR_r/dr = tq/r^2 \tag{24}$$

$units : FS : bm^{-1};\ TR : b;\ r : m; tq : bm$

This equation is valid only for the initial situation of t- and t+ particles. The field strength points from 'fast' to 'slow'.

Having the time-rhythm distribution, the time-mass of t- and t+ particles is derived by integration of variable part of TR:
$TM = \int tq/r.dr$
As $r > 0$, the value zero is excluded by using a fractional radius $r_0 << r$:
$TM = \int_{r_0}^{\infty} tq/r.dr$

$$TM_r = tq.ln(r/r_0) \tag{25}$$

$units : FS : bm^{-1};\ TR : b;\ r : m; tq : bm$
With $r_0 << r$
This equation is valid only for the initial situation of t- and t+ particles. The field strength points from 'fast' to 'slow'.

9 Contraction/expansion of t- and t+ particles

The time force-field of a particle is affected by its own force because each time-rhythm difference within the field causes a force on all other points within the field.
On each point of the field act two opposite forces, TF_m from equation (12) and Z_r from equation (13). If a point in the field is in equilibrium, the magnitudes of the opposite forces TF and Z are equal at that point.

The force field related to a t+ particle undergoes a dimensional expansion because of its internal TF force. Similarly, the force field related to a t- particle undergoes a dimensional contraction.
The expansion or contraction is dimensional only, meaning that the time-rhythm is not affected.
Where in a t- particle TF has a centripetal direction, the equal centrifugal counterforce Z maintains the equilibrium.
Conversely in a t+ particle, TF has a centrifugal direction and the counterforce Z has a centripetal direction.

An expansion or contraction of a particle means an increase or decrease of the radius r, compared with the natural time-rhythm distribution. The relative change β in the radius is here defined as

$$\beta = \Delta r / r_n \tag{26}$$

$units : \beta : -; \ r : m$

The adjusted t- radius is $r_{t-} = r_n(1 - \beta)$.
The adjusted t+ radius is $r_{t+} = r_n(1 + \beta)$.

Using $tq = TR.r$ and using that tq is a constant gives:
The adjusted t- time-rhythm is:

$$TR_{t-} = tq/(r_n(1 - \beta)) \tag{27}$$

$units : TR : b; \ tq : bm; \ r : m; \ \beta : -$

The adjusted t+ time-rhythm is:

$$TR_{t+} = tq/(r_n(1 + \beta)) \tag{28}$$

$units : TR : b; \ tq : bm; \ r : m; \ \beta : -$

For the determination of β two concentric spheres are considered, each with the elementary time-charge tq.
The first with radius $r_n(1 - \beta)$ and time-rhythm $TR_n/(1 - \beta)$.
The other with radius r_n and time-rhythm TR_n.

The time-force-field between the spheres:
$f_{t-} = k_f.FS_{t-}$

$FS_{t-} = dTR/dr = d[tq/(r_n(1-\beta))]/dr = -tq/(r_n^2(1-\beta))$ so
$f_{t-} = -k_f tq/(r_n^2(1-\beta))$

Having equilibrium, $f_{t-} = Z_{t-}$
$Z = x/r\zeta$ with $x = r_n(1-\beta)$ and $r = r_n$ so
$Z_{t-} = (1-\beta)/\zeta$

As $f_{t-} = Z_{t-}$:
$-k_f tq/(r^2(1-\beta) = (1-\beta)/\zeta$ or
$-k_f tq\zeta = r^2(1-\beta)^2$ or

$$\zeta = -\frac{r^2(1-\beta))^2}{k_f tq} \tag{29}$$

$units: \zeta : bm^{-2};\ r : m;\ \beta : -;\ k_f : m^3b^{-2};\ tq : bm$

10 Time-rhythm in empty space

The idea behind this part of the theory is that empty space consists of nothing but z particles. Z particles rotate and do not have sharp edges. Their time-fields touch each other and cause a mutual attraction. The opposing repulsive force of time inertia maintains z-particles separated at an equilibrium distance.

The function of the time-rhythm of z particles in empty space implies that the time-rhythm midway between z particles is elevated compared with the initial universal time-rhythm. See chapter 'Initial properties of z particles.

The elevation of the time-rhythm decreases as the distance increases. Consequently, the time-rhythm elevation midway between z-spots decreases if the distance between z particles increases.

The time-rhythm elevation compared to the local time-rhythm (midway between z particles) is here defined as:

$$RE = TR - TR_L \tag{30}$$

$units: RE : b;\ TR : b$

The midway distance between z spots is equal to the effective radius RZ (unit: m) of z particles.

Using equation equation (21), the time-rhythm elevation can be expressed as:

$$RE = TR_I - TR_L - \frac{tq}{RZ}\,(1 + ln(\frac{RZ}{r_0})) \tag{31}$$

$units : RE : b;\ TR : b;\ \tau : bm;\ RZ : m;\ r : m$

11 Objects and time-rhythm

Objects are considered to be compositions of elementary particles z, t- and t+.

The idea behind this part of the theory is that the elementary particles within objects cause a displacement of the z particles that fill the empty space within the object. This displacement results in a reduced z-density within objects. The displaced z particles are pushed outwards and cause an increased z-density around objects, that fades away as the distance from the object increases.

The reduction of z-density within an object results in a compounded reduction RR of the time-rhythm elevation. With compounded reduction is meant that the reduction in a layer is reinforced by the reduction in the next layer. The larger the object, the larger and deeper the reduction of the time-rhythm elevation. The total compounded time-rhythm reduction has a maximum, as the time-rhythm cannot be negative (conservation of time).

Around the object, the increased z-density results in an increased RI time-rhythm elevation, that fades away as the distance from the object increases.

The time-rhythm of volume (large compared to the distance between z particles) is ruled by the natural time-rhythm distribution, so inversely proportional to the distance.

It is noted that this is different from the time-rhythm distribution within individual z particles as expressed in equation (21). The time-rhythm distortion close to the centers of z particles is ignored when objects are being considered with a size that is far larger than the functional size of z particles.

12 Objects and z-density change

The empty space z-density ρ_z has been defined as the number of z particles per unit of distance in empty space.

The specific z-density ρ_m is the number of z particles per unit of distance, that have been displaced towards the outside of the object by the object's composing particles.

The change in z-density δ_z caused by an object with a specific z-density of ρ_m has been defined as:
$\delta_z = \rho_m / \rho_z$
$units : \delta_z : -; \ \rho : m^{-1}$

Which is, after dividing $[\rho_m = n_m/r]$ by $[\rho_z = n_z/r]$:

$$\delta_z = n_m / n_z \tag{32}$$

$units : \delta_z : -; \ : -$

or

$$n_m = n_z \ \delta_z \tag{33}$$

$units : \delta_z : -; \ : -$
with n_z as the number of z-particles over a distance in empty space and n_m the number of displaced z-particles after addition of the object.

A change in the number of z particles per unit of distance causes a change in the midway distance RZ between z particles.

$n = r/RZ$, so
$n_z = r/RZ_z$ or
$RZ_z = r/n_z$

$n_m = r/RZ_m$ or
$RZ_m = r/n_m$
As $n_m = n_z \ \delta_z$
$RZ_m = r/(n_z \ \delta_z)$

A change in the midway distance between z particles is here defined as

$$\delta_{rz} = \frac{RZ_z}{RZ_m} \tag{34}$$

$units : \delta_z : -; \ RZ : m$

Using this definition for δ_{rz} and inserting RZ_z and RZ_m:
$\delta_{rz} = \frac{r/n_z}{r/(n_z \ \delta_z)}$ or

$$\delta_{rz} = \delta_z \tag{35}$$

$units : \delta_{rz} : -; \ \delta_z : -$

13 Mass density versus z-density

Mass density can be expressed as the product of the atomic weight A_r and the molar mass constant M_u, per unit of molar volume V_m:
$\rho = A_r M_u / V_m$
$units : \rho : kg.m^{-3};\ A_r : -;\ M_u : kg.mol^{-1};\ V_m : m^3.mol^{-1}$

The dimensionless atomic weight A_r relates the mass of elements to the atomic mass unit (1/12 the mass of an atom of carbon).
The molar mass constant is $M_u = 1\ kg/mol$
The Avogadro constant N_A is the number of entities per mole:
$N_A = 6.02214179\ .10^{23}\ mol^{-1}$

The z-density reduction δ_z is caused by an object's composing elementary particles (z, t- and t+).

Without the presence of an object, the z-density is equal to the z-density of empty space ρ_z. Within an object, the specific z-density is reduced to ρ_m, as z particles have been displaced out of the object by the object's composing particles.

The number of an object's elementary particles is proportional to the number of atoms per unit of volume and the number of elementary particles per atom.
Except for the lightest elements, the number of elementary particles (z, t- and t+) per atom is proportional to the atomic weight.

The displacement causes that, the higher the number of elementary particles per unit of volume (the higher the mass density ρ), the higher the number of displaced z particles per unit of distance (the higher the specific z-density ρ_m).

The specific z-density ρ_m depends only on the mass density ρ, or, for elements under static conditions, on the atom number.

The **assumption** of a proportional relation between the displacement of z particles δ_z and the mass density ρ (not for small atoms) is expressed as:

$$\delta_z = k_z\ \rho \tag{36}$$

$units : \delta_z : -;\ k_z : m^3 kg^{-1};\ \rho : kg.m^{-3}$

k_z is the here implicitly defined z-density constant:

$$k_z = \frac{\rho_m}{\rho_z\ \rho} \tag{37}$$

$units : k_z : m^3 kg^{-1};\ \rho_z : m^{-1};\ \rho_m : m^{-1}; \rho : kg.m^{-3}$

14 Time-mass density versus mass density

Time-mass density has been defined as the quotient of the time-mass and the distance: $\rho_t = TM_r/r$
ρ_t (unit:b) could also be considered as the average time-rhythm within a volume.
A reduction of ρ_t means a reduction of the time-rhythm.

The specific z-density ρ_m of an object is the number of displaced z particles per unit of distance. The change in z-density is expressed by
$\delta_z = \rho_m/\rho_z$
A reduction of δ_z results in a time-rhythm reduction, as the distance between the z-particles increases.

The **assumption** that the time-mass density of an object is proportional to its specific z-density, and consequently to its δ_z, is expressed as:

$$\delta_z = k_d \ \rho_t \tag{38}$$

$units : \delta_z : -; \ k_d : b^{-1}; \ \rho_t : b$

with the here implicitly defined density constant k_d

Comparing equations (36) and (38) gives the relation between time-mass density and mass density:
$\delta_z = k_z \ \rho = k_d \ \rho_t$ or

$$\rho_t = \frac{k_z}{k_d} \ \rho \tag{39}$$

$units : \rho_t : b; \ k_d : b^{-1}; \ k_z : m^3 kg^{-1}; \ \rho : kg.m^{-3}$

Or, defining $k \ = \ \frac{k_z}{k_d}$

$$\rho_t = k \ \rho \tag{40}$$

$units : \rho t : b; \ k : bm^3 kg^{-1}; \ \rho : kg.m^{-3}$

The time-charge TQ (=TR.r) of an object is constant as the natural inversely proportional relation between time-rhythm and distance prevails.

As TR.RZ related to the same object is constant:

$$\delta_{tr} = \delta_{rz} \tag{41}$$

with $\delta_{rz} = \frac{RZ_z}{RZ_m}$.

Comparing equations (19), (32), (34), (35), (36), (38) and (41), and implicitly defining the (dimensionless) object-related density change δ:

$$\delta = \delta_z = \delta_{tr} = \delta_{rz} = \frac{\rho_m}{\rho_z} = \frac{n_m}{n_z} = \frac{RZ_z}{RZ_m} = k_d\rho_t = k_z\rho \tag{42}$$

This set of equations makes clear how mass-density, time-mass density and the distance between z particles are related.

15 Reduced time-rhythm within objects

The reduction of z-density within an object results in a reduction RR of the time-rhythm.
The larger the object, the larger and deeper the reduction of the time-rhythm within the object.
The highest time-rhythm change caused by the object is not an elevation at the edge of the object, but a reduction at the center.
The time-rhythm at the edge of the object remains unchanged, equal to the local time-rhythm TR_L.

Starting at center of a spherical object and going towards the edge, the time-rhythm increases at each concentric layer of z particles.
The relative time-rhythm at the center is RC.
The distance from the center is the radius r.
The edge of the object is at radius r_v.
Considering a spherical object and concentric layers separated by a distance equal to the distance RZ between z particles, than the number of layers per meter is $n = 1/RZ$

The total time-rhythm increase per unit of distance is δ_{tr}, hereafter δ.
As the distance between the layers is RZ, the time-rhythm change between two layers is δ/RZ.
As the time-rhythm increase per unit of distance is the time-field-strength, for $RZ \to 0$. The time-field-strength at the edge of the object is product of the local time-rhythm and δ/RZ:

$$FS_{r_v} = TR_L\frac{\delta}{RZ} \tag{43}$$

$units: FS: bm^{-1};\ TR: b;\ \delta: -;\ RZ: m$

The compounded time-rhythm at radius r is
$RR = TR_L - RC + TR_L(1 + \delta/n)^{r.n}$

For $RZ \to 0$, $n \to \infty$

As $lim_{n\to\infty}\ (1+\delta/n)^{r.n} = e^{\delta r}$:
$RR = TR_L - RC + TR_L\ e^{\delta r}$

As the time-rhythm RR at the edge is equal to TR_L, RC is equal to

$$RC = TR_L e^{\delta r_v} \tag{44}$$

$units : RC : b;\ \delta : -;\ r : m$

It is noted that the time-rhythm reduction at the center of an object cannot exceed the local time-rhythm: $RC < TR_L$.

Having RC, RR is expressed as

$$RR = TR_L(1 - e^{\delta r_v} +\ e^{\delta r}) \tag{45}$$

$units : RR : b;\ TR : b;\ RC : b;\ \delta : -;\ r : m$

The time-mass is the line integral of the enclosed time-rhythm. This is the difference between the local time-rhythm and the variable part of the time-rhythm multiplied by the number of layers $n = 1/RZ$:
$TM_r = \int(TR_L(1 -\ e^{\delta r})n).dr$
which is after integration (integration constant is 0):

$$TM_r = TR_L \frac{r}{RZ}\ (1 - e^{\delta r}) \tag{46}$$

$units : TM : bm;\ TR : b;\ r : m;\ n = 1/RZ : -;\ \delta : -$

The total time-mass of an object is the time-mass with $r = r_v$:

$$TM_{r_v} = TR_L \frac{r_v}{RZ}(1 - e^{\delta r_v}) \tag{47}$$

$units : TM : bm;\ TR : b;\ r : m;\ n = 1/RZ : -;\ \delta : -$

16 Increased time-rhythm outside objects

The z particles within empty space are displaced by the composing particles of an object. The displaced z particles are pushed outwards the object. This results in an increased z-density around the object that fades away as the distance from the object increases.
Around the object, the increased z-density results in an increased RI time-rhythm elevation. RI is the sum of the local time-rhythm TR_L and the time-rhythm 'lost' within the object and distributed as the absorbed loss of time-rhythm TR_a outside the object.

The distance between a point outside the object and the center of the object is symbolized by R.
The distance to the surface of the object is $R - r_V$ for $R > r_V$.

The time-rhythm adjustment is determined by the lost time-mass within the object, that must be absorbed. Consequently, the integral time-rhythm adjustment is equal to the absorbed time-mass TM_a.

Moreover, the time-rhythm adjustment TR_a outside an object follows the natural distribution: inversely proportional to the distance from the center of the object (with the distance multiplied by the number of layers $n = \frac{1}{RZ}$).

This is expressed by:
$TR_a.R.n = TM_a$ or
$TR_a = \frac{TM_a}{R\ n}$ or

$$TR_a = \frac{TM_a\ RZ}{R} \tag{48}$$

$units: TR: b;\ R: m;\ n = 1/RZ: -;\ TM: bm$

The absorbed time-mass is the integral of the lost time-mass density TM_{lost}/R:
$TM_a = \int_{r_v}^{R} TM_{lost}/R.dR$
After integration (integration constant is 0):
$TM_a = [TM_{lost} ln(R)]_{r_v}^{R}$ or

$$TM_a = TM_{lost}\ ln(R/r_v) \tag{49}$$

$units: TM: bm;\ R: m;\ r: m$

The lost time-mass within the object is TM_{r_v} from equation (47):

$$TM_{lost} = TM_{r_v} = TR_L \frac{r_v}{RZ}(1 - e^{\delta r_v}) \tag{50}$$

$units: TM: bm;\ TR: b;\ r: m;\ \delta: -$

Insertion of TM_{lost} into TM_a from equation (49) gives:
$TM_a = TR_L \frac{r_v}{RZ}(1 - e^{\delta r_v}) ln(R/r_v)$

Insertion of TM_a into TR_a from equation (48) gives
$TR_a = TR_L r_v (1 - e^{\delta r_v}) \frac{ln(\frac{R}{r_v})}{R}$
Since $RI = TR_L + TR_a$:

$$RI = TR_L \left[1 + r_v (1 - e^{\delta r_v}) \frac{ln(\frac{R}{r_v})}{R} \right] \tag{51}$$

$units: RI: b;\ TR: b;\ r: m;\ R: m;\ \delta: -$

The time-field-strength is the derivative of the time-rhythm:
$FS_R = dRI/dR$ or (for n layers per unit of distance):
$FS_R = d[TR_L \left[1 + r_v.n\ (1 - e^{\delta r_v})\frac{ln(\frac{R}{r_v})}{R}\right]]/dR$
which is after differentiation and substitution of $n = \frac{1}{RZ}$:

$$FS_R = -\frac{TR_L}{R^2}\frac{r_v}{RZ}(1 + e^{\delta r_v})(ln(\frac{R}{r_v}) - 1) \tag{52}$$

$units: FS: bm^{-1};\ TR: b;\ r: m;\ n = 1/RZ: -;\ R: m;\ \delta: -$

The time-field-strength at the edge of the object where $R = r_v$ is

$FS_{r_v} = \frac{TR_L}{r_v^2}\frac{r_v}{RZ}(1 + e^{\delta r_v})$ or

$$FS_{r_v} = \frac{TR_L}{RZ\ r_v}(1 + e^{\delta r_v}) \tag{53}$$

$units: FS: bm^{-1};\ TR: b;\ r: m;\ \delta_z: -$
or, using equation (47)

$$FS_{r_v} = \frac{TM_{rv}}{r_v^2} \tag{54}$$

$units: FS: bm^{-1};\ TR: b;\ r: m;\ \delta_z: -$

17 Comparing different objects

A change in the time-mass TM of an object, whether caused by a change in the specific z-density or by a change in the object's radius r_v, results in a change of the time-rhythm in and around the object.

The magnitude of the time-rhythm change is determined by the change in the time-charge TQ. The time-charge is constant for each object, but changes per object as it is related to the object's size and z-density.

The relation between the time-properties of an object are derived hereafter.

Time-charge has been defined as
$TQ = TR.r_v$ so
$TR = TQ/r_v$

Time-mass has been defined as
$TM = \int TR.dr$ or, inserting $TR = TQ/r_v$

$TM = \int TQ/r_v.dr$ or, after integration (integration constant is 0)
$TM = TQln(r_v)$ or
$TQ = TM/ln(r_v)$

Time-mass density has been defined as
$\rho_t = TM/r_v$ so
$TM = \rho_t r_v$

Combining the these transformed definitions for TQ and TM gives:

$$TQ = TR.r_v = \frac{TM}{ln(r_v)} = \frac{\rho_t r_v}{ln(r_v)} \tag{55}$$

Hereafter the properties are compared of a spherical object A - with a known radius r_a and a known relative z-density ρ_{t_a} - and a spherical object B with an unknown radius r_v and specific z-density ρ_t.

$$\frac{TQ_a}{TQ} = \frac{TR_a}{TR}\frac{r_a}{r_v} = \frac{TM_a}{TM}\frac{ln(r_v)}{ln(r_a)} = \frac{\rho_{t\ a}}{\rho_t} \cdot \frac{r_a}{r_v} \cdot \frac{ln(r_v)}{ln(r_a)} = \frac{\rho_a\ k}{\rho\ k} \cdot \frac{r_a}{r_v} \cdot \frac{ln(r_v)}{ln(r_a)}$$

Which set of equations can be expressed as the dimensionless set of equations:

$$\delta TQ = \delta TR\ \delta r_v = \delta TM\ \frac{ln(r_v)}{ln(r_a)} = \delta\rho_t\ \delta r_v\ \frac{ln(r_v)}{ln(r_a)} = \delta\rho\ \delta r_v\ \frac{ln(r_v)}{ln(r_a)} \tag{56}$$

Using a part of this set of equations gives:
$\delta TR\ \delta r_v = \delta\rho\ \delta r_v\ \frac{ln(r_v)}{ln(r_a)}$ or

$$\delta TR = \delta\rho\ \frac{ln(r_v)}{ln(r_a)} \tag{57}$$

18 Spin, propagation and polarization

The dynamics of this theory, caused by motion and collision of particles, are not addressed in this paper which covers the static aspects only. Consequently, this paper does not address electro-magnetism, waves and wave-like particles. The equations given in this paper provide the basic tools to expand this theory on these physical quantities.

The idea behind the dynamics of this theory includes that the preferred orientation of the rotating particles is such that the direction of the rotation matches gear-like with that of neighboring particles: left spin next to right spin etcetera.

The elasticity and rotation of the z particles cause the propagation of particles and waves through space with the tangential speed of z particles, which is the speed of light.

Moving waves and particles must have a forward effect on the static particles towards they are headed: polarization. Polarization is the change in the orientation of z particles, such that approaching particles will be routed in the same direction of their movement.

If a change in the z-density causes a time-rhythm change, the tangential speed of z particles and the rotational speed (number of cycles per beat) changes. This effect results in a frequency change and a change in the speed of propagation.

The subjects in this paragraph need further investigation.

19 Identification of elementary particles

According to this theory
- there are no other elementary particles than z, t- and t+ particles,
- t- particles have a constant negative time-charge of $TQ = -tq$,
- t+ particles have a constant positive time-charge of $TQ = +tq$,
- z particles have a fading charge and
- time-rhythm differences are the same as electric field strength

From experimentation it is known that
- the smallest particles are electrons, up quarks and neutrinos,
- electrons have a constant negative electric charge of 1 e,
- up quarks have a constant positive electric charge of 2/3 e and
- neutrinos have a very small mass and no measured charge.

Considering these observations, the working hypothesis is adopted that
- electrons are composed of t- particles,
- up quarks are composed of t+ particles and
- neutrinos are or are composed of z-particles.

Summarizing that
- electrons with an electric charge of 3/3 e are composed of t- particles,
- up quarks with an electric charge of 2/3 are composed of t+ particles and
- the time-charges of t- and t+ particles have equal absolute values

and also considering that the fast diminishing time-charge of z-particles do not provide for a strong binding force, the working hypothesis is narrowed down to:

electrons consist of 3 t- particles,

up quarks consist of 2 t+ particles and

neutrinos consist of 1 z particle.

In this theory fermions are compositions of z, t- and t+ particles. Electrons have the assumed ability to bind z particles, thus resulting in a variable mass

of z-electron compositions.
The following table demonstrates how fermions could be composed.

Particle	Symbol	Charge	t-	t+	z	Total
Up	u	2/3	0	2	0	2
Charm		2/3	0	2	1	3
Top		2/3	0	2	4	6
Down	d	-1/3	3	2	0	5
Strange		-1/3	3	2	0	5
Bottom		-1/3	6	2	4	12
Electron	e	-1	3	0	0	3
Muon		-1	3	0	1	4
Tau		-1	3	0	4	7
Neutrino			0	0	1	1
Neutron	n=ddu+4z	0	6	6	4	16
Proton	p=uud+4z	1	3	6	4	13
H atom	p+e	0	9	6	4	19
Fe atom	26p+30n	0	246	336	224	806

20 Connection with known physical quantities

Time-charge and time-mass versus electric charge and mass.

So far the elementary particles and the related static force fields have been defined and identified. The next step is to demonstrate how the theorized equations connect with the known physical quantities, assuming that
- time-mass is the same phenomenon as mass,
- time-charge is the same phenomenon as electric charge and
- electric force and gravitation are the same as time-force.

If time-mass (unit: bm) and mass (unit: kg) are expressions of the same phenomenon, then:

$$M = k_m TM \tag{58}$$

$units : M : kg;\ k_m : kg.b^{-1}m^{-1};\ TM : bm$
with k_m as the here implicitly defined time-mass constant

If time-charge (unit: bm) and electric charge (unit: Coulomb) are expressions of the same phenomenon, then:

$$Q = k_q TQ \tag{59}$$

$units : Q : C;\ k_q : C.b^{-1}m^{-1};\ TQ : bm$
with k_q as the here implicitly defined time-charge constant

Charge and mass of t- and t+ particles

The mass and charge of static electrons and up quarks are approximately:
Electrons:
Mass: $M_e = 9,11\ 10^{-31}\ kg$ (kilogram)
Electric charge: $Q_e = 3/3e = 16,0218\ 10^{-20}\ C$ (Coulomb)

Up quarks:
Mass: $M_{qup} = 35,83\ 10^{-31}\ kg$
Electric charge: $Q_{qup} = 2/3e = 10,6812\ 10^{-20}\ C$

As electrons consist of 3 t- particles:
$M_{(t-)} = (1/3)9,11\ 10^{-31}\ kg$ or

$$M_{(t-)} = 3,04\ 10^{-31} \tag{60}$$

$unit : M : kg$
And
$Q_{(t-)} = (1/3).1.60218\ 10^{-19}\ C$ or
$Q_{(t-)} = 5,34059\ 10^{-20}$ so
$TQ_{(t-)} = 5,34059\ 10^{-20}/k_q\ bm$

As up quarks consist of 2 t+ particles:
$M_{(t+)} = (1/2)35,83\ 10^{-31}\ kg$ or

$$M_{(t+)} = 17,92\ 10^{-31} \tag{61}$$

$unit : M : kg$
And
$Q_{(t+)} = (1/2)10,6812\ 10^{-20}\ C$
or, for t+ and t-:

$$Q_{(t+)} = 5,34059\ 10^{-20} \tag{62}$$

$unit : Q : C$

The z-density change δ

The z-density change δ can be determined by using the measured time-rhythm difference between Earth' surface and a flying altitude of 7.800.
This time-shift is given by the Schwarzschild metric:

$t_o = t_f\sqrt{1\ -\ \frac{2GM}{Rc^2}}$

The results of this metric have been verified by the Chesapeake Bay' experiment and the Hafele Keating experiment.

The result of the Schwarzschild metric is equal to the time-rhythm difference determined by using equation (51):
$RI = TR_L \left[1 + r_v(1 - e^{\delta r_v}) \frac{ln(\frac{R}{r_v})}{R} \right]$

This results in the following equation:

$\sqrt{1 \; - \; \frac{2GM}{Rc^2}} = r_v(1 - e^{\delta r_v}) \frac{ln(\frac{R}{r_v})}{R}$

From which δ can be resolved:

$$\delta = \frac{1 - \frac{\frac{R}{r_v} \sqrt{1 \; - \; \frac{2GM}{Rc^2}}}{\frac{ln(\frac{R}{r_v})}{R}}}{r_v} \tag{63}$$

Inserting:
- earth' radius $r_v = r_0 = 6,37 \; .10^6 \; m$
- $R = r_v + 7.800 = 6,37 \; .10^6 + 7.800 \; m$
- $TR_L = 1 \; b$
- $G = 6,6730 \; .10^{-11} \; Nm^2kg^{-2}$
- $M = 9,1094 \; .10^{-31} \; kg$
- $c = 299.792.458ms^{-1}$

results in

$$\delta_{Earth} = 8,93 \; .10^{-14} \tag{64}$$

The z-density constant k_q

Having δ, the z-density constant k_z (that connects mass-density to z-density) can be determined.
Since $\delta = k_z\rho$:
$k_z = \delta/\rho$
So, related to Earth, inserting $\delta = 5,8 \; .10^{-12}$ and $\rho = 5515kg/m^{-3}$ gives :
$k_z = [5,8 \; .10^{-12}]/[5515]$ or

$$k_z = 1,05 \; .10^{-15} \; m^3kg^{-1} \tag{65}$$

Time-elasticity of t- and t+ particles

The time-mass change for t- particles (because of the own force field) is expressed by using equation (25) for the uncompressed respectively the compressed time-mass:
$TM_{t-} = tq.ln(r_{t-}/r_0)$
respectively
$TM_n = tq.ln(r_n/r_0)$

The contraction quotient is:
$TM_{t-}/TM_n = ln(r_{t-}/r_0)/ln(r_n/r_0) = ln(r_{t-})/ln(r_n)$

The same for the expansion of t+ particles gives the expansion quotient:
$TM_{t+}/TM_n = ln(r_{t+})/ln(r_n)$

Dividing the contraction quotient by the expansion quotient gives:
$TM_{t-}/TM_{t+} = ln(r_{t-})/ln(r_{t+})$

As $M = k_m TM$:
$TM_{t-}/TM_{t+} = M_{t-}/M_{t+}$ and consequently
$r_{t-}/r_{t+} = M_{t-}/M_{t+}$
Insertion of M_{t-} and M_{t+} gives:
$r_{t-}/r_{t+} = [3,04\ 10^{-31}]/[17,92\ 10^{-31}]$ or
$r_{t-}/r_{t+} = 0,1695$

As $r_{t-} = r_n(1-\beta)$ and $r_{t+} = r_n(1+\beta)$,
$r_n(1-\beta)/r_n(1+\beta) = 0,1695$
resolving β gives:
$\beta = (1-0,1695)/(1+0,1695)$

$$\beta = 0,71 \tag{66}$$

$unit : \beta : -$

The elementary particles do not have sharp edges as their time-rhythm changes gradually fade away from their centers outward. The internal properties near the centers are significantly different than the external properties away from their centers. Consequently, the radius and radius-related time-mass cannot be clearly quantified. The radius and mass can only be determined by defining a virtual radius that separates the internal and the external properties.

The edge of a particle is here defined as the radius where the time-field-strength is X ($FS_{edge} = X$).

The uncompressed time-field-strength of t- particles is, using equation (24):
$FS_e = tq/r_{t-}^2$
Setting $FS_e = X$ gives:
$tq = X r_{t-}^2$

The classical electron radius expressed as Lorentz radius or Thomson scattering length is calculated as:
$r_e = 28,2\ 10^{-16}$

Since electrons presumably consist of three t- particles, the radius of one t-particle is smaller than the electron radius.

Setting the radius of a t- particle equal to the radius of an electron:
$r_{t-} = r_e = 28,2\ 10^{-16}$

and using $tq = Xr_{t-}^2$
gives

$$tq = 7,940787\ .10^{-30}\ X \tag{67}$$

The time-charge constant k_q

Using equation (59)
$Q = k_q TQ$,
substituting Q by $Q_{(t+)}$ from equation (62)
$Q_{(t+)} = 5,34059\ 10^{-20} Coulomb$

and substituting TQ by tq from equation (64) $tq = 7,940787\ .10^{-30}\ X$
k_q is determined as:
$k_q = Q/TQ = [5,34059\ 10^{-20}]/[7,940787\ .10^{-30}\ X]$ so

$$k_q = 6,7255156\ .10^{9}\ X \tag{68}$$

$unit : k_q : Cb^{-1}m^{-1}$

The time-mass constant k_m

The time-mass of t- particles can be expressed by using equations (7) and (25).
Equation (7): $TM_r = \int TR_r.dr$
and inserting TR from equation (25): $TR_{t-} = tq/(r_n(1-\beta))$
gives:
$TM_r = \int [tq/(r(1-\beta))].dr$
After integration (integration constant is 0):
$TM_r = -tq.ln(r(1-\beta))/(\beta - 1)$

Inserting:
$tq = 7,940787\ .10^{-30}\ X$,
$r_{t-} = 28,2\ 10^{-16}$ and
$\beta = 0,71$ gives:
$TM_{t-} = -[7,940787\ .10^{-30}\ X].ln([28,2\ 10^{-16}](1-0,71))/(0,71-1)$ or

$$TM_{t-} = 9,517881\ .10^{-28}\ X \tag{69}$$

Since $M = k_m TM$:
$k_m = M/TM$
Inserting for a t- particle:
$M_{(t-)} = 3,036460\ 10^{-31}$ and
$TM_{t-} = 9,517881\ .10^{-28}\ X$

gives:
$k_m = [3,036460\ 10^{-31}]/[9,517881\ .10^{-28}\ X]$ or

$$k_m = \frac{3,190269\ .10^{-4}}{X} \tag{70}$$

$unit : k_m : kg.b^{-1}m^{-1}$

Gravitational field versus time-field

In this theory the gravitational field and the time-field outside objects are expressions of the same phenomenon. Hereafter is derived how these physical quantities are mutually related.

The time-force between two time-masses is expressed by equation (12):
$TF = k_f.TM_1.TM_2/r^2$
$units : TF : m^2b^{-1};\ k_f : m^2b^{-3};\ TM = bm;\ r : m$
with the field-force constant k_f
Time-field-strength, see equation (54): $f = k_f.FS$ with $FS = TM/r^2$

The gravitational force between two masses is stated by Newton's law:
$F = G.M_1M_2/r^2$
$units : F : N;\ G : Nm^2kg^{-2};\ M : kg;\ r : m$
with the gravitational constant G.
Gravitational field-strength: $g = G.M/r^2$

As the time-field and the gravitational field are expressions of the same phenomenon, the field-strengths are proportional to each other as expressed below.

$$f = k_g g = k_g GM/r^2 \tag{71}$$

$units : f : m^2b^{-1};\ k_g : bm;\ g : mb^{-2};\ G : Nm^2kg^{-2};\ M : kg;\ r : m$
with k_g as the here defined time-gravitation constant

$$f = k_f FS = k_f TM/r^2 \tag{72}$$

$units : f : m^2b^{-1};\ FS : bm^{-1};\ k_f : m^3b^{-2};\ TM : bm;\ r : m$
with k_f as the field-force constant, defined in equation (11)

Comparing equations (68) and (69) gives:
$k_g GM/r^2 = k_f TM/r^2$ or
$k_g = k_f TM/GM$

Hereafter the quotient of k_g and k_f is determined by using the known values for electrons and TM_{t-} from equation (66):

$G = 6,6730\ .10^{-11}\ Nm^2kg^{-2}$

$M = 9,1094\ .10^{-31}\ kg$
TM_{t-} (3 $particles$) $= 3\ .\ 9,517881\ .10^{-28}\ X\ = 2,855365\ .10^{-27}\ X\ bm$

Insertion of $TM,\ G\ and\ M$ into $k_g = k_f TM/GM$ gives:
$k_g = k_f\ [2,855365\ .10^{-27}\ X\ ]/[6.6730\ .10^{-11}][9,1094\ .10^{-31}]$ or

$$k_g/k_f = 4,696772\ .10^{13}\ X \tag{73}$$

Mass density ρ versus z-density ρ_z

The z-density ρ_m within an object, the z-density ρ_z of empty space and the z-density change δ_z are determined by using earth as a test object with a known mass, volume and gravity.

Using $f = k_f FS$ and $f = k_g g$ gives:
$FS = (k_g/k_f)g$
Inserting from equation (70) $k_g/k_f = 4,696772\ .10^{13}\ X$ gives
$FS = 4,696772\ .10^{13}\ Xg$

Inserting Earth' gravity calculated as $G.M/r^2$ is $g = 9,822339\ ms^{-2}$ gives:
$FS_E = 4,696772\ .10^{13}\ X\ .9,822339$ or

$$FS_E = 4,613329\ .10^{14}\ X\ bm^{-1} \tag{74}$$

Using equation (54), the time-field-strength can be expressed as:
$FS_E = \frac{TM_E}{r_E^2}$

Resolution of TM_E, using Earth' radius $r_{v_E} = 6,37\ .10^6\ m$, gives:
$TM_E = [4,613329\ .10^{14}\ X][6,37\ .10^6]^2$ or

$$TM_E = 1,872533\ .10^{28}\ X\ bm \tag{75}$$

Since the time-field-strength at the inside and outside of Earth' surface are equal, equation (43) can be used:
$FS_{r_v} = TR_L \frac{\delta}{RZ}$
Inserting $\delta = 8,93\ .10^{-14}$, $FS_E = 4,613329\ .10^{14}\ X\ bm^{-1}$ and $TR_E = 1\ b$ gives:
$[4,613329\ .10^{14}\ X] = [1]\frac{8,93\ .10^{-14}}{RZ}$ so

$$RZ = \frac{1,9361\ .10^{-28}}{X} \tag{76}$$

RZ (the distance between z particles and their size in empty space) and X (the significance mark of the time-field-strength) remained unsolved.

An indication of the magnitude of RZ can be obtained by observing the z-density changed caused by the atoms in Earth.
Since Earth is composed of mostly iron atoms and the molar volume of iron is

known:
$V_{mol} = 7,11\ .10^{-6}\ m^3/mole$,
using Avogadros constant:
$Na = 6,00\ .10^{23}$ atoms per mole,
and using the concept (table in paragraph 'Identification of elementary particles') that the number of elementary particle per per iron atom is: 806 particle per atom,
gives the number of displaced z-particles per meter:
$n_m = \sqrt[3]{n.N_A/V_{mol}} = \sqrt[3]{[6,00\ .10^{23}][806]/[7,11\ .10^{-6}]} = 4,08\ .10^{10}$

Since $\delta = n_m/n_z$
and using equation (64), demonstrating that the z-density of empty space changes by Earth' iron atoms with:
$\delta_{Earth} = 8,93\ .10^{-14}$
results in
$n_z = n_m/\delta = [4,08\ .10^{10}]/[8,93\ .10^{-14}] = 4,57\ .10^{23}$

$RZ_z = 1/n_z$, so
$RZ_z = 1/4,57\ .10^{23}$ or

$$RZ_z = 2,19\ .10^{-24} \tag{77}$$

Having RZ, X is resolved by using equation (76):
$RZ = \frac{1,9361\ .10^{-28}}{X}$ so
$X = \frac{1,9361\ .10^{-28}}{2,19\ .10^{-24}}$

$$X = 8,85\ .10^{-5} \tag{78}$$

Having resolved the approximate value of X, the values of the X-related quantities can be resolved.
The elementary time-charge:
$tq = 7,940787\ .10^{-30}\ X = 7,940787\ .10^{-30}\ [8,85\ .10^{-5}]$ or

$$tq = 7,03\ .10^{-34} \tag{79}$$

The time-charge constant:
$k_q = 6,7255156\ .10^{9}\ X = 6,7255156\ .10^{9}\ [8,85\ .10^{-5}]$ or

$$k_q = 7,60\ .10^{13} \tag{80}$$

The time-mass of t- particles:
$TM_{t-} = 9,517881\ .10^{-28}\ X = 9,517881\ .10^{-28}\ [8,85\ .10^{-5}]$ or

$$TM_{t-} = 8,42\ .10^{-32} \tag{81}$$

The time-mass constant:
$k_m = \frac{3,190269\ .10^{-4}}{X} = \frac{3,190269\ .10^{-4}}{[8,85\ .10^{-5}]}$ or

$$k_m = 3,61 \tag{82}$$

The quotient of the time-force constant and the field-force constant:
$k_g/k_f = 4,696772\ .10^{13}\ X = 4,696772\ .10^{13}\ [8,85\ .10^{-5}]$ or

$$k_g/k_f = 4,16\ .10^{9} \tag{83}$$

The field-strength at Earth' surface:
$FS_E = 4,613329\ .10^{14}\ X = 4,613329\ .10^{14}\ [8,85\ .10^{-5}]$ or

$$FS_E = 4,08\ .10^{10} \tag{84}$$

Earth' time-mass:
$TM_E = 1,872533\ .10^{28}\ X = 1,872533\ .10^{28}\ [8,85\ .10^{-5}]$ or

$$TM_E = 1,66\ .10^{24} \tag{85}$$

21 Conclusion

Based on a few basic assumptions about the fundamental structure of the universe, a set of equations has been developed describing the basic static physical quantities such as time-charge, time-mass, time-field-strength and time-energy.

Since the constants that connect the theorized with the known physical quantities have been quantified, the theory is ready for application.

Although many parallels exist between this theory and the known reality, there are also fundamental differences that can be exploited to find new solutions for old problems and to find new opportunities.