Complete Relativity

Nature of observables

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Abstract:

This article presents the knowledge stemming from philosophy, mathematics and imagination applied to information accumulated through observation and experience of universes.

It is a universal framework postulating complete relativity of universes and scale invariance of physical laws, providing answers to, not only how, but why all sensible phenomena operate and exist.

In conclusion, everything must be relative in order to exist and everything exists and evolves in order to conserve this, existence conserving, relativity. Time and momentum thus form the intrinsic and fundamental signature of a universe.

Keywords: relativity, theory of everything, toe.

1. Introduction

A theory of everything observable must provide the framework which can be used to explain all phenomena in observable universes without exceptions - special cases. Complete relativity with incorporated invariance to scale has such power, offering profound understanding of nature. However, all creatures have limited senses and it would be naive to claim any theory is absolutely complete.

Its completeness is thus, inevitably, species relative.

2. Postulates

Here are the postulates of **Complete** relativity (**CR**). They are all *entangled* and one may stem from the other, but not always in apparent way.

⊦ 2.1. Everything is relative

> everything is variable *relative synonyms*

$$\Delta E > 0$$

No system can be completely isolated. Everything existing must be absorbing and radiating energy all the time, but never in the same amount during the same instant of time.

Relative isolation is possible and if oscillation is beyond the threshold of detection, the energetic state might be considered stable but this stability is dependable on the stability of the environment. Maintenance of such relative constancy requires energy.

$$\Delta E \neq \infty$$

There is no single, absolute and infinite universe (*Universe*). For any observer, there is a finite number of universes with mutually entangled characteristics, exchanging energy between each other.

One could argue that the sum of all universes is infinite and that sum is a single absolute entity. However, such *Universe* is absolutely unobservable and would absolutely not exist, at least not in the context of **CR**, where existence is relative. Although one can construct a theory on unobservables, such theory has no place in science, rather in religion where, generally, a value of zero may be inflated to infinity.

Infinities and zeros are mathematical abstractions - one may use zeros and infinities as relative quantities due to limitation in spatial or temporal resolution of observation but anything infinitely big or infinitely small simply does not have a place in anyone's reality.

In order for something to be absolute (absolutely real) it must be absolutely elementary. That would make it featureless, static and constant - with no ability to change (exchange energy). Thus, relativity is an intrinsic property of reality.

Relativity requires universes of different scales and each one is at some scale a part of a medium for finite speed of information (energy) exchange.

As transfer and transformation of energy requires capacity for energy storage the structural quanta of any medium must have real size.

- Every universe must be divisible and non-isolated - contained within a larger universe and contain universes of smaller scale,
- reality containing these universes must be at least **2** dimensional,
- everything is existentially entangled with everything at some scale of energy,
- universes of different scale (vertically parallel universes) are self-similar but instances are evolutionary dominantly separated in time,
- universes of the same scale (horizontally parallel universes) are self-similar but instances are evolutionary dominantly separated in space.

Since existence requires continuous exchange of energy, any relative constants (energies) must be oscillations. None of these oscillations can be absolutely stable - even the oscillation itself must change relative to something. Thus, each form of existence (energy) must evolve, either progressively or regressively.

However, evolutionary direction also must be relative. With finite speed of information (energy) transfer this implies discrete points of symmetry (event horizons) between different energies (oscillations).

Such points also imply self-similarity of universes and the existence of such a reference frame relative to which multiple universes of different scale (vertically parallel universes) are evolutionary synchronized.

Two-dimensional planes of reality must have some thickness to allow energy exchange - therefor, reality requires a **3**rd dimension.

Universes cannot have more than **3** spatial dimensions (there is no space for them!), although, due to scale invariance, space is effectively divided into subspaces and if these are frequently entangled, a multidimensional manifolds may be used to describe reality. As no more than **3** dimensions can be real, all extra dimensions are virtual and a result of entanglement in a **3**-dimensional space. One should thus be careful not to declare such entanglements (couplings) intrinsic and constant properties of reality - the strength of any entanglement must be variable in completely relative reality.

With no real constant values, all apparently constant values are average values over time and/or space, but changes may also be synchronized with the reference frame (strong entanglement).

Images (cloned moments) of a universe on one scale may exist on different scales.

A scale of a universe is a vertical discrete energy level, analogous to horizontal energy levels in **Quantum Mechanics** (**QM**).

The entanglement of space and time is an entanglement of space at different scales (scale entangled spaces).

Without infinitely fast (non-local) communication and static energy, relativity implies variability, even between strongly entangled systems.

- For any particle there is a reference scale relative to which that particle is virtual (unstable),
- for any particle there is a reference scale relative to which that particle is real (stable),
- structure of space affects the stability of particles,
- during lifetime, particles oscillate between relative existence and relative non-existence,
- everything oscillates between vertical energy levels through the transformation of scale of angular momentum properties (m,v,r),
- during oscillation, angular momentum (energy) is conserved,
- the scales of invariance of physical laws are discrete, with exponential progression and may be separated by multiple orders of magnitude.

⊦ 2.2. On absolute scale everything is conserved, relatively - everything is exchangeable

Absolute relativity in space introduces problems such as one in the relativity of containment. Consider two perfect spheres different in scale and located (centered) at the same point in space - how is it possible that a reference frame exists in which a bigger sphere is contained within a smaller one (non-dimensional rationality is relative)?

Conservation of relativity thus clashes with the conservation of rationality (intuition).

Seemingly, either non-dimensional rationality is relative or one must be sacrificed for the other.

Here, finite speed of information transfer enables an elegant resolution - conservation of both by exchanging relativity in space for rationality in time.

If two spheres oscillate in time between two scales and one does not discriminate between space and time, both quantities are conserved (rationality in space, relativity in time).

Thus, on absolute scale everything is conserved, but relatively even relativity can be sacrificed.

Note that, since existence is relative, existence of containment must be relative, so there also must exist a reference frame in which one cannot tell which sphere is contained within the other.

When integrated over time, such state may be interpreted as superposition of different states (spheres), while it's derivative in space is an entirely new sphere (as a result of fusion or superposition of multiple states).

It might seem that relativity of containment is generally not conserved, even in time. Consider the example of a chicken in an egg - there is apparently no oscillation, chicken might be growing inside the egg and will eventually get bigger than the egg but the egg is not getting smaller and is at no point inside the chicken.

Here, relativity of equality solves the problem - the egg was once inside the adult chicken. This means there must exist a reference frame relative to which there is no distinction between two chickens (relativity of identity). Such reference frame does exist and is enabled by the finite resolution (scale) of information carrier particle.

Effectively, both the chicken and the egg are oscillating over time. With absolute containment nothing would be able (required) to grow - neither chicken nor any other universe, with relative containment everything must grow.

Complete relativity and its conservation in reality is what makes everything possible.

Experience of reality is relative to how fast one is moving with respect to specific space and time (scale of space).

This enables distinction and differentiation of energy into species (group classification of energy transformation mechanisms). Obviously, no two individuals can be absolutely equal. Due to conservation of relativity, equality is forbidden - even two entities of different scale centered in the same point of space and time (which can be most similar) can only be absolutely equal at the central point of **0** volume.

Not only that, but if they do not separate in space, they must have inverted properties - due to oscillation they will at a certain moment in time occupy the same space (which is irrational/forbidden in space), thus, stable oscillation requires inverted properties (matter/anti-matter or charge). Attractive and repulsive forces thus emerge from the conservation of relativity.

One cannot tell with absolute certainty what is real and what is fictitious - if real is equal to rational (intuitive by recent experience or instinct - inherited experience) and fictitious to irrational.

For us, because we move too fast relative to it to experience it, time is mostly a fictitious (irrational) dimension, but there must exist a reference frame in which time is real and space is fictitious.

Such is the frame of a standard photon relative to the observable universe(s).

However, since it interacts, it exists and it cannot be absolute.

If mass and energy are equivalent in corpuscular form and frequency and energy are equivalent in wave form, and as witnessed, wave speed of a massive particle depends on its momentum, the assumption of special particles moving at finite constant velocity through space and having no mass is completely non-intuitive (such particle could only exist in time, not ever in space).

Apparently, both **General Relativity** (**GR**) and **QM** allow (or are at least partially based on) the existence of an absolute rest frame and the absolute **0** mass particle static in time but effectively moving through space as a wave with a finite constant velocity, completely disallowing any faster means of information transfer on any scale.

Assumptions like that make **GR** absolutely non-relative and in **QM** produce many non-intuitive phenomena in space which would otherwise be completely understandable.

Note that, if one does not discriminate between space and time (spatiality is the requirement for existence in **CR**), one could notice that space and time are inverted in **QM**. With such substitution it becomes much easier to understand the effects of **QM**. Statements such as:

- entangled photons are separated in time,
- a particle may exist in multiple points or states in time,

are intuitive (one can imagine time as a sequence of snapshots of a particle in space), as opposed to entanglement, non-locality and simultaneity in *ordinary* space.

Wave/particle duality with a change of scale (during collapse/inflation) also becomes intuitive, and a reasonable explanation of quantum tunneling.

It is reasonable to assume that the (default) scale of time relative to the scale of atoms is the scale of photons and gravitons, however, it is not impossible for the entangled scales of space and time to be of the same order of magnitude (ie. entanglement of a positron and electron).

Note that the speed in space is limited by the specific scale entanglement (it is now obvious that annihilation of matter and anti-matter must involve a change of scale).

If reality is completely relative (as logic dictates) and if violation of rationality exists in local space on small scales, due to scale invariance of physical laws, it should be happening on big scales too. Apparently, no such phenomena has ever been observed (although misinterpretation in some cases might not be

excluded).

However, assuming a reference frame exists relative to which space and time are inverted on small scales (where rationality is conserved in time, not in space), **QM** could be based on such a frame, though in that case, the treatment of small scales and big scales is improper - how can the same constants be used in both **GR** and **QM**?

With inverted space-time, radiation would not move through space and everything else (subatomic particles) would move close to the speed of light. Space on small scale would thus be aether composed out of *static* (they still can rotate at **c**) photons. Propagation of electro-magnetic (em) waves would thus be similar to propagation of electric current.

But here, a paradox arises - a transfer of momentum between adjacent particles which have **0** mass, occupy **0** volume and possibly have some spin momentum. Apparently, this aether does not exist but it transfers momentum at always equal and finite speed.

However, **GR** claims that this aether does exist and can even be curved - proportionally to mass provided by the subatomic particles (moving/orbiting close to **c**).

Obviously, both theories are fixed to an absolute rest frame (aether) emerging from the theory on em waves with a massless photon, violating rationality on both large and small scales.

In complete relativity, a particle simply cannot have **0** mass in one dimension and frequency in other, in order to exist it must have both (exist in both simultaneously).

There is no reason for intrinsic coupling of subatomic mass (space) and aether (time) curvature, therefor a reference frame must exist where there is no such coupling - *dark matter* is a direct evidence (in the context of **GR** dark matter must be some exotic invisible form of matter coupled with aether).

Aether thus has relative density and pressure and it can attract subatomic masses - which have their own aether coupled with them. This allows reference frames in which reality is intuitive even on small scales - electron can rotate faster than **c** (although this can be understood as the rotation of aether with electron matter being at rest relative to that aether), have a real radius and real orbits inside the atom.

With the atomic nucleus allowed to have its own rotating aether it becomes obvious why electrons do not emit energy when in a specific orbit - they are at rest relative to rotating space.

Relative electric permittivity (dielectric constant) and magnetic permeability of materials now make physical sense and can be attributed to the aether of the atomic nucleus.

Current (absolute) vacuum electric permittivity and magnetic permeability would be no different - these

would simply be the properties of an aether on a larger scale in which the atoms and large scale structures of the observable universe are embedded in.

Complete relativity with scale invariance of physical laws allows one to elegantly unify small scale and large scale physics, and do so while conserving sanity.

⊦ 2.3. Everything has an angular momentum

> everything has mass *relative synonyms*

All phenomena emerge from the intrinsic and inheritable spin and orbital angular momenta of space.

For something to exist and be observable, it must have a momentum.

Each angular momentum is composed of spin momentum quanta.

Capacitance of space allows transfer of momentum, but also its conservation. Any mass (energy) at relative rest is a conserved momentum in form of local spin momentum(s). The rest energy is thus locally conserved kinetic energy and a reference frame must exist relative to which the mass is in motion.

Each source of such momentum is a universe with its own associated quantized space. The space has density (gradient) and each quantum has a capacity.

Individual momentums may entangle to form larger structures, and with enough energy, fuse to form larger momenta. Since momenta are quantized not every momentum is stable, and even the stable ones are only relatively stable with a difference in decay rates.

Obviously, rest mass is relative and can differ even between individual particles of the same species.

⊦ 2.4. Everything is intrinsically entangled

All physically possible entities exist and are physically entangled, directly or indirectly. In absolute reality this would imply everything was initially condensed into a singularity, but in relative reality this is a consequence of omnipresent existences (energies) the spaces of which overlap (no absolute empty space, nothingness, or isolation).

The strength of relative entanglement depends on difference in entangled energy and distance:

$$\propto \frac{\sum E}{\Delta E} \frac{1}{r^n}$$

where **E** is the energy of space of entangled entity.

In case of weak direct entanglement, the strength is [relatively] constant, as difference in energy decreases with increase in distance ($\Delta E \propto r^{-n}$). This entanglement can be [relatively] broken with the formation of new direct entanglements, at which point it becomes indirect. Physical interpretation (manifestation) of ΔE is a carrier particle of entanglement which decreases in scale with increase in distance (decrease in scale decreases probability of interaction of a single particle and increases its velocity, but distance increases the number of such particles).

Strong (stable) direct entanglement is established when it becomes physically impossible to disturb the proportionality of ΔE and distance. This occurs when multiple particles are in the same state acting as a single particle so any applied energy is distributed equally on each particle (space), increasing entanglement.

Such (*bosonic*) particles are only virtually in the same state (they do not occupy the same physical space although their spaces overlap) and strong entanglement can be broken by more specific targeting using sufficiently small quanta of energy and adequate frequency.

⊦ 2.5. No real neutral particles

Since energy requires spin which can have different orientations, it is intrinsically polarized. Any apparently neutral system is thus a configuration of polarized systems and must stem from homogeneous charge distribution or polarity oscillation.

High frequency oscillations may be interpreted as a superposition of adjacent states, but in reality the period of oscillation is always > **0.**

All energy oscillates between different energy levels and with variable complexity, depending on the level of evolution.

⊦ 2.6. Physical laws are scale invariant

In nature, distance in quantized, but the size of quanta is not constant. Energy generally oscillates between stable discrete energy levels. These energy levels can be horizontal (as described by **QM**) or vertical. Horizontal energy levels differ in the amount of energy, vertical levels differ in the scale of energy. Once one recognizes vertical energy levels, the path to unification of apparent large scale forces (gravity), medium (electro-magnetic) and small scale (nuclear) forces becomes obvious - the quanta of energy are scale dependent and apparent *constants* are relative to scale.

Physical laws of nature are thus scale invariant, with stable scales appearing at discrete points between intervals of exponential progression.

Since everything changes all the time and cannot occupy the same space there can be no equal entities of the same scale in any universe. This implies everything must be composed of smaller entities and is a part of a bigger entity. All apparent equality is relative.

If absoluteness would be possible, absolute equality could exist between completely symmetric parallel universes relative to any point on an infinitely long line or surface centered (perpendicular) in between. But this also violates other postulates of **CR** (ie. this infinite line cannot have angular momentum).

Therefor:

- each entity (universe) has finite horizontal capacity - maximum number of entities of the same scale it can sustain in a stable state,
- any symmetry can be only relatively complete.

Thus, elementary particles are strongly relative to reference scale. From a smaller scale they will be evidently composite and differ from each other, while from a larger scale they may even be unobservable (non-existent).

⊦ 2.7. Coupling of matter and space is not intrinsic

Sources of gravity are discontinuities (gravitational maximums) in space providing vacuum energy for the effects of gravitational force. Space curvature is the effect of a gradient in vacuum potential (density).

Gravitational wells can exist on multiple scales and independently of massive matter.

Strong coupling is possible between a matter of a particular scale with a gravitational maximum of adjacent larger scale. Interactions of equal scale will produce orbits (weak coupling) or induce fusion.

Smaller scale matter coupled to a gravitational maximum has no large effects on space curvature (due to shielding effect), apart from usually negligible frame dragging and pressure due to kinetic energy (which should be attributed to gravitational maximums of matter particles).

The coupling can be lost simply by spin changes, as it includes a temporary change of scale through the exchange of spin momentum properties.

3. On equations

Equations are very useful and powerful constructs of a mathematical language. They can lead to new insights on details and plausibility of hypothesis, but can also be very deceiving.

Trying to decode nature with an almost purely mathematical mind is a way of brute force which will eventually induce systematic errors (due to non-intuitive conclusions) and bury the mind into a hopeless search for non-sense in a real sensible world.

Whether the equation is purely empirical or a product of sensible philosophy, it is relative. There are a lot of different spaces and times, and all are changing.

All dimensional constants are space and time relative, so - more constants the value of equation depends on, more unstable it is.

Dimensionless constants are generally stronger, but even these are not absolute.

When everything is relative, a presumption of absoluteness will eventually lead to discrepancies in measurement. Resolution of such discrepancies can be very *dangerous* if certain measurements are discarded based on age or deviation from presumed absoluteness in theoretical *fact*. This leads to bias, eventually transforming science into religion.

I will use mathematics where **I** feel the need for it, but **I** will not be rewriting **General Relativity** or **Quantum Mechanics** here. It should be rather simple for a theoretical physicist to make **GR** and **QM** completely relative. The framework presented in this paper and evidence in supporting articles should be enough to guide one to formal unification of the two, if one feels the need to do so. I, however, do not. After all, the **CR** does effectively unify these two universes and does so in a way most of the world can understand it.

I do not feel the need to further complicate its language.

> *Nature does not hide anything. Contrary. Things one cannot see on a small scale, are shown on a big screen. It is only the overblown ego wrapped into an envelope of false absolute uniqueness preventing one to see the obvious. To discover the true reality of eco-systems, it is necessary to collapse this unsustainable ego-system.*

4. Definitions

Here are the definitions of terms and expressions used in **CR**. Note that these may be different than standard or common definitions in everyday use.

4.1. n_{th} order observer

In the context of quantization (measurement) of physical phenomena, observer is an entity performing the measurement.

The order of the observer is a relative sum of the number of interactions in the act of measurement which affect its result.

In example, **1**st order observer may be the information carrier (radiation) particle, **2**nd order observer is then the radiation detector, etc.

Every observation is measurement, albeit not always a conscious one. Each measurement affects all interacting entities.

4.2. n_{th} order interaction

Consider the forces in **Newton**'s law of gravitation:

$$F = \frac{d}{dt}p = \frac{d}{dt}(mv) = ma = G\frac{m_1 m_2}{r^2}$$

$$F_1 = m_1 a_2 = m_1 \frac{m_2 G}{r^2} = m_2 a_1 = m_2 \frac{m_1 G}{r^2} = F_2$$

Here, the forces acting on bodies $\mathbf{m_1}$ and $\mathbf{m_2}$ are equal and have opposite direction, as expected for forces of action and reaction. These are considered actions and reactions at distance.

In **General Relativity** there is no action and reaction between the two bodies, but between the continuous space and a particular body. And it is not an action/reaction at distance (it is equal to **0**).

Note that in both cases the action/reaction is instantaneous, so even in **Newton**'s law the distance between the sources is effectively **0**, only the **1**st order sources differ.

In **Complete Relativity** there are no absolute zero and infinite distances, thus every action is action at a

distance which may only relatively be equal (set) to **0.**

The two bodies have an effect on space (and vice versa) but they also affect, albeit indirectly in **GR**, each other.

In **CR** with applied scale invariance, it is obvious that even the interaction between quanta of space and quanta of bodies must also be an action at a distance, albeit this distance is orders of magnitude shorter than distance between the bodies (without applied scale invariance on distance).

The sources of force of action and reaction are thus relative to scale - measuring on larger scale it may be more appropriate to attribute the sources to bodies, while on lower scale the sources may be the quanta of space.

From a **3**rd perspective one may consider the action between the force carrier particle in space (even if it is a bound *static* particle with potential energy) and a body as **1**st order interaction, and the interaction between two bodies as the **2**nd order interaction.

One may also consider the **1**st order interaction as relatively instantaneous, **2**nd order occurring at some speed **c**, **3**rd order at even some lower speed, etc.

In any case, distance is quantized and there is no absolutely instantaneous reaction to action (it requires quantum of distance equal to **0**, or, equivalently, infinite speed of carrier particles).

The relativity of sources (force carriers) and distances has an important consequence on the law of action and reaction - it needs generalization:

$$\int_{t=0}^{T} \left[\vec{F}_1(t) + \vec{F}_2(t) \right] dt = 0 \tag{1.1}$$

Instantaneous action and reaction is thus a special case of action and reaction impulses, where the period of energy oscillation **T** is compressed to an instant - a single quantum of time (dt **= T = 1**):

$$\vec{F}_1 + \vec{F}_2 = 0$$

Note the equivalence of distance in time and space of different scales - in the **1**st order interaction (**GR**) distance in space is **0**, while in the **2**nd order interaction (**Newton**) distance in time is **0.** Increase of distance in space between two bodies at **2**nd order scale proportionally increases the distance in time at **1**st order scale.

Also note that, although not required, it is not forbidden for action and reaction to be simultaneous, nor it

is forbidden for reaction to precede action, allowing relativity of cause and effect (something that is, with absolutely constant **c**, forbidden in **GR**).

The equation **1.1** is equivalent to momentum pulse (energy) reflection:

$$\int_{t=0}^{T}\Big[\vec{F_1}(t)+\vec{F_2}(t)\Big]dt=\int_{t=0}^{T}\Big[\frac{d\vec{p_1}}{dt}+\frac{d\vec{p_2}}{dt}\Big]dt=\int_{t=0}^{T}\Big[d\vec{p_1}+d\vec{p_2}\Big]=\Delta\vec{p_1}+\Delta\vec{p_2}=0$$

With **T** > **0**, action and reaction becomes a manifestation of energy oscillation.

Total reaction on the source when summarized over time will be equal to action.

Thus, even though the reaction may be fragmented and carried by intermediate force carriers following multiple curved paths, over time neutrality is conserved.

Such nature of non-apparent oscillation stems from different scales of energy quanta enabling diversity and evolution of complex forms of energy, its conduction and transformation.

Note that, due to relativity, the reaction does not even have to stem from the *original* action. It is only important that total action from, and reaction on, the same body over time is equal to **0.**

In example, the *original* action may be the reaction to action from a **3**rd body in which case the source returns to equilibrium after the action and the body may be interpreted as simply the energy conductor (momentum carrier).

In extreme cases, local force of reaction may be absent (due to capacitance) or negative, so the interaction is more appropriately described through conservation of momentum:

$$p_1+p_2=C$$

4.3. Superposition

Superposition is a special state of a system which is a combination (sum) of multiple possible states.

As such, it is an imaginary state, existing only in pure mathematical (abstract) form.

With each state having a unique physical interpretation, in reality, only effective superposition is possible - relative to the spatial or temporal resolution (scale) of the [**1**st order] observer.

A superposition in nature is thus either:

- an average value of oscillation between multiple states in time,
- an entirely different physical state, as a result of spatial transformation of state forming entities.

4.4. Universe (U)

Although any distinct form of energy in reality is a universe itself, generally, what is considered a universe will depend on context. In **CR**, what is commonly used is a scale of universe, which, by default, refers to a discrete scale of *elementary* energy, vertically entangled with bigger and smaller scale of such energy. These are the scales of *elementary particles*, the building blocks of intermediate unstable (evolving) scales of energy.

With applied scale invariance, physical laws in these universes are equal. Each universe oscillates between multiple stable states of different scale.

Oscillation includes a transition point, an intermediate unstable state representing the superposition of adjacent states.

Even though these universes are evolutionary coupled, due to distance in scale, there is distance in time. Larger universe may be living the past, while the smaller universe may be living the future of the superposition.

4.4.1. Charge (c) and scale (n.m) of a universe

Universe will typically refer to a scale. If it refers to a specific particle or a system of particles, charge may also be specified. There are two equivalent notations:

$$cU_{n.m} = cU(n.m)$$

n = vertical scale of the universe (0 = reference universe)
m = scale of the (horizontal) sub-universe
c ∈ {-, +}
n ∈ $\mathbb{Z}$
m∈ $\mathbb{Z}$

The **n** scales are usually chosen in such a way that $\mathbf{U_0}$ scaled energy quanta form the space (medium) of $\mathbf{U_1}$, while $\mathbf{U_{-1}}$ forms the space (medium) of $\mathbf{U_0}$.

If **m** is specified, the $\mathbf{U}_{n.m}$ denotes the sub-universe of scale **m**, larger than **n** but smaller than **n+1.**

If specified, charge **c** denotes the polarization, matter dominant (**-**) or anti-matter dominant (**+**).

4.5. Electric polarization

Particles can be positively (+) or negatively (-) charged. Positively charged particles may be referred to as anti-matter, negative as matter.

Charge is the effect induced by the polarization of a neutral gravitational field (space). Electric charge and gravitationally neutral mass can be, effectively, exchanged.

In **CR**, there is no missing anti-matter. Having equal amount of charge, but (orders of magnitude) different mass, electrons and protons belong to two different universes. For every electron there is a positron *hiding* beyond the relative event horizon of an atom - it is reformed (from proton energy) during electron-proton interaction (leaving +**1**e/**3** and **-1**e/**3** charge with neutral mass in the core).

In one interpretation, proton itself is the positron evolved in time in order to preserve the existence. Existence requires asymmetry, while with asymmetry, evolves diversity.

4.6. Elementary particle

An elementary particle is a stable particle that cannot be physically disassembled into individual stable particles. Since stability is relative, an elementary particle is defined with a consensus on required stability. Ideally, it would depend on context. In completely relative reality, it is thus reasonable to define defaults for any variables and *constants* (default reference scale).

In **CR**, by default, elementary particles of scale $\mathbf{U_0}$ in observable universe are protons and electrons.

4.7. Existence

> intrinsic momentum *relative synonyms*

Existence requires energy. Distinct forms of existence are distinct forms of energy. The source of all discrete quanta of energy is angular momentum.

Therefor, all *rest* energy is fictitious and is the result of accumulation of kinetic energy.

This momentum must exist in both space and time, although it may be fragmented into smaller quanta.

For any physical entity to exist, there must be a reference frame relative to which its angular momentum (L) is greater than **0**:

4.7.1. Single entity

$$|L = mvr| > 0 => |m|, |v|, |r| > 0$$

4.7.2. System of n entities

$$L = \sum_{i=1}^{n} L_i$$

4.8. General oscillation

With no absolute constants allowed, obviously everything must oscillate, even oscillation itself.

In reality thus, proper change of a variable in a space/time dimension $\mathbf{x_i}$ should generally be described with the appliance of the following operator:

$$\frac{d}{dx_i} = a_1 f\big(\omega_1 (x_i + \phi_1)\big)\Big[1 + a_2 f\big(\omega_2 (x_i + \phi_2)\big)\Big[1 + a_3 f\big(\omega_3 (x_i + \phi_3)\big)\Big[1 + \ldots\Big]\Big]\Big]$$

f = oscillation function

a_j = amplitude of j^{th} order oscillation

ω_j = frequency of j^{th} order oscillation

φ_j = phase shift of j^{th} order oscillation

where, generally, $\mathbf{a_j < 1}$ for $\mathbf{j > 1}$.

Multiple dimensions are generally entangled, so **f** may be **f**($\mathbf{x_i}$, ..., $\mathbf{x_n}$).

Note that nothing here can be an absolute constant, even the quanta such as $\mathbf{dx_i}$, if one is to take into account non-uniformity of space/time at the proper level.

4.9. Frequency of existence

Existence is relative and it depends on the scale of a reference frame (one cannot have the ability to measure energy at any scale possible), but it also oscillates between adjacent vertical scales (energy levels), to conserve relativity in time.

For a particular order of general oscillation and its period $\mathbf{T_x}$, frequency of existence is:

$$f_x = \frac{1}{T_x} = \frac{1}{\Delta T_1 + \Delta T_0}$$

where $\Delta\mathbf{T_1}$ is the average lifetime on a larger scale and $\Delta\mathbf{T_0}$ is the average lifetime on a smaller scale. By default, $\Delta\mathbf{T_0}$ is << $\Delta\mathbf{T_1}$, and $\mathbf{T_x}$ is approximated with $\Delta\mathbf{T_1}$.

Frequency of existence is a property of species but it fluctuates in value between individuals.

4.10. Intelligence

Intelligence is the ability of the individual to focus and produce objective (logical) thoughts optimally correlated in problem solving.

Nothing can exist without relativity, thus relativity must exist in intelligence too.

To conserve this relativity, two main classes of intelligence exist: extroverted and introverted.

Due to scale invariance, everything that happens outside of the body can happen inside the body. For strongly extroverted species everything that happens inside the body is virtual and inaccessible. Thus, extroverted species need external stimulation of senses to perceive reality.

Introverted species do not need external stimulation and are generally more energy efficient organisms with pronounced brain capacity. In extreme cases, introverted organisms are most of the time *closed* self-sustaining systems, do not have limbs, most expressed organ is the brain while other organs are subdued and mainly used to support brain function.

Generally, introverted organisms may be more intelligent, but with no externally projected consciousness may not be considered intelligent or, in extreme cases, even alive at all - by extroverted organisms.

This does not imply that introverted organisms cannot sense the external reality at all, they just do not act in it - or at least not with their own bodies.

Generally, life-forms are hybrids of extroverted and introverted intelligence. This is evident by the existence of dreams in extroverted species, however, lack of control and consistence in these make them virtual experiences for most.

The expression of intelligence of an individual is always a product of superposition of intelligence of

individual neuron cells.

Each class of intelligence has two components: material and spiritual. Intelligence is polarized when one component is higher than the other.

Progressive evolution of existence favors balance (harmony) so the amount of polarization is inversely proportional to amount of intelligence.

Increasing polarization thus signalizes regressive evolution (toward species of lower amount of intelligence).

4.10.1. Material intelligence

Material intelligence (**I_M**) is the amount of intellectual capacity used to ensure the survival of the body (short-term survival).

4.10.2. Spiritual intelligence

Spiritual intelligence (**I_S**) is the amount of intellectual capacity used to ensure the survival of the soul (long-term survival).

4.10.3. Intelligence potential

> real intelligence *relative synonyms*

The intelligence potential (**IP**) is a measure of intelligence.

The **IP** is plastic, and, in polarized (disease prone) individuals, can be strongly affected by diseases (such as depression).

$$IP = \frac{1}{\Delta I}$$

$$\Delta I = \left| \frac{1}{I_S} - \frac{1}{I_M} \right|$$

$$I_S + I_M = 1$$

$I_S, I_M \in \mathbb{Q} > 0$

4.10.4. Intelligence quotient

> amount of extroverted intelligence *relative synonyms*

Intelligence quotient (**IQ**) is a conventional measure of extroverted intelligence. While intelligence potential is invariant to form of intelligence, **IQ** and similar variants (ie. EQ) are a measure of such intelligence projected to (entangled with) external reality.

While **IQ** might be a good measure of **IP** for extroverted species, it is not well suited for extremes and is completely inadequate for introverted species.

> Some species of animals on **Earth** may be more intelligent than humans. Humans may be most intelligent among dominantly extroverted species but they are least intelligent among dominantly introverted species.

4.11. Total mass

> gravitational mass *relative synonyms*

Total mass is the sum of gravitational energy in space (img mass) and matter (real mass) of a body:

$$M = m_{img} + m_{re}$$

It is usually denoted with uppercase letter **M**.

4.12. Imaginary mass

> virtual mass *relative synonyms*

Imaginary or virtual mass is the energy of an empty (naked) gravitational well associated with a specific gravitational maximum.

This mass is usually denoted with $\mathbf{m_{img}}$.

4.13. Real mass

A naked gravitational maximum of a particular scale will attract matter. Real mass, relative to a particular maximum, represents the acquired mass of lower scale.

However, real mass (relative to particular scale) is also any compact mass of lower scale without a distinct gravitational maximum - usually such mass previously was a part of a larger body which had a distinct maximum.

It is usually denoted with $\mathbf{m_{re}}$.

With kinetic energy stored in the gravitational maximum (G), the increase of gravitational potential will result in the increase of real mass if matter of that scale is available in local space.

Due to conservation of momentum, addition of real mass will be decreasing kinetic energy until it drops to *rest* velocity.

However, real mass in a distinct gravitational well is always being converted to other forms of energy (through fusion, heat, chemical reactions, etc.) and lost energy will generally be periodically replenished, as long as real mass is available (effectively, imaginary mass is periodically being exchanged with real mass).

With the absence of a distinct gravitational well of larger scale, matter in a composite form of multiple filled wells of $\mathbf{U_0}$ scale, such as an asteroid, or a human being, will have real mass equal to total mass (some of these might have a distinct maximum, but it's energy relative to total energy is negligible).

Physical interpretation of real mass of $\mathbf{U_0}$ scale are standard particles. Since these particles (neutrons, protons, ..) are just a composition of charged and uncharged gravitational wells with their own real mass of even smaller scale, it is obvious that even real mass (matter) is not a different kind of energy, rather total mass of smaller scale:

$$\sum m_{re}(n) = \sum M(n-1)$$

With such recursion, real mass is obviously fictional.

Angular velocity of space (effective gravitational field line) at radius **r** of a gravitational well is defined by this equation (derived from **Kepler**'s laws):

$$v_s{}^2 = rg = \frac{GM}{r} \tag{R1.1}$$

while the capacity of the well is:

$$C = m_{img} - m_{re}$$

Well capacity is related to spin velocity of its maximum:

$$c_s{}^2 = r_s g_s = \frac{GM}{r_s} = G\frac{m_{img} + m_{re}}{r_s}$$

With the addition of matter (real mass), gravitational well is loosing its absorption capability (capacity being filled with matter). With increasing $\mathbf{m_{re}}$, and **G** remaining constant, $\mathbf{c_s}$ must be increasing, while $\mathbf{r_s}$ must decrease proportionally to $\mathbf{Mc_s}$ to conserve momentum.

However, with a decrease in $\mathbf{r_s}$, to satisfy above equation, $\mathbf{c_s}$ has to increase again, so this would eventually lead to singularity.

Note that, if $\mathbf{r_s}$, instead of initial decrease, increases proportionally to **M**, due to conservation of momentum, $\mathbf{c_s}$ cannot remain constant and has to decrease.

Decrease of $\mathbf{c_s}$, to satisfy the equation, has to again increase $\mathbf{r_s}$, so this, again, leads to infinity.

There are several solutions:

1. changes are compensated with a change in **G**,
2. decoupling of imaginary and real mass, where only imaginary mass has to satisfy the equation,
3. the equation is valid only in special cases (equilibrium).

Imaginary mass is dark matter and can decouple from real mass with spin change, here, however, the spin of two momentums remain synchronized.

While **CR** allows changes in **G**, without a change in scale, these changes are negligible.

For bodies with a distinct gravitational maximum, imaginary mass is generally bigger than real mass by several orders of magnitude, and with the addition of real mass it gets exponentially harder to reach imaginary mass (the velocity of real mass is limited by the velocity of the imaginary mass maximum $\mathbf{c_s}$, with the addition of mass, due to conservation of momentum, the velocity of real mass must decrease and thus cannot ever reach $\mathbf{c_s}$ having mass > **0**).

This can only be achieved with an impulse of external energy equal or greater than $\mathbf{m_{img}}$, usually provided in annihilation and fusion events, when, with a change in scale, $\mathbf{c_s}$ changes.

It is obvious that real masses of planets generally do not satisfy the equation. The solution number **2** is thus the real solution, and the valid equation for the maximum is:

$$c_s{}^2 = r_s g_s = G\frac{m_{img}}{r_s}$$

Note however, that each maximum has its own imaginary mass and will generally not satisfy equation **R1**.**1** relative to some inner maximum **GM** until it collapses to lower scale and forms the orbital body of that maximum.

Generally, real mass of planets doesn't even satisfy the **R1**.**1** equation. More real mass the planet has, discrepancy gets bigger.

Real mass can thus be determined comparing its orbital velocity with the velocity of the effective gravitational field line at its orbit.

If real mass is compact and forms a solid-like body (period of rotation is constant and doesn't depend on distance from the maximum) then it can be considered as a point particle orbiting at the barycenter of mass (maximum). Proper relativistic equation is then:

$$M = \frac{m_{re}}{\sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}}} + m_{img}$$

$$m_{re} = \left(M - m_{img}\right) \sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}}$$

$$v_{re} = \frac{2\pi r_{re}}{T_{re}} = \frac{2\pi r_s}{T_{re}}$$

v_{re}, r_{re}, T_{re} = orbital velocity, radius and period of rotation of real mass, respectively
c_s, r_s = velocity and radius of the maximum, respectively

With:

$$M\sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}} \approx m_{img}$$

real mass becomes:

$$m_{re} = m_{img} - m_{img}\sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}} = \left(1 - \sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}}\right) m_{img}$$

For **M = 2 m_{img}**, imaginary mass may be interpreted as the kinetic energy of real mass relative to the gravitational maximum (event horizon). That implies that the kinetic energy (orbital angular momentum) of real mass is the source of gravity, and thus the source of the maximum itself.

However, decoupling of real and imaginary mass, as well as intrinsic spin momentums of standard scale, require a different interpretation.

Creation of maximums (energy) out of nothing is not possible in **CR**, energy can only be transformed - this includes inflation and deflation from different scales. A maximum can also be understood as concentrated

quanta of [maximums of] smaller scale.

Assuming that these came from real mass, this would be storage of kinetic energy at distance (again requires decoupling, and requires smaller scale maximums which are, by recursion, composites of even smaller scale).

If real mass is quantized into multiple bodies with different periods of rotation, mass equation is:

$$M = \sum \frac{m_{re}}{\sqrt{1 - \frac{{v_{re}}^2}{{c_s}^2}}} + m_{img}$$

4.14. Event horizon value (EH operator)

As there can be no perfect symmetry, real mean value between different energy levels (generally, space and time) is never the arithmetic average. Since all real fields are gradients this value will generally be closer to one or the other pole.

The event horizon value is given by the **EH** operator:

$$EH_N(a,b) = \frac{c}{d}\frac{d+1}{c-1}a = \frac{c}{d}\frac{d-1}{c+1}b$$

$$a = \frac{d-1}{c+1}\frac{c-1}{d+1}b$$

where **N = c/d** is the event horizon order.

The inverse value:

$$\left[EH_N(a,b)\right]^{-1} = EH_{N^{-1}}(e,f)$$

The inverse must satisfy the following condition:

$$\frac{EH_N(a,b)}{\left[EH_N(a,b)\right]^{-1}} = \frac{c}{d}\frac{d+1}{c-1}$$

This gives:

$$\left[EH_N(a,b)\right]^{-1} = a$$

$$\frac{d}{c}\frac{c+1}{d-1}e = \frac{d}{c}\frac{c-1}{d+1}f = a$$

It is evident that all parameters (**a**,**b**,**c**,**d**,**e**,**f**) of an entity and its inverse are mutually entangled (**a**,**b**,**e**,**f**

strongly). As each entity (universe) has its inverse and each entity is a part of another entity, absolutely everything that exists is entangled.

Since one of the parameters can be omitted, the following notations may be used:

$$EH_{N}(a,b) = EH_{N}(a) = EH_{N}(,b)$$

4.15. Relativistic uncertainty

Naturally, when solving problems, one cannot measure all properties in real time. All properties (including time) change all the time (space).

Since everything is physical, no measurement can be performed without altering the subject of measurement.

However, one can take advantage of scale invariance (entanglement between scales) to measure properties of species beyond standard uncertainty.

The **Heisenberg** (standard) uncertainty principle, with its absolute (non-relativistic) form cannot be fundamental:

$$\sigma_x \sigma_y \geq \tfrac{1}{2}\boldsymbol{\hbar}$$

Proper relativistic uncertainty is:

$$\sigma_x \sigma_y \geq \tfrac{1}{2}\boldsymbol{\hbar}_n$$

$$\boldsymbol{\hbar}_n > 0$$

where $\hbar_{\mathbf{n}}$ is relative to scale [of energy] **n**.

It may thus be interpreted as a statement on the observational power of possible technology:

$$\lim_{n \to -\infty} \sigma_x \sigma_y = 0,$$

4.16. Zero

Absolute zero (non-existence) cannot exist. Thus, the value of **0** in physical systems always represents either the minimum value of a variable (or a relative constant) in an [relatively] isolated system or the limit in observation (for every **0** there is a *smaller* **0**).

4.17. Infinity

Absolute infinity cannot exist. Thus, the value of ∞ in physical systems always represents either the maximum value of a variable (or relative constant) in an [relatively] isolated system or the limit in observation (for every ∞ there is a *larger* ∞).

4.18. Graviton

> quantum of space spin momentum, closed gravitational field line *relative synonyms*

Graviton is a real or effective source of a general force field (vacuum gradient).

Real gravitons (gravitational maximums) are sources of general force, while effective gravitons are induced by real gravitons and are carriers of the force through the general field.

Generally, graviton is a low density (high vacuum), rotating region of space at some scale, more or less polarized.

Its shape depends on charge and spin momentum. The spin momentum is quantized and can generally be oriented *up* or *down* along a particular axis of quantization. In extremely charged state, graviton quanta are in a shape of [**2**-dimensional] rings differing in the direction of rotation and thus the polarization of a magnetic field.

In extremely neutral state, graviton is a **3**-dimensional boson, in the shape of a sphere and localized on its **2**-dimensional surface. In such state it is a source of gravity (electro-magnetic component of general force is subdued).

Relativistic momenta may further distort the shape of a graviton.

Thus, in reality, graviton is split into at least **3** components - **1** neutral and **2** charged spins, forming an ellipsoid with openings on poles in size proportional to the amount of charge.

Radius of charged components differs due to asymmetry in charge, with the radius of neutral component forming gravitational maximum in between, at equilibrium.

Due to relativity of superposition and asymmetry in charges, the graviton generally has dual nature. Bodies close to the graviton may experience strong gravitational force and almost no electro-magnetic force, while at large distances bodies may experience electro-magnetic force and almost no gravitational force.

Charges are composed of multiple opposite charges different in mass. This difference in mass is reflected

in charge carrier particles - they travel at different velocities, therefor, a phase difference exists between positive and negative charge carriers, increasing with distance. The difference in phase is thus proportional to relative charge felt by other bodies (although, the density of this charge decreases with distance).

If two bodies are in resonance (cycling at the same frequency) this will cause repulsive force, while a certain phase difference will cause attraction.

Charged particles are thus *only* relatively charged - at close proximity, difference in speed of carriers has a negligible effect and electro-magnetic force becomes gravity.

4.19. Gluon

> non-polarized graviton, quantum of gravity *relative synonyms*

Gluon is a non-charged graviton, a superposition of anti-aligned space spin momenta. It can be formed by splitting and neutralization of a charged (spin) momentum into up/down superposition with external stimulation or by pairing of two spin anti-aligned gravitons.

4.20. Gluon tube

> wormhole, quantum of entanglement *relative synonyms*

Gluon tube is a product of gluon deformation (stretching) between multiple particles.

Can be interpreted as a distortion in space connecting two gluons.

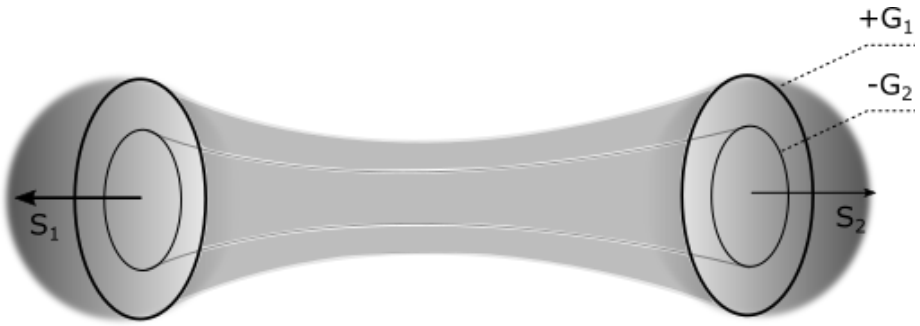

***Fig. 1**: Gluon tube*

Fig. 1 shows the gluon tube, with induced cross-sectional capacitance due to spatial separation of gravitons $\mathbf{G_1}$ and $\mathbf{G_2}$.

4.21. Event horizon

> gravitational maximum, soul maximum *relative synonyms*

Event horizon is a real graviton having maximum potential (energy) of a gravitational well.

Each localized (distinct) living being has its associated gravitational maximum. It represents the soul of the organism. The loss of consciousness should thus be interpreted as a temporary collapse of such maximum, while death would indicate a permanent decoupling of maximums [and their wells] with particular matter, with which it was entangled at birth and development.

4.22. Gravitational well

> spiritual well *relative synonyms*

Gravitational well is a distortion of space caused by the associated gravitational maximum. A gravitational well may also be a superposition of multiple wells - containing multiple gravitational maximums centered at the same *point*.

Gravitational field of a well can be described by **Yukawa** potential.

All gravitational wells rotate with speed proportional to graviton density. This rotation of space is the source of centrifugal force which prevents a gravitational collapse and enables particles to be at rest relative to space and thus not loose energy while orbiting other bodies.

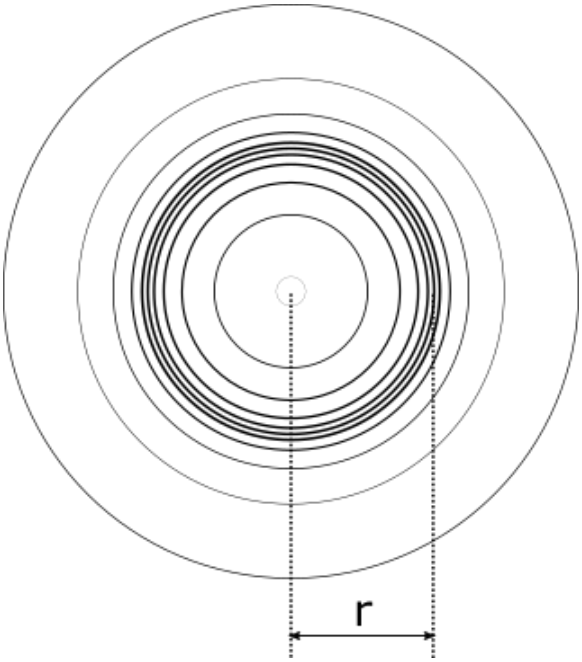

***Fig. 1**: Gravitational well scheme*

Fig. 1 shows a cross-section of a gravitational well with a maximum radius **r**. Density of gravitons is represented by concentration of circles (gravitational field lines), it is greatest at event horizon **r**.

Matter approaching the well at velocity lower than escape velocity will get captured by the well. Difference in angular momentum between matter and the well causes friction and results in emission of energy in form of radiation. This may continue until angular momentum of matter becomes equal to the momentum of space (the effect of matter on well space momentum in negligible).

The decay and inverse decay of elements can create distortions in the gravitational field.

4.23. Black hole

Black hole is a gravitational well having one or more large scale gravitons whose escape velocity is greater than the speed of light.

The more charged black hole is, more two-dimensional it will be and the density of the [neutral] gravitational field will be decreasing from equator to the pole. Thus, the gravitational escape velocity (without taking rotation and other factors into account) will be much lower at the poles (note that, otherwise, the particles forming magnetic field lines cannot be standard photons, but even of smaller scale, as they would have to be faster than light).

This restricts the feeding potential of a black hole, so, instead of acquisition of matter, most mass may simply be accelerated at the equator ring and ejected through the poles at extreme velocities. In an ideal case, such black hole does not acquire additional energy and is simply the most efficient transformer of energy (life-form) - transforming composite energy into individual charged particles so these can be digested elsewhere (in stars, where they combine to form hydrogen fuel).

In reality, however, some matter will have a momentum parallel to the equator plane and may form a disc of orbiting material.

Note that a black hole is only relatively special form of a gravitational well. Particles faster than light must exist (even if one cannot detect them due to small scale) and every gravitational well has a relative event horizon - digesting energy of one scale and ejecting smaller scale ions which then combine to feed *moons*. The only difference is scale.

Note that this explains why each metabolism is ionic and why most elements in geochemistry are ions.

This scale invariance also indicates that discs of material around stars and planets, like in the case of black holes, are formed due to charge of the host at the time of formation - grater charge will create thinner discs.

Note that the trajectory of ejected charges is bent by the magnetic field lines and these can be considered as a form of intestines.

4.24. Strong force and strong entanglement

Since space cannot be absolute, it has properties and energy which can be transformed. Thus, it will not always be homogeneous and isotropic.

Strong force is the force holding the particles of the atom nucleus together. It is a properly scaled general force, strongly localized with the compression of space (metric) and separation of charge mass and gravitational mass.

Furthermore, a particle/anti-particle pair in the same quantum state is generally strongly entangled. Energy applied to such pair may generally and effectively not result in separation of particles rather in stretching of space in between, which will, with enough energy result in the annihilation/inflation of a pair of particles forming that space.

Assuming that a binding of electron to proton localizes proton charge into a positron, the structure of a photon becomes obvious - it is an electron/positron pair of a smaller scale, which, when absorbed by an atom, results in stretching of space between entangled positron/electron pairs.

Emission of a [standard] photon can then be understood as effective linearization of the orbital momentum of an event horizon [quantum], between a pair of entangled particles, with **Keplerian** velocity equal to the speed of light.

Note that the escape velocity of such event horizon is $\sqrt{\mathbf{2}}\mathbf{c}$, so it is a black [hole] event horizon. Note also that **Keplerian** velocity of electrons, being *above* the horizon, have to be $<\mathbf{c}$, while, due to presence of inner maximums (event horizons), **Keplerian** velocity of positrons can be $>\mathbf{c}$ if they orbit in space of a maximum with even higher **Keplerian** velocity.

However, the structure of a photon may not necessarily be limited to electron/positron pairs, other particle/anti-particle combinations are possible, resulting in heavy photons or neutrinos.

Note that all these particles have to have mass so the momentum of a photon is never absolutely linear.

Also note that **Keplerian** velocity is effectively independent of orbiting real mass, which explains why photons and neutrinos travel at equal speed.

4.25. Weak entanglement

Particles connected with gluon tubes may be entangled in such a way that correlated properties are anti-aligned. Gluon tubes are always physical, however, if strong physical connection is not apparent and the correlation is fragile, the physical entanglement is weak.

As long as there is no change in energy resulting in the change of entangled properties the entanglement will not be broken, even if the particles are spatially separated.

Due to the fact that energy remains constant, the volume of the gluon tube connecting the particles must remain constant. With increase in distance, the gluon tube thus deforms - being stretched between the particles and contracted in the cross-section.

Contraction of gravitons concentrates the vacuum (force) to the middle of the tube, increasing the speed (and the speed limit) of information transfer proportionally to decrease in scale (speed of information is proportional to spin velocity of gravitational maximums [of the gravitons]).

Note that, at infinite distance, cross-section in the middle would be zero and, in such case only, this would become a non-local phenomena. However, absolute non-locality is unreachable.

Note also that this can be interpreted as the stretching of the metric, with no increase in spatial separation (in that context, for the observer in the tube there is no change in **c**).

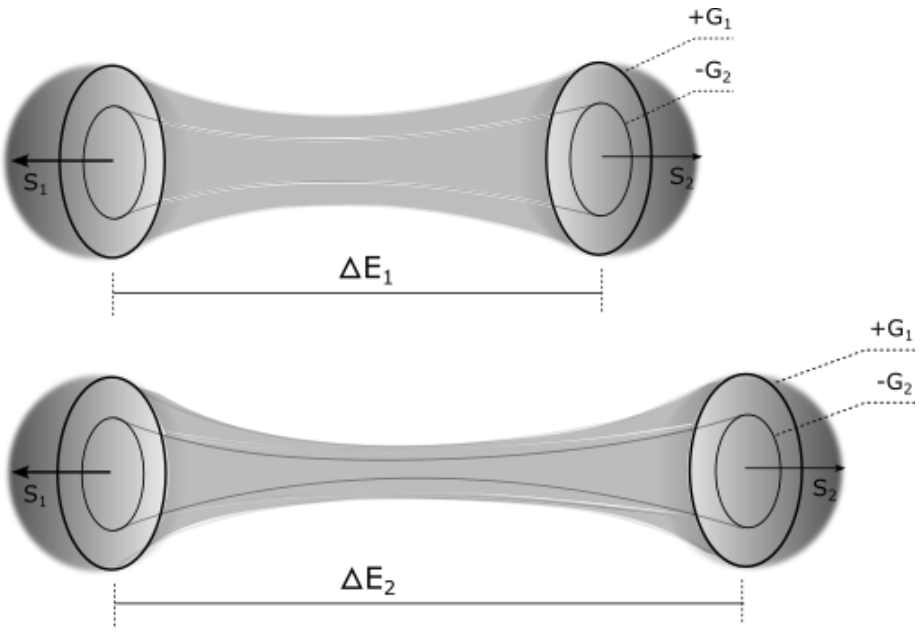

***Fig. 1**: weak entanglement*

$$\Delta E_1 = \Delta E_2 = \Delta E = \text{const.}$$

4.26. Constant

A constant is a property [of a system], non-changeable in a particular space and/or time domain (there are no absolute constants). Depending on the size of the domain, the constant may be weak or strong.

Naturally, all properties oscillate so the existence of constants is relative to the resolution (unit quantum) of space/time of the observer.

4.27. Proper reference frame

Given the fact that there is no ideal (constant) uniformity, no entity is absolutely at rest relative to any reference frame.

A suitable reference is then usually a *point* relative to which the ratio of constants to variables of the observable system is maximal:

$$\lim \sum (\Delta x_i > \hbar_x) = 0$$

However, due to scale invariance and relativity of constants, one must also introduce the concept of a proper reference frame, to be used in comparison of systems of differently scaled, but otherwise, equal species. In case of polarized frames, a proper [neutral] reference frame may be required even in case of systems of equal scale, to provide more accurate (objective) view of reality.

Given the fact that all momentums are inherently angular, a suitable reference is often an orbital potential (energy level).

A proper reference frame for a comparison of two systems of equal species on different vertical energy levels is a frame relative to which both have such rest mass by which the [scale] invariance of species is preserved.

5. Discrete states of invariance

> energy levels *relative synonyms*

Discrete states of a universe are stable states with invariant (entangled) mechanics. There are vertical and horizontal discrete states (energy levels).

In horizontal states the [energy] difference between the levels is of the same order of magnitude.

In vertical states the difference is in multiple orders of magnitude.

One example of horizontal states are electron energy levels in atom, whereas two vertical states are an atom and a planetary system.

5.1. Progression of states

The progression of discrete states of scale invariance is exponential. For horizontal states, in the top-bottom approach (energy inversely proportional to **n**):

$$E_n = \frac{E_1}{n^2} = E_{n-1}\left(\frac{n-1}{n}\right)^2 ; \;\; n > 1,\, E_1 = \text{const.}$$

For vertical states (energy proportional to **n**):

$$\log(E_n) = \log(E_{n-1}) + (n+1)n = \log(10^{(n+1)n} E_{n-1})$$

For example, the mass of **Neptune** (**U_1**.e) can be obtained from standard electron (**U_0**.e) mass:

$$\log(M_N) = \log(M_e) + (n+1)n\,; \;\; n = 7,\, M_e = 9.10938356 * 10^{-31}\, kg$$

$$M_N = 10^{\log(M_e)+8*7} = 0.910938356 * 10^{26}\, kg$$

Mass of the standard [unpaired, or half-] photon (**U_{-1}**.e) is obtained from electron mass (**n = 6**):

$$M_e = 10^{\log(M_p)+7*6}$$

$$M_{p_e} = 10^{\log(M_e)-7*6} = 9.10938356 * 10^{-73}\, kg$$

Assuming symmetric pairing of positive and negative charge, mass of the standard photon is then twice this mass:

$$M_p = 1.821876712 * 10^{-72}\, kg$$

Of course, the values obtained above will deviate slightly from current values due to fluctuation and the fact that the energy of the outermost electron in **Carbon-10** (corresponding to **Neptune**) slightly differs from the free electron energy used above.

In effect, **Neptune** is a [vertically] excited electron, and electron is the excited photon [scale] electron.

It is obvious now that the [**42** orders of magnitude] difference between electric and gravitational force between two electrons is sourced in the difference in mass between the standard photon [electron] and electron - also **42** (**7*****6**) orders of magnitude.

With a change in vertical energy level, the nature of the force evolves, exchanging polarization (electro-magnetic potential) for neutral gravitational potential or vice versa, depending on the direction of evolution.

However, even the nature of the force must be relative, it is thus likely that even in standard atoms at the same scaled conditions as the **Solar System** is in, the constituent particles of the atom are held together by properly scaled gravitational force, while particles outside of the atom dominantly feel the electro-magnetic force as external space is still polarized.

This makes the nature of the force dependent on distance and frequency of oscillation.

Similar to neutral pions, standard photon is composed of a particle/anti-particle pair ($\mathbf{U_{-1}}.e^{-}/\mathbf{U_{-1}}.e^{+}$). These have anti-aligned **1**/**2** spin momenta, with aligned orbital momenta forming the total spin of the photon.

Unpaired photon should be understood as half-photon, a polarized component of the standard photon ($\mathbf{U_{-1}}.e^{-}$ or $\mathbf{U_{-1}}.e^{+}$).

The scaling *constants* of potentials, such as the **Yukawa** potential, are thus scale (vertical energy level) dependent.

Note the following:

$$M_{p_e} = \frac{M_e}{M_N} K_A = \frac{M_e}{M_N} 1.02413 * 10^{-16}\, kg$$

where $\mathbf{M_N}$ = **1.02413** * $\mathbf{10^{26}}$ kg is the mass of **Neptune**, and quantum of mass $\mathbf{K_A}$ = **1.02413** * $\mathbf{10^{-16}}$ kg (**5.7** * $\mathbf{10^{19}}$ eV = **57** EeV) is the mass (energy) of asymmetry.

If standard electron mass would be equal to $\mathbf{K_A}$, the unpaired photon would have mass equal to **K** * $\mathbf{10^{-42}}$,

and the system would be symmetric relative to the electron.

The asymmetry breaking energy of **5.7** * **10^{19}** eV must be the energy limit for <=**U_0** particles produced in any universe conforming to the above progression of vertical states. This includes the **Solar System** and likely all systems in **Milky Way** galaxy.

Studies confirm this energy as the cutoff energy[1] for intra-galactic sources[2].

It is also in agreement with the measurements of **GZK** (**Greisen-Zatsepin-Kuzmin**) energy limit (cutoff) for protons - **5.6±0.5±0.9** * **10^{19}** eV[3].

None of the masses are constant, like in the case of electron or **Neptune**, mass of the photon is dependable on frequency (energy level).

The splitting of energy levels can also occur, under the influence of external fields, in vertical states.

As electromagnetic force is a polarized gravitational force, mass of the standard graviton neutrino can be deduced from photon e mass:

$$M_n = \frac{^{10}C \text{ atom mass}}{\text{electron mass}} M_p \approx \frac{10.016853\,u}{M_e} M_p = 2 * 1.663337576 * 10^{-68}\,kg = 3.326675152 * 10^{-68}\,kg$$

Since electron energy is the half-photon energy of the **U_1** (**Solar System**) scale, the **^{10}C** atom mass is the mass of a *static* carbon graviton half-neutrino of **U_1**:

$$M_{n_{e_1}} = 10.016853\,u = 1.663337576 * 10^{-26}\,kg$$

This graviton may be interpreted as the standard carbon *dark matter* particle. The mass corresponds to **9.33063546** * **10^9** eV (**9.33063546** GeV) of energy and is in agreement with empirical evidence[4].

> Note that there is no single dark matter particle. Any naked soul (gravitational maximum) of any scale is a particle of dark matter.

5.2. Lorentz factor

With complete relativity, relativistic corrections must be relative themselves. Scale invariance (vertical energy levels) implies change of metric [units]. Without this change, one must change the value of *constants* accordingly. Thus, the **Lorentz** factor cannot be valid for all scales.

This is also obvious from another standpoint - one of logic. In current form, the **Lorentz** factor allows a body of infinite mass to move, bound by the same speed limit as any other body of mass. Since such mass

requires infinite energy just to start moving, its speed limit is effectively **0**, it cannot be **2.99792458** * $\mathbf{10^8}$ m/s, nor any other number > **0.**

Similarly, a particle of zero mass should have a speed limit equal to infinity.

Thus, if one is to use absolute formal limits instead of effective, one must relativize zero and infinity. But, once zero and infinity are relative, obviously speed limits can be broken.

Speed limits are thus relative to rest mass.

> Generally, speed limit depends on density/pressure of space. However, density/pressure is relative to scale (not all scales of energy are equally sensitive to specific density/pressure [scale]).

Since rest mass is also relative, at the point the speed limit is broken, rest mass of the body increases to another level, speed decreases to *rest* velocity, while the speed limit decreases to value associated with the new level.

The **Lorentz** factor should thus have the form:

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{{c_n}^2}}}$$

when applied to rest mass:

$$\gamma = \frac{m_n}{\sqrt{1 - \frac{v^2}{{c_n}^2}}}$$

$$m_n \propto \frac{1}{c_n}$$

where **n** is the vertical energy level.

Breaking of speed limit thus requires appliance of a minimum discrete amount (impulse) of energy which can take the body to another vertical energy level.

This allows for planetary systems such as the **Solar System** to be inflated atoms or a system of bound, but individually inflated particles.

Note that inflation must be sufficiently fast to preserve the structure, but it cannot be infinitely fast to break

the inevitable asymmetry.

It is likely that such inflation is triggered by matter/anti-matter annihilation (similar to annihilation/inflation of standard photons into standard electron/positron pairs).

Such event is both, the moment of death, and birth, since it likely occurs in the space of a dark matter particle pair (soul, gravitational maximum) where one pair is inflated and the other collapses (exchange of souls) - ie. a collision occurs at $\mathbf{U_0}$ energy level, one pair inflates to $\mathbf{U_1}$, other collapses to $\mathbf{U_{-1}}$.

Since there are no absolute universes, any universe must be inflating in another universe, thus any *anomalous* energies might have a source in that larger universe.

The speed limit of $\mathbf{c = 2.99792458 * 10^8}$ is the speed limit for $\mathbf{U_0}$ particles (ie. standard electrons), speed limit for $\mathbf{U_1}$ scale is lower, while for $\mathbf{U_{-1}}$ scale it is higher.

Standard photons can travel faster than **c** even though one [of standard scale] cannot detect such photons *directly*. However, spin magnetic momentum of electron is the evidence of half-photons (photon electrons) orbiting at velocities faster than **c**.

One might interpret this momentum as imaginary, but one should then interpret its intrinsic nature and zero radius as relative.

6. Implementation of scale invariance

There is no absolute invariance. Thus, even to scale, physics can only be more or less invariant. There are two interpretations of this:

- inflation/deflation between scales is never absolutely instant,
- communication between scales in never absolutely instant.

Both are true. Thus, there will always be some phase difference in correlation (entanglement) between scales.

Quantities which are best preserved between the scales are scalar and non-dimensional [ratios].

There are two approaches to the implementation of scale invariance.

One can either scale the metric [units] or redefine *constants*. What is more convenient will depend on the reference frame.

Discrete scales of invariance are also relative. There is always energy at intermediate scales, products of multiple quanta of a particular scale.

One might wonder which constant to use for energy between two adjacent discrete scales. However, generally, discrete scales are the stable scales - with no additional energy supply, intermediate energy will decay/defragment to rest energy of the lower scale. Only when excited by [at least] the difference in energy between two discrete scales (levels) its rest energy will change scale and thus conform to the *constants* of that scale.

7. The unification

If everything is relative, nothing can be intrinsic, apart from the change (momentum), the nature of which is observer dependable.

The *continuum* of space should not be an exception.

7.1. Relativistic space

In **General Relativity** space is absolute and its properties are coupled to the speed of light through this relation:

$$c = \sqrt{\frac{1}{\epsilon_0 \mu_0}}$$

ε_0 = vacuum electric permittivity = **8.85418782** * 10^{-12} F/m

μ_0 = vacuum magnetic permeability = **4**π * 10^{-7} H/m

This can be rewritten in terms of energy density **ρ** and pressure **p**:

$$\epsilon_0 = K_\epsilon \frac{F}{m} = K_\epsilon \frac{s^4 A^2}{m^3 kg} = K_\epsilon \frac{s^4 N^2}{m^3 m^2 kg T^2} = K_\epsilon \frac{s^4 kg^2 m^2}{m^3 m^2 kg s^4} \frac{1}{T^2}$$

$$\epsilon_0 = K_\epsilon \frac{kg}{m^3} \frac{1}{T^2} = K_\epsilon \frac{kg}{m^3} \frac{1}{T} \frac{C}{N} \frac{m}{s} = \rho_s \frac{1}{B_1} \frac{1}{E_1} v_1$$

$$\mu_0 = K_\mu \frac{H}{m} = K_\mu \frac{mkg}{s^2 A^2} = K_\mu \frac{mkg m^2 T^2 s^4}{s^2 kg^2 m^2}$$

$$\mu_0 = K_\mu \frac{ms^2}{kg} T^2 = K_\mu \frac{ms^2}{kg} T \frac{N}{C} \frac{s}{m} = \frac{1}{p_s} B_2 E_2 \frac{1}{v_2}$$

$$\text{for } E_1 B_1 = E_2 B_2\text{:}$$

$$c = \sqrt{\frac{p_s}{\rho_s} \frac{v_2}{v_1}} = \sqrt{\frac{p_s}{\omega \rho_s}}$$

K_ε = **8.85418782** * 10^{-12}

K_μ = **4**π * 10^{-7}

and now in terms of energy **E** and mass **m**:

$$\epsilon_0 = \rho_s v_1 = \frac{m}{V} v_1$$

$$\frac{1}{\mu_0} = p_s v_2 = \frac{E}{V} v_2$$

$$c = \sqrt{\frac{E/V}{m/V} \frac{v_2}{v_1}} = \sqrt{\frac{E}{m} \frac{v_2}{v_1}}$$

From this follows:

$$E = \frac{v_1}{v_2} mc^2 = \omega m {v_r}^2$$

$$\omega = \frac{v_1}{v_2} = \frac{v_r}{\sqrt{{v_r}^2 - v^2}} = \frac{1}{\sqrt{1 - \frac{v^2}{{v_r}^2}}}$$

Here, factor **ω** is the non-dimensional relativistic factor.

In **GR**, energy is always limited by the energy of **CMB** (**Constant Microwave Background**) rest frame (**v_r = c**), which itself is thus always at rest (**v = 0**).

The **CMB** rest frame is considered absolute, it's energy intrinsic and non-changeable.

In **QM** discrete energy is limited to the scale of a standard photon.

In **CR** there are no such restrictions, **CMB** is not absolute, each gravitational well has its own space and there are, not only horizontal but, vertical energy levels corresponding to the scale of a discrete packet of energy.

The energy of **CMB** is not intrinsic in **CR**, but the result of velocity (**v**) equal to **c**, relative to a rest frame **v_r** > **c**, and having a *rest* mass < **mc^2/v_r^2**.

Obviously, absolute rest mass is fictional - using recursion:

$$\lim_{v_r \to \infty} m = 0$$

This rationality of energy is the source of its discreteness.

There are no absolute rest frames and no isolated systems. It is thus possible for a system to exceed the energy limit imposed by the rest space (limit is only effectively exceeded, in reality it is the limit which has increased), but this energy must have an external source.

The scale of such energy must be lower than the scale of the rest space. However, the cross-section of radiation quanta decreases with scale thus decreasing the probability of interaction.

Effectively, in equilibrium conditions, there will be a cutoff discrete energy scale beyond which the

possibility of interaction is so low that a certain rest frame can be considered absolute.

In order to be effectively isolated, it must have such escape velocity that only radiation below the cutoff scale can cross its boundaries (event horizon).

All other scales of energy are, depending on the scale, either reflected or fragmented to a digestible scale.

In non-equilibrium conditions (ie. at the event of spin change or collapse of the *cutoff* rest space) when the entanglement with the *cutoff* rest frame is lost, the limit is increased.

In the observable universe the *cutoff* rest frame is the **CMB** rest frame and the cutoff scale is the scale of the standard photon.

All energy (above the *rest* energy) in the observable universe was thus accumulated during inflation (which occurs during a change of energy level, spin change) when it was accelerating (if it is negatively polarized) or decelerating (if positive) relative to underlying external space.

7.2. Omega factor

> relativistic change *relative synonyms*

Omega factor is a non-dimensional relativistic factor, a generalization of the **Lorentz** factor. It is a necessary modification in order to allow relative size of energy quanta and scale invariance of laws of nature.

Each gravitational well is characterized by its **εμ** product defining its rest value, physical interpretation of which is the curvature, or density gradient, of well space.

Omega factor represents the change in this value due to kinetic energy (momentum).

Changes in momentum affect the radii of maximums and it is appropriate to derive the omega factor from an ellipse:

$$\frac{k^2}{1^2} = \frac{v^2}{c^2} + \frac{1^2}{\delta^2}$$

$$\delta = \frac{1}{\sqrt{\frac{k^2}{1^2} - \frac{v^2}{c^2}}}$$

$$\omega = k\delta = \frac{1}{\sqrt{1 - \frac{v^2}{k^2 c^2}}}$$

c = standard speed of *light*

where **k** is quantized and depends on the vertical energy level (scale of energy).

Note that ω^{-1} is the eccentricity of the ellipse of width equal to **2kc** and height equal to **2v**.

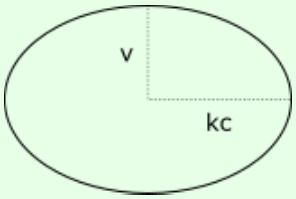

***Fig. 1**: Relativistic ellipse*

With **k = 1**, width is fixed to **c** and omega factor degenerates to **Lorentz**.

Note also that if **k** itself has the form of ω^{-1}, degeneration to **Lorentz** becomes degeneration of a variable ellipsoid to an ellipse of fixed width.

However, this should be further generalized, to allow polarization of space and summation of (sensitivity to, awareness of) different scales of energy.

In a physical reality in which every universe (or distinct form of energy) has a momentum the energy of which is stored into its gravitational maximum, it is appropriate to introduce the concept of rest velocity for rest frames (or rest spaces), equal to:

$$v_{rn} = \sqrt{\frac{1}{\omega \epsilon \mu}}$$

ε = rel. const. (ie. **8.854** * $\mathbf{10^{-12}}$ F/m)

μ = rel. const. (ie. **4**π * $\mathbf{10^{-7}}$ H/m)

where

$$\omega = \omega_n = \omega(n, q_0) = \left(\frac{1}{\sqrt{1 - \alpha_n}} \right)^{-sgn(q_0)},$$

$$\alpha = \alpha_n = \sum_{m=1}^{m=\infty} \frac{v^2}{{v_{r(n-m)}}^2} \approx \frac{v^2}{{v_{r(n-1)}}^2},$$

$n \in \mathbb{Z}$

$m \in \mathbb{N}$

and **n** is a discrete (vertical) energy level of the rest frame, **v** and $\mathbf{q_0}$ its velocity and charge (polarization),

respectively, relative to rest frame *chosen* by the observer (since awareness of the observer is generally limited to adjacent vertical levels of energy, this frame will usually be n-**1**, and n-**2** for larger scales of energy).

7.2.1. Degeneration to Lorentz factor

For a negatively polarized rest frame, and $\mathbf{U_{n\text{-}2}} << \mathbf{U_{n\text{-}1}}$ ($\mathbf{v_{r_{(n\text{-}2)}}} >> \mathbf{v_{r_{(n\text{-}1)}}}$):

$$\alpha_n = \frac{v^2}{{v_{r(n-1)}}^2}$$

Fixing all discrete packets of energy to single scale where $\mathbf{v_{r_{n\text{-}1}}} = \mathbf{v_r} = \mathbf{c}$ is the speed limit (speed of *light*) on that scale, **Omega** factor becomes **Lorentz** factor:

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$

7.2.2. Effect on charge and mass

Effective electric charge **q** and mass **m** now become:

$$q = q_n = \frac{q_0}{\omega}$$

$$M_{img} = M_n = \omega M_0 = \frac{q_0}{q} M_0$$

$$M_{re} = M_{n-1} = \frac{M_{0-1}}{\omega} = \frac{q}{q_0} M_{0-1}$$

$\mathbf{q_0}$ = rest charge = rel. const. (ie. **1.60217733** * $\mathbf{10^{-19}}$ C)

$\mathbf{M_0}$ = img rest mass = rel. const.

$\mathbf{M_{0\text{-}1}}$ = real rest mass = rel. const.

$$m = \sum_{i=0}^{\infty} M_{n-i} = \sum_{i=0}^{\infty} \omega^k M_{0-i} \approx M_{img} + M_{re}$$

$$k = k(i) = -1^{(i \mod 2)}$$

Note 1: All indexed parameters ($\mathbf{q_0}$, $\mathbf{M_0}$, $\mathbf{M_n}$, etc.) are simply factors of proportion, relative to scale of choice. Since rest state of energy is relative (nothing is absolutely at rest), using recursion, one concludes that the only intrinsic property of a universe is change (evolution), but in order for it to exist, multiple universes (bigger and smaller scale) are required.

7.2.3. Effect on radius

Effective radius of a gravitational maximum also depends on ω:

$$R = \omega R_0$$

R_0 = rest radius

For negative charges it increases with velocity, for positive decreases.

7.3. Energy

A distinct form of energy (universe) can be composed of one or more discrete scales of energy, and each of these is a universe:

$$E = \sum E_n = mv^2$$

where **v** is the rest velocity of a rest frame (usually **n-1**).

Since kinetic energy of a system is stored in discrete gravitational maximums, its distribution and magnitude will depend on the scale of such maximums in a system.

A system of $\mathbf{k_n}$ particles (**k** distinct gravitational maximums of scale **n**) will have much smaller energy (**~10**$^{\mathbf{-n^r}}$) than the same system with **1** additional maximum of a larger scale (**>= n+1**). Here the larger maximum would correspond to imaginary mass, while real mass would be the sum of quanta of smaller maximums.

Changes in momentum can result in collapse (fragmentation) of **n** maximum into **n-1** maximums and fusion of **n** into **n+1** maximums.

Fusion and fragmentation into intermediate states (≠ k**n**, k ∈ $\mathbb{Z}$) is possible, but the stability (mean lifetime) of such states will be inversely proportional to distance from stable states.

Each gravitational maximum with its associated gravitational well (space) is characterized by its ω factor the value (and thus nature) of which depends on the frame of reference.

Consider the interaction of particles a_n and b_n in space of a $\mathbf{U_{n+1}}$ universe - from the perspective of a universe c_k ($n < k < n+\mathbf{1}$, $c_k \in \mathbf{U_{n+1}}$) the interaction might be polarized (electro-magnetic), but from the perspective of a universe d_m ($m < n$, $d_m \in a_n$) a non-polarized (gravitational) interaction may prevail.

7.4. General force

The general force acting on a particle (ie. moon maximum) of mass **m**, charge **q** and velocity **v** is the sum of polarized (electro-magnetic) and neutral (gravitational) force.

The source of the force is a general rotating gravitational maximum with its associated space (field of quantum potentials):

$$\vec{F} = qm\vec{S} + qm\vec{v} \times \vec{B} + qm\vec{E} + qm\vec{G} = qm\vec{S} + qm\vec{M} + qm\vec{E} + qm\vec{G}$$

$$\vec{F} = qm(\vec{S} + \vec{M} + \vec{E} + \vec{G})$$

with the charge/mass radius of a maximum reduced to infinitesimal value:

> Even though the maximum has multiple associated charges and real charge/mass radii, to simplify equations, it is useful to reduce it to a point particle, especially in cases where it effectively is a point particle - ie. when space/time resolution is such that real radii or the oscillation in charge/mass distribution cannot be determined.

$$\vec{M} = \vec{v} \times \vec{B}$$

$$\vec{B} = \frac{1}{m}\mu\frac{q_r}{r^2}\vec{v_r} \times \frac{\vec{r}}{r}$$

$$\vec{E} = \frac{1}{m}\frac{1}{\epsilon}\frac{q_r}{r^2}\frac{\vec{r}}{r}$$

$$\vec{G} = \frac{1}{q}\frac{1}{g}\frac{m_r}{r^2}\frac{\vec{r}}{r} = \frac{1}{q}\frac{1}{r}{v_s}^2\frac{\vec{r}}{r}$$

$$\vec{S} = \vec{v} \times \left(\frac{1}{q}s\frac{1}{r}\vec{v_s} \times \frac{\vec{r}}{r}\right)$$

ε = electric permittivity of space (*$\mathbf{4}$π)

μ = magnetic permeability of space (/$\mathbf{4}$π)

g = **1**/G = real density of space-time at the maximum (used vacuum capacity)

s = relativistic factor

M = spin electric field at **r**

B = magnetic field at **r**

E = electric field at **r**

G = gravitational field at **r**

S = spin gravitational field at **r**

v_s = spin velocity of space [field line] at **r**

where $\mathbf{m_r}$, $\mathbf{q_r}$ and $\mathbf{v_r}$ are mass, charge and velocity, respectively, of the field maximum, **r** is the distance between the maximum and the particle.

Note that **s** is non-dimensional (invariant) and must be equal to:

$$s = \frac{v_s v}{{c_n}^2}$$

For **n = 0** ($\mathbf{c_0}$ **= c**), using substitution:

$${v_s}^2 = \frac{Gm_r}{r}$$

, with the angle **φ** between **v** and ($\mathbf{v_s}$ x **r**) being equal to the angle between $\mathbf{v_s}$ and **r**, the **qmS** term reduces to:

$$qm\vec{S} = \frac{Gm_r m v^2}{c^2 r^2} \sin^2 \phi$$

which, when simplified to one-body problem - using reduced (effective inertial) mass (**m** = **μ**, $\mathbf{m_r}$ = **M** + **m**), becomes the correction factor to gravitational potential from **General Relativity**:

$$V(r) = \int qm\vec{S} dr = -\frac{G(M+m)\mu v^2}{c^2 r} \sin^2 \phi$$

At extreme momentum change, polarized and neutral components can exchange potential - **E** exchanges with **G**, while **M** exchanges with **S**.

Note that in equilibrium $\mathbf{v_s}$ = **v** ($\mathbf{v_s v}$ becomes $\mathbf{v_s}^2$), and, using the above substitution for $\mathbf{v_s}^2$, spin gravitational vector **S** becomes:

$$\vec{S} = \vec{v} \times \left(\frac{1}{q} \frac{G}{{c_n}^2} \frac{m_r}{r^2} \vec{v_s} \times \frac{\vec{r}}{r} \right) = \vec{v} \times \left(\frac{1}{q} k \frac{m_r}{r^2} \vec{v_s} \times \frac{\vec{r}}{r} \right)$$

k = specific vacuum density [m/kg]

making the vector **S** the gravitational equivalent to spin electric vector **M**.

Note also that even the ratio between *constants* of the polarized and neutral force vectors is equal:

$$\frac{1}{\epsilon} \frac{1}{\mu} = \frac{1}{g} \frac{1}{k} = G \frac{{c_n}^2}{G} = {c_n}^2$$

This cannot be a mere coincidence - it is the result of symmetric potential exchange (entanglement) between **E**/**M** and **G**/**S**.

One might assume that with the change in scale, charge (**q**) is exchanged with mass (**m**), while **μ**, **ε** and **g**, **s** exchange with distance, however, all non-dimensional *constants* should change with scale.

Note that if momenta are quantized on one vertical energy level, they must be quantized on all levels - from a proper (scale invariant) reference frame.

Due to [relatively] low energy oscillations in vertical scale (ie. neutrino, lepton oscillation) caused by the splitting of a vertical level, inflation of a system of multiple bodies may inflate different bodies [of the same species] to different [relatively] low energy levels and the quantization might not appear conserved (as timescales might be inadequate to detect oscillation).

Also note that, with a change in level (ie. oscillation), due to finite speed of propagation of changes in space, distant bodies might not feel the same force as local bodies.

7.4.1. Proper relativistic treatment

Force vector *constants* are scale relative (and not necessarily all of equal scale), thus, not only **c**, but **μ**, **ε**, **s**, **g**, **k** and **G** should all be properly scale indexed, ie:

$$\mu_{-1},\ \epsilon_0,\ s_0,\ k_0,\ g_1,\ G_0,\ G_1,\ c_0$$

7.4.2. Mechanism of exchange

The exchange of electro-magnetic potential for gravitational potential is done through the change of scale. In example, the radii of charge maximums may be deflated with inflation of a mass radius of a gravitational maximum. This doesn't affect only orbital radii of maximums but the spin radii of maximum quanta - effectively, the charge is subdued (reduced) with the inflation of mass (gravity).

Note that no external energy is required as this is simply a change of force flavor, not strength, making it a part of natural (general) oscillation.

However, even as such, the process needs stimulation.

The triggers may be:

- annihilation of matter with anti-matter,
- critical temperature/density (extremely low, extremely high).

As part of natural oscillation, triggers are the signals of resonance. Each inflation of a maximum is relatively simultaneous with deflation of a maximum of the same species at some finite distance of space (time) and each will emit gravitational waves of equal scale. Thus, the absorption of such wave will trigger the inverse action.

However, propagation speed of these signals [of entanglement, or, action and reaction] is also finite (even if it increases with scale decrease), thus, the lifetime in a particular state is always greater than **0**, but also must be less than infinity.

The exchange of potentials of general force is common in birth and death of bosons and boson (**Bose-Einstein**) condensates.

It is also the source of equivalence of bosenovas and supernovas, galaxies and quantum vortices, planetary systems and atoms.

Note also that multiple boson waves of one type (action or reaction) can be absorbed before the absorption of a wave of the inverse type, which also explains the additional inflation of the observable universe, which is just a part of a larger gravitational maximum.

7.5. Gravitational constant evaluation

Gravitational constant is not fundamental:

$$G = \frac{1}{2}\frac{A_s}{M}\frac{v_s}{T_s} = 2\pi\frac{R^2}{M}\frac{v_s}{T_s} = \frac{3\pi}{\rho}\frac{1}{{T_s}^2} = \frac{R}{M}{v_s}^2 \quad \left[\frac{m^3}{kgs^2}\right]$$

A_S = surface area of the gravitational maximum

R = radius of the maximum

M = mass of the maximum

ρ = mass density of the maximum

v_s = orbital velocity of the maximum [space]

$\mathbf{T_s}$ = period of rotation of the maximum [space]

It is relative to a particular gravitational maximum and has its properties, such as mass, radius and velocity, built in. These are generally variable properties.

Even if, generally, all these variables are correlated in such a way that **G** remains constant, are they correlated (entangled) at all times and do changes propagate instantly?

In **CR**, instant propagation of information is [absolutely] impossible and some phase difference between changes in [**G** and] the variables will always exist. The **G** itself must oscillate.

Obviously, a gravitational maximum has a [changeable] spin momentum and this can further be complicated when it is evidently composed of multiple maximums.

While the **3**-dimensional (spherical) form of one maximum will cloud the existence of inner maximums, outer maximums can have different spin momenta. Even if the whole system changes spin, changes cannot be instantaneous across all maximums, rather propagate in a wave-like nature.

The **G** can thus be generally described as a waveform of [maximum] potentials.

Rotational profiles of galaxies show that **1**/**R** is often not proportional to $\mathbf{v_s^2}$. Even if outer maximums have collapsed (fragmented) to multiple satellite maximums of smaller scale, these cannot acquire [real] mass instantaneously nor they will always acquire [real] mass during collapse.

Although collapse requires energy, it doesn't necessarily have to come from real mass. Unlike in **GR**, gravitational collapse in **CR** is not reserved for massive bodies, the energy for collapse depends on the initial energy of the maximum.

The maximums can thus remain naked for long times, proportionally to scale and inversely proportional to mass (energy) field density, before the equilibrium is established and **1**/**R** becomes proportional to $\mathbf{v_s^2}$.

Real mass required for equilibrium can be obtained through the conservation of angular momenta:

$$\left[m_{img}(n) + m_{re}(n)\right] v_n r_n = \left[m_{img}(n-1) + m_{re}(n-1)\right] v_{n-1} r_{n-1} = M v_s R$$

m_{img} = effective (imaginary) mass of the naked gravitational maximum

v = orbital velocity of the maximum

r = radius of the maximum

m_{re} = [acquired] real mass

$v_s = v_{n\text{-}\mathbf{1}}$ = spin velocity of the [collapsed] maximum

$R = r_{n\text{-}\mathbf{1}}$ = radius of the [collapsed] maximum

M = $\mathbf{M_{n-1}}$ = total mass of the [collapsed] maximum

where **n** is the scale of the maximum. In the above, dependence on scale has two equivalent notations, ie.:

$$m_{img}(n) = m_{img_n}$$

The collapse occurs when this is established:

$$m_{img}(n) = m_{re}(n)$$

With the assumption of a completely naked maximum, $\mathbf{m_{re}(n) = 0.}$ If the energy for collapse does not come from real mass, $\mathbf{m_{img}(n)}$ must be decreased to match $\mathbf{m_{re}(n)}$. This is achieved with the increase in $\mathbf{v_n r_n}$ product.

Since increase in $\mathbf{v_n}$ is not [absolutely] simultaneous with the collapse of $\mathbf{r_n}$, this will not be valid at all times, even if **M** is relativistic:

$${v_n}^2 = \frac{GM_{n+1}}{r_n}$$

where $\mathbf{M_{n+1}}$ is the total mass of the body $\mathbf{M_n}$ is orbiting.

In order to conserve momentum, one must allow for imaginary mass $\mathbf{m_{img}}$ on one scale to be exchanged for real mass $\mathbf{m_{re}}$ on another. However, in that case **G** is not conserved.

Note that, if $\mathbf{m_{img}(n)}$ is relativistic, increase in $\mathbf{v_n}$ will increase it, so, in order to match $\mathbf{m_{re}}$ eventually, it must be initially negative.

In order to disallow negative mass, **G** must be relativistic, rather than mass. With relativistic **G**, img mass is decreased with the emission of large scale gravitational waves.

Since this is proportional to radius collapse, velocity must be increasing exponentially. With increase in **G** however, acquisition of real mass is growing.

In this case, collapse triggers the acquisition of mass, rather than real mass triggering collapse.

Note that real mass is never absolutely zero so no collapse (deflation) can proceed infinitely. The same is true for inflation which occurs with the decrease of spin velocity.

This must eventually happen as real mass becomes larger than img mass - if negative mass is disallowed, the **G** has to start decreasing.

Conservation of variables will thus depend on the chosen reference frame, which will usually be a choice between a momentum in space and momentum in time.

However, even that choice will have to oscillate between inflation/deflation events.

Note that the energy for oscillation of **G** will generally come from annihilation of particles, as the energy for deflation/inflation is equal to the inverse of $\mathbf{m_{img}/m_{re}}$. Note also that with large difference in scale, with total mass conservation:

$$\frac{m_{img}(n)}{m_{re}(n)} = \frac{m_{img}(n)}{m_{img}(n-1)} = \frac{m_{re}(n-1)}{m_{re}(n)} \approx 1$$

One can now attempt to construct an invariant (non-dimensional) gravitational momentum, conserved between scales:

$$\frac{1}{G_n}\frac{1}{M_n}{v_n}^2 r_n = \frac{1}{G_{n-1}}\frac{1}{M_{n-1}}{v_{n-1}}^2 r_{n-1} = \frac{1}{G_{n-1}}\frac{1}{M_{n-1}}{v_s}^2 R \qquad (\mathrm{G1.1})$$

But even that one cannot be invariant absolutely.

If one calculates $\mathbf{v_{n-1}}$ and applies this to **Earth**:

$$v_{n-1} = \sqrt{\frac{G_{n-1}M_{n-1}}{r_{n-1}}} = 18178.844015\ \frac{m}{s}$$

v_n = **Earth**'s orbital velocity = **29780** m/s

r_n = **Earth**'s orbital radius = **149.6** * $\mathbf{10^9}$ m

$v_s = v_{n-1}$ = spin velocity of the current **Earth**'s maximum

$R = r_{n-1}$ = radius of the current **Earth**'s maximum = **1206115** m

$\mathbf{G_{n-1}}$ = **6.673899** * $\mathbf{10^{-11}}$ m^3/kgs^2

$\mathbf{M_{n-1}}$ = total mass of current **Earth** = **5.9723** * $\mathbf{10^{24}}$ kg

using $\mathbf{G_n} = \mathbf{G_{n-1}}$ (right side of **G1**.**1** equal to **1**), one obtains the same equation as one gets by equalizing centripetal and gravitational force, which gives:

$$M_n = 1.988500 * 10^{30}\ kg$$

naturally, equal to total mass of the **Sun**.

Note that if in this step **G** is conserved, in previous the total mass was conserved, so if one interprets $\mathbf{M_n}$ as img mass $\mathbf{m_{img}(n)}$, real mass is:

$$m_{re}(n) \approx \frac{1}{m_{img}(n)} = 5.02368131 * 10^{-31}\ kg$$

suggesting that the **Earth** has been inflated from a positron or electron maximum to its current orbital radius, then deflated to current [spin] radius.

With [chosen] total mass of **5.9723 * 10^{24}** kg and **G = 6.673899 * 10^{-11}** m^3/kgs^2, one can now obtain real mass of **Earth** using equation for mass angular momentum conservation:

$$\left[m_{img}(n) + m_{re}(n)\right] v_n r_n = \left[m_{img}(n-1) + m_{re}(n-1)\right] v_{n-1} r_{n-1} = M_{n-1} v_{n-1} r_{n-1}$$

using:

$$m_{re}(n-1) = m_{img}(n)$$

$$m_{re}(n) = 5.02368131 * 10^{-31}\ kg$$

one obtains real mass:

$$m_{re}(n-1) = 2.93676 * 10^{19}\ kg$$

giving img mass of **Earth**:

$$m_{img}(n-1) = M_{n-1} - m_{re}(n-1) \approx M_{n-1} = 5.9723 * 10^{24}\ kg$$

The real mass here is the mass in standard scale atoms, while img mass is the energy in space of the gravitational maximum.

Obviously, with **G = 6.673899 * 10^{-11}** m^3/kgs^2, the result is wrong - it is the real mass of **Earth** which should be **5.9723 * 10^{24}** kg.

One might interpret the obtained real mass as initial real mass which grows over time by the conversion of imaginary mass to real mass.

However, proper solution is in the variability of the gravitational *constant* - **G$_{n-1}$ ≠ G$_n$**.

The **Sun** also had to be initially inflated to a larger radius, if scaled equally to **Earth**'s inflation:

$$r_{\odot}(n) = \frac{r_E(n)}{r_E(n-1)} r_{\odot}(n-1) = 86.29087608 * 10^9\ km \approx 577\ AU$$

However, likely the radius was much bigger (scaling with **Neptune** would be more appropriate).

There are no fundamental constants. All are fundamentally variable.

8. Equivalence of distant scales

For each entity there is a minimum quantum of energy it can be aware of. Beyond that limit everything is effectively infinitely small or infinitely far away - non existent.

Effectively, infinitely small and infinitely big entities are equal. This may be interpreted as the cause, or effect, of scale invariance.

Thus, if a planetary system is equal to an atom, galaxies must be equal to even smaller entities - free electrons and positrons. Since an image at apparent size and distance is dependent on the moment of time in evolution, galaxies are the early moments (snapshots) of star system evolution and electrons are atomic embryos.

9. The number 666

Physical values represented by numbers are always relative and change with time (space). Thus, if there are any numbers close to being *immortal*, these must be non-dimensional ratios.

Consider an homogeneous system - a gravitational maximum.

Suppose this system split into **3** components, two of which moved some distance apart (space and time) from each other, leaving the third component (event horizon) in between, but all remain entangled, exchanging radiation.

Assuming distance in space is equal to distance in time (evolution), requirement for existence [of the system] is then such a ratio which will provide [rational] asymmetry in distance between the *left* (ie. space) and *right* side (ie. time) of the horizon, in such a way it does not produce infinities.

Starting with the following ratio, associated with the horizon:

$$\frac{0}{0}$$

Moving numerator and dominator from each other by integer quantum of **1**, nearest ratios, symmetric relative to this ratio, representing distance to horizon, are **-1**/**1** and **1**/**-1.** These are equal in value - space and time would be equal, absorbed and emitted radiation would be equal, so there would be no change (events) and the system would be at infinite rest, frozen in space and time. Note that this also implies infinite and linear event horizon.

Increasing by **1**, next ratio is:

$$\frac{1}{1}$$

Here, symmetric ratios are **0**/**2** and **2**/**0.** Time and space are at infinite distance from each other and one of the dimensions is at the event horizon - requires infinite curvature (point dimension) on one side and no curvature on the other.

Due to infinite curvature, one dimension cannot emit radiation at all. The other, to induce change, must emit radiation at infinite speed and zero carrier mass. If that would be possible it would evaporate instantly. There would be no existence, so this is not possible. Note that this dimension would have to have **0** mass in the first place in order to be separated from event horizon to infinite distance. So, paradoxically, something possessing **0** mass, traveling at infinite speed, would have to emit **0** mass particles at infinite speed in opposite direction. An exact definition of non-existence (nothingness), or absolute rest.

Next ratio:

$$\frac{2}{2}$$

Symmetric ratios are **1**/**3** and **3**/**1.** Event horizon is curved but not infinitely, space and time are separated from the horizon, but not equally and not infinitely. There is a phase shift in evolution between space and time and, therefor, both can exist, oscillating in *flavor*.

Distance from **1**/**3** to **1** (**2**/**2**) is **2**/**3**, distance from **1** to **3**/**1** is **2** (which can be quantized by **2**/**3**, **2 = 3** * **2**/**3**).

Minimum distance to event horizon is thus **2**/**3.**

$$\frac{2}{3} = 0.666'$$

In reality, however, quanta of anything cannot be infinitely small and the ideal **2**/**3** ratio simply cannot be observed and cannot exist. Therefor, in physical phenomena, ratios such as these will be cut off at a certain decimal, depending on the scale. Often, **2**/**3** may be equal to:

$$\frac{666}{1000} = 666 * 10^{-3}$$

or even:

$$\frac{66}{100} = 66 * 10^{-2}$$

This ratio may be interpreted as the minimum ratio required for existence, but a universe cannot be limited absolutely.

Evaluating further (splitting) from the ratio **2**/**3**, next naturally possible ratios are **1**/**4** and **3**/**2.** Note that **1**/**4** is also the ratio of the distance on the left (**2**/**3**) and total distance between space and time dimensions (**2**/**3** + **2** = **8**/**3**) in case of **2**/**2** event horizon.

These ratios may thus be considered as general *root* numbers, perhaps most common in nature or most significant at some [relatively] elementary levels.

10. Nature and center of the observable universe

For every universe there must exist a reference frame that universe is revolving about.

Given the determined scales of vertical energy levels, observed isotropy and homogeneity, it is reasonable to assume that the center of the observable universe is outside of it - it may be interpreted as relatively non-localized entity having an orbital momentum with no developed spin momentum.

Thus, all observable galaxies orbit barycenter(s) outside of the observable universe. These can be confirmed and approximated by observing galaxies on a different energy level of the same system.

Ie. for carbon **6**p6n state there are **4** energy levels - **2** pairs of fused galaxies and **2** individual galaxies.

Momenta of such galaxies should be correlated - in equilibrium state they orbit the center in the same direction but with a calculable difference in speed and distance from the center.

Ie. If one considers **Milky** way as a bound electron, the atom which **Milky** way is a part of should have a diameter on the order of **10** trillion ($\mathbf{10^{13}}$) light years, $\mathbf{10^3}$ times the diameter of the observable universe. *Sadly*, for carbon galaxy species, all other energy levels are outside of the observable universe.

Considering distances between atoms (planetary systems) and molecules (binaries and other strongly correlated systems) the observable universe is a gas bubble of extremely low density with particles concentrated in quantum vortices (galaxies).

This bubble or soup, however, cannot be completely homogeneous and it is only a matter of technology and proper interpretation whether one can observe the difference between the closest and the furthest layers of this gas (layer) relative to the external central point.

11. Atomic property differentiation between systems

Vertical energy levels are entangled. This implies entanglement between equal species, but entanglement between different species of different scales is not forbidden either.

Increasing number of protons and electrons in an atom is splitting (or increasing) the energy levels (layers) of the atom.

What if properties of standard scale atoms are strongly correlated with properties of $\mathbf{U_1}$/$\mathbf{U_{-1}}$ systems (atoms) they are co-evolving with?

For example, radii of atoms might be correlated with [a density of] the gravitational well they are in.

Consider the **Lyman** (or any other) series for a hydrogen [like] atom - if density of series is not invariant to such correlation, one could have a distorted image of non-local reality, as the spectrum lines of standard atomic elements would be variable across time and planetary systems.

Ie. in the **Nitrogen** system the **Lyman** series for hydrogen would have red-shifted frequencies.

> One might even argue there are **6** distinct wavelengths (after **6**th, the spectrum becomes continuous) in **Lyman** series and that such differentiation is a direct consequence of the **Solar System** being an atom with **6** protons and **6** electrons (carbon), or that series beyond the **6**th may be influenced by more distant systems.

12. Wave-particle duality

All particles having a momentum always generate waves. A particle itself may be in wavelike or corpuscular form. This form, like everything, is relative. One observer might detect a wave while other may observe a particle form (both forms can be observed at the same time). This is, like in the case of em force and gravity, dependent on the properties of local space, which may be affected by the observer too.

Generally, with more energy density, a corpuscular form is more likely to be detected. These are coherent waves which have more concentrated mass due to wave collapses initiated by self interference. Waves may be coherent in space (laser waves) and/or in time (high frequency waves). Coherence in both, space and time, will thus produce the most dense energy.

A wave collapse may also be initiated by interaction with other waves (particles).

From human perspective, wave nature prevails on $\mathbf{U_{-1}}$ scale, particle/wave on $\mathbf{U_0}$, while on $\mathbf{U_1}$ scale nature appears mostly corpuscular.

One may describe a universe with a single particle/wave (photon), other particles being simply multiple photons in coherence, fused to form a photon of larger scale.

This coherence is a gravitational maximum forming a gravitational well which may or may not acquire real mass and charge.

The current usage of terms *mass* and *matter* among human population is somewhat confusing. Mass is often considered equal to energy but sometimes it is used interchangeably with matter which is only one form of energy.

The phrase *acquisition of mass* by particles is also misleading. If mass is energy, a particle always has some mass, but it may or may not be coupled with matter.

Thus, *acquisition of matter* should be a more appropriate phrase. However, matter is simply a composition of smaller scale gravitational wells which may be coupled with even smaller scale matter.

This recursion only ends relatively (limit may be imposed by available technology), making the existence of matter relative. For most practical purposes, an *elementary* particle, and even larger structures, will have a single gravitational well coupled with matter of a single scale.

Note that what is in modern physics referred to as *dark matter*, are uncoupled gravitational wells of some scale, further adding to the confusion.

Appropriate term in **CR** would be *dark mass* or *dark energy* instead, but that term is in modern physics used for something else, although the two likely have the same source (gravitational maximum) differing only in scale.

To summarize, both, dark matter and matter, are forms of energy (mass) but may be of different scale and contain different amounts of that energy.

13. Evidence

The evidence for **CR** is presented in follow-up articles. Mainly in the analysis of the **Solar System** in **CR** context[5].

> The evidence for **CR** is everywhere. I am sure everyone can feel it. For some, it might just take some *time* to admit it.

14. Conclusion

Everything is, completely, relative.

15. References

1. [1]Astropart. Phys. 29, 188 (2008), J. Abraham et al

2. [2]Indications Of Intermediate-Scale Anisotropy Of Cosmic Rays With Energy Greater Than 57 EeV In The Northern Sky Measured With The Surface Detector Of The Telescope Array Experiment (2014), R. U. Abbasi et al
   https://dx.doi.org/10.1088/2041-8205/790/2/L21

3. [3]First Observation of the Greisen-Zatsepin-Kuzmin Suppression (2008), R. U. Abbasi et al
   https://dx.doi.org/10.1103/PhysRevLett.100.101101

4. [4]The empirical case for 10-GeV dark matter (2012), D. Hooper
   http://dx.doi.org/10.1016/j.dark.2012.07.001

5. [5]The Solar System: Nature and mechanics (2021), Amenoum
   https://amenoum.org/solar_system.html