Complete Relativity: Nature of observables

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October 10, 2021

Abstract

A complete relativity of all observables with scale invariance in physical laws is postulated and discussed.

Along with definitions of new terms which may be used in follow-up articles written in the context of the theory, in order to conform to this physics, a redefinition and generalization of some terms and factors already in use has also been suggested.

In conclusion, the theory suggests that everything must be relative in order to exist and everything evolves in order to conserve this, existence conserving, relativity.

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1 Introduction

A theory of everything observable should provide the framework which can be used to qualitatively describe all phenomena, without exceptions - special cases. Complete relativity with incorporated invariance to scale has such power, opening a path to profound insights into fundamental mechanics of nature.

Although unification mechanisms are offered here, this is not a formal mathematical unification of all currently accepted theories in modern physics, but it is certainly a guidance with a set of ingredients necessary for such unification, which should be trivial if one wants to embark on such endeavor.

Understanding of fundamental nature and mechanics of universes does not require knowledge of complex mathematics, rather a holistic approach of an open mind. This is a result of a holistic approach of an open mind.

There is no doubt that mathematical constructs can be beautiful. In fact, a lot of these are absolutely perfect. While one might not see a problem in that, it surely is a problem, for physical reality. This is a theory in physics, using mathematics where it is useful to understand, not just describe phenomena in another language.

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)

$$\Delta E > 0$$

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. In the context of CR, all existence has to be relative. Although one can construct a theory on unobservables, such theory has no place in science, rather in religion where even a value of zero may be inflated to absolute 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.

An physical entity having absolute properties would have to be absolutely isolated in order for these properties to remain constant. With no ability to change (exchange energy) such absolutely elementary entities would be unobservable. 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.

> In this context, a universe is any distinct form of energy.

As transfer and transformation of energy require capacity for energy storage, 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 3 dimensional,
- everything is physically 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.

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

Universes cannot have more than 3 spatial dimensions (there is no space for them!), however, 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).

Relative to difference in scale between observer energy and energy of observables, phenomena may be interpreted as physical (real) or mental (imaginary), however, due to relativity in interpretation/manifestation, every mental phenomena is interpreted physically at some scale, and vice versa.

Entanglement of space and time is an entanglement of spaces at different scales (scale entangled spaces). Space and time both are physical at some scale, having properties such as density and pressure.

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 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 particles.
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 must exist to conserve 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.

If we move trough time at constant speed (as GR suggests) and that speed is equal to speed of light, such is the frame of a standard photon relative to 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.

Apparently, both General Relativity (GR) and QM allow [or are at least partially based on] the existence of an absolute rest frame with constant speed

c, 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. Even space in GR is non-intuitive - it has *plastic* geometry but no physical properties.

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 often inverted in QM.

In example, quantum entanglement between distant particles can be local in time even though it appears non-local in 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 (default) scale of time relative to scale of atoms is the scale of photons and gravitons, however, it is not impossible for entangled scales of space and time to be of the same order of magnitude (ie. entanglement of a positron and electron).

Note that 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. Yet, we don't see anything non-intuitive happening on large scale - apart from gravity, but only if we assume space is some absolutely abstract geometry.

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, treatment of small scales and big scales is improper - how can the same constants be used in both GR and QM?

Massless photons or even waves are a big problem for intuitive reality.

If one assumes space is pure geometry, one can also assume it is made of quanta of such geometries of smaller scale.

Gravitational and electro-magnetic waves could then propagate more *naturally*, having a medium to excite, even if abstract one, but then these waves cannot be massless (in GR, massive matter excites space).

However, if this space is flat, according to GR, it has 0 mass in it and quanta of space must be massless.

That's not where paradoxes end - according to QM, a propagation of these waves would be a transfer of momentum between adjacent particles which have 0 mass, occupy 0 volume and have some spin momentum. Apparently, this medium does not exist but it transfers momentum at always equal and finite speed.

Note that sound waves don't propagate in low density environments because, from the perspective of sound carrier particles, these environments are massless.
We know that these environments are far from being massless. Interplanetary space is filled with radiation where it is not filled by dust and more massive particles.
The same is true for intergalactic space. Couldn't radiation be actually forming that space? Yet, *we* insist space and photons are absolutely massless.

If space is real, there is no reason for intrinsic coupling of matter and space curvature, therefor a reference frame must exist where there is no such coupling - *dark matter* then becomes a direct evidence for real space (in context of GR dark matter must be some exotic invisible form of matter coupled with space - not space itself).

It is intuitive for space to have relative density and pressure which can, as vacuum, attract particles that are sensitive to such density and pressure. And these particles may have their own space coupled with them. Reality thus becomes intuitive even on small scales - electron can rotate faster than c (although this can be understood as rotation of space, with electron matter or charge being at rest relative to that space), have a real radius and real orbits inside the atom.

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

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

Current (absolute) vacuum electric permittivity and magnetic permeability would be no different - these would simply be the properties of space on a larger scale in which 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.

One may argue that the existence of physical space has been disproved with experiments, however, that is not the case - various interpretations of aether have been disproved[1]. While space in Complete Relativity has some similarities with, what was originally called, aether, it is not the same phenomenon. One should understand space in CR to have the same geometry as space in GR, however, with real density and pressure instead of being nothing more than non-intuitive abstract geometry. Thus, this

space is not absolutely homogeneous and isotropic. It has gradients of potential and can be private.

2.3 Everything has an angular momentum (everything has mass)

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 at some scale.

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.

A 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 ($\Delta \mathrm{E} \propto \mathrm{r}^{-n}$). 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 specific targeting using appropriate 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 is 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 (gravitons) in space providing vacuum energy for the effects of gravitational force. Space curvature is one interpretation of the effect of a gradient in vacuum potential (density of gravitons).

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 graviton of adjacent larger scale. Interactions of equal scale will produce orbits (weak coupling) or induce fusion.

Smaller scale matter coupled to a graviton 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 gravitons of matter particles).

The coupling can be lost simply by spin changes, as it includes a temporary change of scale through 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 hypotheses, 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 not, 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.

> *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 that may be used in CR and articles in CR context. 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, 1st order observer may be the information carrier (radiation) particle, 2nd 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 m_1 and 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 1st 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 3rd 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 1st order interaction, and the interaction between two bodies as the 2nd order interaction.

One may also consider the 1st order interaction as relatively instantaneous, 2nd order occurring at some speed c, 3rd 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 1st order interaction (GR) distance in space is 0, while in the 2nd order interaction (Newton) distance in time is 0. Increase of distance in space between two bodies at 2nd order scale proportionally increases the distance in time at 1st 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 3rd 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.

With each state having a unique physical interpretation, in reality, only effective superposition is possible - relative to spatial or temporal resolution (scale) of the [1st 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 U_{-1} scaled energy quanta form the space (medium) of U_1 bodies, while U_{-2} forms the space (medium) of U_0, etc.

If m is specified, the $U_{n.m}$ denotes the sub-universe of scale m, larger than n but smaller than n+1.

If specified, charge c denotes the polarization, in context of electric charge - matter dominant (-) or anti-matter dominant (+).

4.5 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 or limitations in resolution. 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).

Appropriate elementary particles of scale U_0, in most cases, should probably be protons and electrons.

4.6 Existence

Existence requires energy. Distinct forms of existence are distinct forms of energy. All discrete quanta of energy are *produced* (inflated or deflated) with changes in momentum.

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

4.6.1 Single entity

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

where m, v and r are momentum mass, velocity and radius, respectively.

4.6.2 System of n entities

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

4.7 General oscillation

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

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

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

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, $a_j < 1$ for $j > 1$.

Multiple dimensions are generally entangled, so f may be f(x_i, ..., x_n).

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

4.8 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 T_x, frequency of existence is:

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

where ΔT_1 is the average lifetime on a larger scale and ΔT_0 is the average lifetime on a smaller scale. By default, ΔT_0 is « ΔT_1, and T_x is approximated with ΔT_1.

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

4.9 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:

$$\sigma_x \sigma_y \geq \frac{1}{2}\hbar$$

Proper relativistic uncertainty is:

$$\sigma_x \sigma_y \geq \frac{1}{2}\hbar_n$$

$$\hbar_n > 0$$

where $\hbar_n$ is relative to scale [of energy] n.

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

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

4.10 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).

4.11 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* ∞).

4.12 Graviton (quantum of [space] spin momentum, [closed] gravitational field tube, quantum of energy)

Graviton is a real or effective source of a general force field - a more or less polarized vacuum gradient.

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

The force (vacuum, or curvature in some interpretations) is greatest in a real graviton and decreases exponentially with distance of effective gravitons from the real one.

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

Its shape depends on electric charge and spin momentum. The spin momentum may be quantized from some reference frames, oriented *up* or *down* along a particular axis of quantization.

Relativistic momenta may further distort the shape of a graviton.

Graviton is a composite of at least 3 components - 1 neutral space (vacuum) and 2 charged momenta, forming a torus (ellipsoid with openings on poles) with size of openings proportional to amount of electric polarization.

Charge carrier particles are generally asymmetric and will have different momenta in polarized states.

4.12.1 Physical interpretation

Graviton can exist on different vertical energy levels (scales), however, characteristics of its space are relatively invariant to scale as the size/energy of constituent particles is proportional to scale.

Space of a real graviton is flat with extremely low temperature and density and, thus, high vacuum pressure. This vacuum is a source of gravity.

While temperature and density are low globally, localized high temperatures and densities are possible. Constituent particles are often in condensed (bosonic) states and grouped in quantum vortices (galaxies).

The shape of a graviton is generally a torus, with an intrinsic spin momentum. This spin momentum is quantized with constituent particles (smaller scale spin momenta), forming smaller scale sources of vacuum (these are centers of quantum vortices, where most energy is concentrated inside graviton space). Thus, large scale spin momentum (of the graviton) is strongly entangled with small scale momenta.

Shape of a graviton is shown in Fig. 1, where the surface of a torus represents effective boundary of its space.

> Note that it is relatively easy to maintain extreme conditions inside the graviton, as accumulation of particles is extremely hard due to these conditions.
> Any particle having a momentum perpendicular to the graviton will be

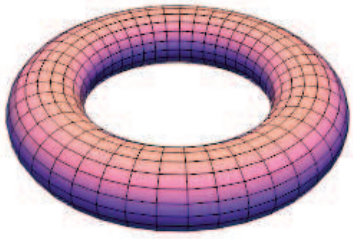

Figure 1: General shape of a graviton

accelerated inside, but once the point of maximum gravity is reached the particle will start decelerating and will exit the graviton with the same momentum. Collisions will be hard even if constituent and passing particles are of the same scale, but if constituent particles are of smaller scale (discrete vertical energy levels differ in energy by multiple orders of magnitude), accumulation becomes almost impossible.
And if escape velocity of vacuum (gravity) is larger than speed of energy radiation, no energy can be lost either. In that case, graviton is transparent for any energy except vacuum (gravity).
However, nature of a graviton can change with changes in its spin momentum.

Assuming that, in neutral state, escape velocity inside the graviton is larger than the speed of light, a graviton can become polarized if its rotation decreases enough that escape velocity becomes smaller or equal to the speed of light.

If its rotation is proportional to its vacuum, then this becomes exchange of gravitational potential for electro-magnetic potential.

Note that, to conserve momentum, constituent particles now must increase angular momentum. As these particles are now polarized and asymmetry exists between positive and negative charges, graviton itself becomes a large scale charged particle and a source of magnetic field.

If vacuum is decreasing but number of constituent particles remain constant, the vacuum volume must decrease. Assuming that volume must be conserved, it must be conserved in magnetic field lines (tubes, or toruses). Magnetic field lines are thus polarized gravitons perpendicular to the original graviton and through these lines flow electric currents of even smaller scale than the constituent particles of the original graviton.

Note that polarization is concentrating constituent particles and shrinking the torus to a *2-dimensional* ring, while neutralization is expanding it to more spherical shape. To conserve volume, expansion will be decreasing the thickness of a torus, converging to a *2-dimensional* sphere.

Increasing rotation of space thus increases mass (gravity) of constituting matter, reducing its angular speed and charge, while decreasing rotation of space does the opposite.

Since characteristics of a particular graviton are invariant to scale, this explains the existence of generations in particles, and implies that different characteristics between gravitons will be a difference between different species.

Note that recent analyses[2] have shown that local universe has a shape of a torus[3]. Considering its characteristics, it must be a [large scale] graviton.
If distances between galaxies (large scale quantum vortices) are increasing, this graviton is increasing its vacuum and must be changing shape toward a sphere [surface].
Recent acceleration however may indicate absorption of additional gravitational energy in the form of another graviton.
This should result in creation (inflation) of additional constituent spin momentum quanta between galaxies and merging with existing black holes (galaxies).

4.12.2 Superposition of equal species and generation (merging of gravitons)

Two gravitons of relatively equal species and generation can merge (bosonic condensation) with opposite spins (male and female). Their constituent particles merge similarly. This superposition is effectively new species of graviton.

Note that this merging will almost double vacuum and charge, even though rotation decreases significantly (different spins have different energies so rotation cannot be canceled and some energy will be radiated away). This is because ratio of graviton spin velocity and charge angular velocity remains the same. Note also that, to conserve momentum, radius will also be almost double the original.

4.12.3 Superposition of gravitons of different species or generation

One real graviton may be contained within another if they are of different species or equal species but different generation.

If they are the same species (same ratio of gravity to charge), the outer graviton will be shielding the inner graviton. For a completely neutral fully formed graviton, shielding would be isotropic, however, such gravitons are impossible and shielding will not be perfect on the poles.

Superposition of multiple gravitons will form composite particles and this can result in large difference between [gravitational] mass and charge radii of such particles.

4.12.4 Acquisition of matter (acquisition of smaller scale energy quanta)

A naked graviton will attract other gravitons, whether they are naked or not. If these are gravitons of smaller scale, with no sufficient energy to escape the vacuum, they will concentrate around the graviton.

Similar to shielding of inner gravitons, acquired smaller scale gravitons will shield the gravity of the large scale graviton.

For reasons stated before (extreme nature), acquired matter cannot be concentrated within the graviton and will be concentrated in orbits around it. The graviton will form a discontinuity in the system. Electro-magnetic nature of a graviton will concentrate polarized matter in the center, while neutral matter can start concentrating there with collisions.

4.13 Gluon (paired graviton)

Gluon is a graviton merged with a graviton of opposite spin momentum.

4.14 Gluon tube (wormhole, quantum of entanglement)

Gluon tube is a product of deformation (stretching) of [gluon] space between two merged gluons.

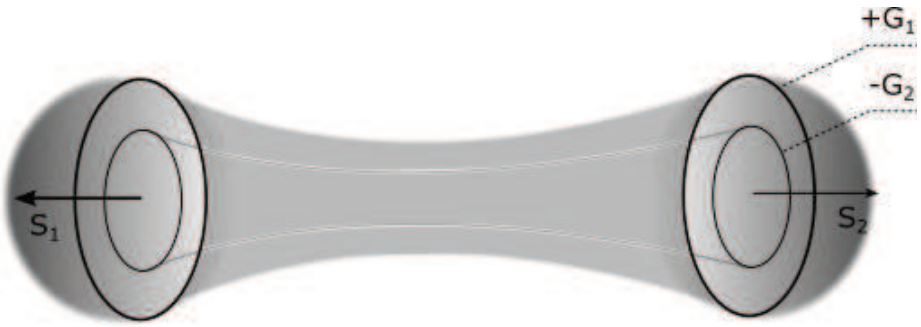

Figure 2: Gluon tube

Fig. 2 shows the gluon tube, with induced cross-sectional capacitance due to spatial separation of gravitons G_1 and G_2.

With no additional energy, volume of graviton (gluon) space will remain the same with deformation.

4.15 Gravitational maximum (G-maximum, [relative] event horizon, soul)

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

> Physics of a theory of everything cannot be reserved for particles and their interactions at specific scale. In certain reference frames, even living beings are particles.
> Distinction between living and non-living forms of energy is very relative and physics will necessarily merge with biology in an successful attempt to understand the universes.

In standard model of QM, a special mechanism was invented to give mass to particles. I find it appropriate to equalize a massless (naked) particle with a soul - an essence of a living being providing distinct consciousness.

The soul of a standard (U_0) scale may thus already be a part of QM, it was just not recognized as such. The naked particle or a soul may be massless in QM, but in CR it cannot be absolutely massless, only relatively.

Since energy of a naked particle (graviton) is a maximum energy of a gravitational well it can be understood as capacity of that well. If that capacity is full, the acquired matter is fully shielding the naked potential and apart from deformation of the well there is no difference in gravity between a naked and *full* well. Thus, from an external reference frame, this may be interpreted as violation of energy conservation, although all energy is conserved.

However, generally, graviton well will have full capacity for 0 time, as this is synchronized with changes in energy level of a graviton, when its capacity will change.

I interpret the acquisition of [larger scale] mass by the naked particle as an act toward symbiosis of smaller scale and larger scale mass. The gravitational well of the maximum provides the environment and acts as a catalyst for evolution of matter (enabling fusion, chemical reactions, etc.) while the interaction also enables the soul to co-evolve with acquired matter (constituent particles of the soul will mirror acquired matter to some degree).

Here, the actions of consciousness may be expressed externally (through larger scale mass) and internally (through smaller scale mass). The ratio of external to internal expression will depend on species and may characterize the species as dominantly extroverted or dominantly introverted, but may also characterize it neutral in that regard.

Every living being is a symbiosis of multiple organ[isms] with their associated gravitational maxima of some scale. However, any distinct form of energy may have this distinction rooted in a distinct maximum, providing distinct amount of consciousness - co-evolving with maxima in symbiosis (entanglement).

The loss of consciousness should thus be interpreted as a temporary collapse of [scale of] that maximum, while death would indicate a permanent decoupling of maxima with particular matter, with which these were entangled at conception and development.

4.16 Gravitational well (spiritual well)

A real graviton will induce effective gravitons, forming a vacuum gradient of space - a gravitational well.

Since gravitons rotate with speed proportional to graviton vacuum, gradient of vacuum in a well will also be the gradient of angular (Keplerian) velocities. In equilibrium (stable orbits), this rotation of space is equal to centrifugal rotation of matter. Such matter is at rest relative to space. Thus, it doesn't loose energy while orbiting.

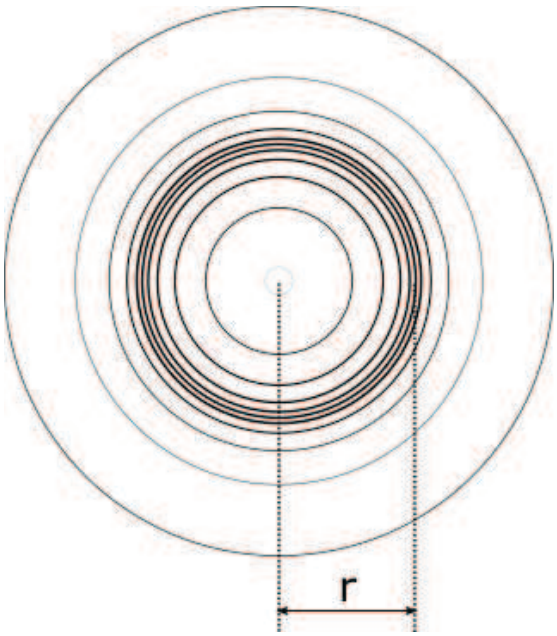

Figure 3: Gravitational well scheme

Fig. 3 shows a cross-section of a gravitational well with a [gravitational] maximum radius r. Density of gravitons is represented by concentration of circles, it is greatest at event horizon r.

Difference in angular momentum between matter and the well causes friction and results in emission of energy in form of radiation.

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

4.17 Black hole

Black hole is a gravitational well of a graviton whose escape velocity is greater than the speed of light.

More charged black hole is, more two-dimensional it will be and the density of the 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 or standard photon scale, but of even smaller scale, as they would have to be faster than standard 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 case of black holes, are formed due to charge of the host at the time of formation - greater charge will create thinner discs.
> Note also that the trajectory of ejected charges is bent by the magnetic field lines (tubes) and these can be considered as a form of intestines.

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

However, the structure of a photon is not limited to electron/positron pairs, other particle/anti-particle combinations are possible, resulting in heavy photons or [pairs of] 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 would explain why photons and neutrinos travel at equal speed.
> However, another interpretation exists for that, which will be discussed later.

4.19 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, with no additional energy applied to gluon space, 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.

Note that gluon tube consists of effective gravitons in between real ones.

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

However, weak entanglement is not reserved for gluons - all correlations *at distance* will stretch private space between entangled particles.

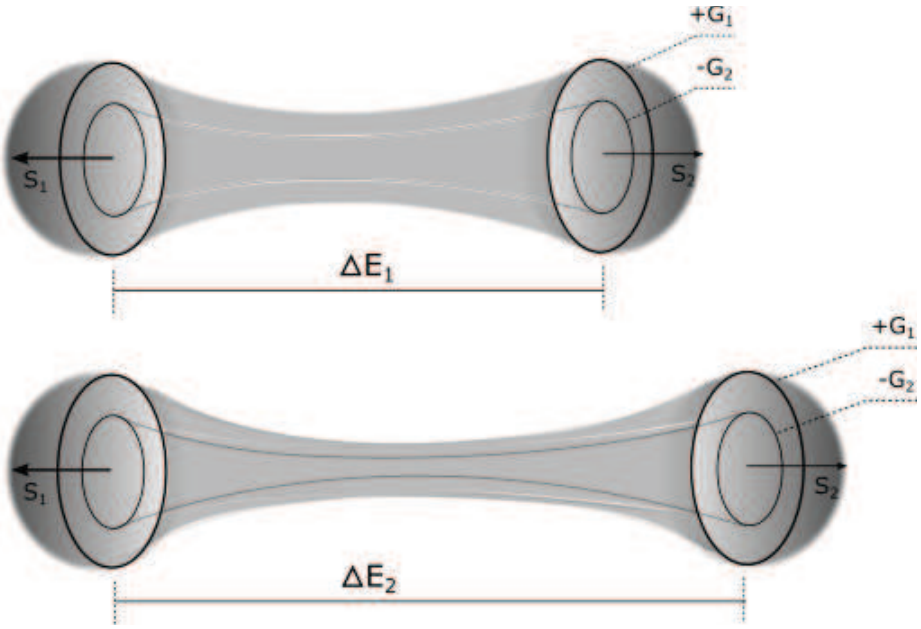

Figure 4: Weak entanglement

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

4.20 Electric polarization

Particles can be positively (+) or negatively (-) charged. As such, they are sources of electric, magnetic fields and electro-magnetic radiation. In CR, positively charged particles may be referred to as anti-matter, negative as matter.

Creation is relative, in the context of particles, it is generally inflation of energy from a smaller scale to a larger scale.
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 +1e/3 and -1e/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 (avoid annihilation), one may refer to it as a vertically excited positron.
Existence requires asymmetry, while with asymmetry, evolves diversity.
In another interpretation, a quantized collapse of a gravitational maximum (neutron event horizon) produces a positron/electron pair, electron is emitted outward while positron is emitted inward and a collapsed event horizon with a captured positron now forms the proton.
Note that these interpretations are not mutually exclusive.
Conventional anti-proton (matter particle in CR) is a vertically excited electron.
Affinity for ejection/absorption of a specific flavor (matter or anti-matter) will depend on particle species and scale.
Anti-neutrons are thus beyond smaller and larger scale event horizons.

4.21 Total mass (gravitational mass)

Total mass is the sum of unshielded gravitational energy of a graviton (img mass) and acquired matter (real mass) forming a body:

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

It is usually denoted with uppercase letter M.

4.22 Imaginary mass (virtual mass)

Imaginary or virtual mass is the unshielded energy of a specific graviton. It is maximal when its gravitational well is empty (graviton is naked).

This mass is usually denoted with m_{img}.

4.23 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.

Real mass is usually denoted with m_{re}.

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

Real mass in a distinct gravitational well [of a larger scale graviton] 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 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 shielded and its [img] mass relative to total energy is negligible).

Physical interpretation of quanta of U_0 scale mass 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 tube) at radius r of a gravitational well is defined by this equation (derived from Kepler's laws), with the assumption of a point-like, or non-polarized (spherical), source of gravity:

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

while available mass capacity of the well is:

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

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 is decreasing).

If m_{img} would remain constant, with increasing m_{re}, and G remaining constant, c_s must increase, while r_s must decrease proportionally to increase in Mc_s to conserve momentum.

However, with a decrease in r_s, to satisfy above equation, c_s has to increase again (increasing m_{img}), so this would eventually lead to absolute singularity (impossible in CR).

If r_s, instead of initial decrease, increases proportionally to M, due to conservation of momentum, c_s cannot remain constant and has to decrease.

Decrease of c_s, to satisfy the equation, has to again increase 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 imaginary mass only has to satisfy the equation (M becomes m_{img}),
3. as hypothesized, m_{img} decreases with increase in m_{re} - effectively, real mass is shielding the gravitational potential of the maximum.

While CR implies oscillation of G, without a change in scale, these changes are negligible, leaving solution 3 as the only valid solution during weak evolution (no scale changes).

During inflation or [gravitational] collapse of scale, obviously, certain amount of real mass will have to decouple from img mass (as evident in supernovas, for example) if changes are not, or cannot be, fully compensated by changes in G. In reality, all 3 solutions will be, more or less, utilized.

Decoupling can be simply achieved with a change of a spin of a maximum, which is synchronized with a change in scale, even if that change is temporary.

For bodies with a distinct gravitational maximum, imaginary mass of a maximum is generally bigger than a quantum of real mass by multiple orders of magnitude, and with the addition of real mass it gets exponentially harder to reach imaginary mass of a naked maximum (the velocity of real mass is limited by the velocity of the imaginary mass maximum c_s, with the addition of mass, due to conservation of momentum, the velocity of real mass must decrease and thus cannot ever reach c_s while having mass greater than the mass of constituent particles of the maximum or density higher than that of the maximum).

If m_{re} would become greater than m_{img} of a naked maximum, this would again lead to instability and singularity, which must be solved with temporary or permanent changes in scale.

This is generally synchronized with an impulse of external energy, a discrete one for permanent changes.

It is obvious that spin momentum of real masses of planets generally does not satisfy the equation. However, this implies that coupling of real mass and space [of the gravitational well] is weak. The space (real and effective gravitons) should still satisfy the equation:

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

With a difference in momentum, a friction (energy exchange) then may exist between real mass and space of the well and real mass will radiate energy as a product of this interaction.

This will be radiation in the form of gravitational waves of some scale, however if space is polarized, interaction with charged quanta will radiate photons.

> Note that a real graviton may 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.

As it radiates energy, to conserve momentum, real mass must increase orbital velocity and/or decrease orbital radius (if that energy is not replenished).

> Note that, in example, if Earth is receding from the Sun and if Earth's absorption and emission of energy is balanced, recession must be caused by changes in space.

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) with isotropic energy distribution then it can be considered as a point particle rotating at the barycenter of mass (also center of maximum). Proper relativistic equation (relative to the maximum [scale]) for total mass is then:

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

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

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

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:

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

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

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

4.24 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:

$$EH_N(a,b) = EH_N(a) = EH_N(,b)$$

4.25 Intelligence

Intelligence is the ability of an individual to focus and produce objective (logical) thoughts or conclusions 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 [operating] as individuals, 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 (superpositions) of extroverted and introverted intelligence. This is evident by the existence of dreams in extroverted species, however, lack of control and consistency in these make them virtual experiences for most.

External expression of intelligence of an individual is always a product of superposition of intelligence of individual neuron cells and proteins.

This superposition is mirrored in the soul as quantum superposition.

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

4.25.1 Material intelligence

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

4.25.2 Spiritual intelligence

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

4.25.3 Intelligence potential (real intelligence)

The intelligence potential (IP) is a measure of neutral (non-biased) intelligence.

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

Generally, a function for determination of IP should look something like this:

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

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

$$I_S + I_M = 1$$

I_M = normalized material intelligence
I_S = normalized spiritual intelligence
$\mathrm{I}_S, \mathrm{I}_M \in \mathbb{Q} > 0$

Note that for $\mathrm{I}_S = \mathrm{I}_M$ this produces infinity. Since absolute physical infinity is impossible, such result can only be obtained due to limited precision in measurement. Therefor, this infinity should be taken relative and proportional to precision.

4.25.4 Intelligence quotient (amount of extroverted intelligence)

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 correlate well with IP for extroverted species, it is not well suited for extremes and is completely inadequate for measurement of [introverted] intelligence of 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 may be least intelligent among dominantly introverted species.

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 a domain, constant may be weak or strong.

Naturally, all properties oscillate. Existence of constants is thus relative to 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)

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

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

In vertical states, 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

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:

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

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

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:

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

I hypothesize that the Solar System is the equivalent of a Carbon-10 (^{10}C) atom. Evidence will be presented in follow up works.
Of course, the values obtained above will deviate slightly from current values due to fluctuation and the fact that 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, 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 possible that even in standard atoms at the same scaled conditions as the Solar System is in, constituent particles of the atom are held together by properly scaled gravitational force [at least periodically], while particles outside of the atom dominantly feel electro-magnetic force as external space is still polarized.

This makes 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 (ie. $U_{-1}.e^-/U_{-1}.e^+$). These have anti-aligned 1/2 spin momenta, with aligned orbital momenta forming total spin of the photon. Unpaired photon should be understood as half-photon, a polarized component of a standard photon ($U_{-1}.e^-$ or $U_{-1}.e^+$).

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

If standard electron mass would be equal to K_A, the unpaired photon would have mass equal to K * 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[4] for intra-galactic sources[5].

It is also in agreement with measurements of GZK (Greisen-Zatsepin-Kuzmin) energy limit (cutoff) for protons - 5.6±0.5±0.9 * 10^{19} eV[6].

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

Splitting of energy levels can also occur, under influence of external fields, in vertical states.

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

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

Note that this mass is completely in agreement with other calculations of graviton mass[7], based on existing theories and experimental data.

Since electron energy is equal to 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 a standard carbon *dark matter* particle, it is thus [relatively] sterile - interacts only gravitationally (polarized interactions at some scale must exist, but they are generally beyond the threshold of detection). The mass corresponds to 9.33063546 * 10^9 eV (9.33063546 GeV) of energy and is in agreement with some empirical evidence[8].

Note that there is no single dark matter particle. Any naked graviton of any scale is a particle of dark matter.
Note also that [rest] masses of standard photons and neutrinos may generally be determined from momentum, relative to c constant.
Masses obtained here are invariant to c. Obtained photon mass corresponds to a particle of vacuum energy density ($9.9 * 10^{-27}$ kg/m^3), with a radius of U_0 scale Neptune ($\approx 3.8343 * 10^{-16}$ kg) and velocity of $\approx 3.5 * 10^{26}$ m/s.
Physically, a particle with such momentum can be obtained with a collapse of a gravitational maximum of Neptune to U_0 scale, converting mass to velocity to conserve momentum (note that this speed would be valid even in GR, if photon is understood as quantum of vacuum - here it does have vacuum energy density).
Rest photon mass relative to c (when its spin momentum is not taken into account) can be obtained through conservation of momentum (p=mv), and it is $\approx 2.1 * 10^{-54}$ kg.

5.1.1 Oscillation of photon mass

Mass of all particles should be oscillating and photon cannot be an exception. Its constituent particles (half-photons) should, as leptons, oscillate between 3 generations.

Assuming calculated mass is the lowest mass, other two can be calculated from tau/muon/electron mass ratios.

For $M_\tau = 1776.86$ MeV/c^2, $M_\mu = 105.6583755$ MeV/c^2 and $M_e = 0.511$ MeV/c^2:

$$M_{\gamma\tau} = \frac{M_{tau}}{M_e} M_{\gamma e} = \frac{1}{2} 6.335068208 * 10^{-69}\, kg$$

$$M_{\gamma\mu} = \frac{M_\mu}{M_e} M_{\gamma e} = \frac{1}{2} 3.767055455 * 10^{-70}\, kg$$

$$M_{\gamma e} = \frac{M_p}{2} = \frac{1}{2} 1.821876712 * 10^{-72}\, kg$$

$M_{\gamma e}$ = electron half-photon *rest* mass
$M_{\gamma\mu}$ = muon half-photon *rest* mass
$M_{\gamma\tau}$ = tau half-photon *rest* mass

To prevent annihilation, masses of two constituent particles should be equal for 0 time relative to other combinations (relative 0). The oscillation of one half-photon should thus be anti-aligned with the other (phase difference of 180° in ideal case) and the whole system (photon) can be reduced to two-body oscillation. Here the intermediate (0 time) state must be the state with lowest mass (state lifetime is proportional to mass).

Note that, there must exist a threshold frequency - at which point two half-photons will fuse and form a graviton half-neutrino.

At lowest frequencies, photon mass is effectively equal to $M_{\gamma\tau} + M_{\gamma\mu}$. At highest frequencies photon mass is equal to 2 $M_{\gamma e}$, however, with increasing frequency, orbital momenta of half-photons increases and, with increased gravitational mass, the oscillation slows down.

Due to non-zero mass, photon must loose energy with distance and its effective range will be equal to [reduced] Compton wavelength (if not accelerated by strong sources of gravity), for low frequencies:

$$r = \frac{\hbar}{M_p c} = \frac{\hbar}{c} \frac{1}{M_{\gamma\tau} + M_{\gamma\mu}}$$

$\hbar = h/(2\pi) = 1.054573 * 10^{-34}$ Js
$c = 2.99792458 * 10^{8}$ m/s

Note that constant c has to change with time and it was likely lower in the past.

Obviously, r must also be roughly equal to the radius of observable universe (universe that can be observed).

Deceleration of emitted photons must also oscillate but it is effectively constant for effective mass. For effective mass equal to $M_{\gamma\tau} + M_{\gamma\mu}$, acceleration is:

$$a = -\frac{1}{2} c^2 \frac{c}{\hbar} \left(M_{\gamma\tau} + M_{\gamma\mu}\right) = -\frac{1}{2} \frac{c^3}{\hbar} \left(M_{\gamma\tau} + M_{\gamma\mu}\right) = -4.287091748 * 10^{-10} \frac{m}{s^2}$$

For highest frequencies:

$$a = -\frac{1}{2} \frac{c^3}{\hbar} 2 M_{\gamma e} = -\frac{c^3}{\hbar} M_{\gamma e} = -2.327418326 * 10^{-13} \frac{m}{s^2}$$

However, if constituent photon particles have low (effectively 0) charge there is no requirement for anti-alignment - in fact, alignment becomes a more stable solution. Generally, taking into account phase shift and using relativistic (gravitational) mass, the equation becomes:

$$a = -\frac{1}{2} \frac{c^3}{\hbar} \left(\frac{1}{2} + \frac{1}{2} \sin^2 \phi\right) \Delta M \frac{1}{\sqrt{1 - \frac{f^2}{{f_n}^2}}}$$

$$\Delta M^2 = 2^2 \frac{{M_1}^2 + {M_2}^2}{2} = 2 \left({M_1}^2 + {M_2}^2\right)$$

where ΔM is the superposition of mass, f is photon frequency, f_n is the maximum possible photon frequency and φ is a mixing angle (equal to 90° for aligned and 0° for anti-aligned oscillation of half-photons). For previously determined maximum energy of M_n = 1.02413 * 10^{-16} kg (5.7 * 10^{19} eV), f_n is:

$$f_n = \frac{c}{\lambda_n} = \frac{E_n}{h} = \frac{M_n c^2}{h} = 1.389120683 * 10^{34}\, Hz$$

For f « f_n, $M_1 = M_{\gamma\tau}$, $M_2 = M_{\gamma\mu}$ and $\varphi = 90°$, acceleration is:

$$a = -\frac{\sqrt{2}}{2}\frac{c^3}{\hbar}\sqrt{{M_{\gamma\tau}}^2 + {M_{\gamma\mu}}^2} = -5.732686887 * 10^{-10}\,\frac{m}{s^2}$$

For $M_1 = M_2 = M_{\gamma\tau}$:

$$a = -\frac{c^3}{\hbar}M_{\gamma\tau} = -8.092948194 * 10^{-10}\,\frac{m}{s^2}$$

Deceleration of photons from the source will be misinterpreted as a change in Doppler shift (change in acceleration of the source) when mass of the photon is considered to be 0.

Indeed, analysis of motion of Pioneer 10/11, Galileo, and Ulysses spacecraft shows anomalous constant weak long-range acceleration of - (8±3) * 10^{-10} m/s^2 (deceleration relative to the Sun) for which no satisfactory explanation has been found[9], with the assumption that photon mass is 0.

Obviously, predicted photon mass oscillation can fully explain this *anomaly*.

Ad hoc solutions have been proposed to solve the problem. In example, the VSLT hypothesis[10].
While variable speed of light is predicted by CR - both in space and time, here the author proposes that light speed is not variable during travel (photon remains massless), rather the source emits photons with constant speed only the [value of the] constant decreases over time. However, speed of a massless photon has been derived by J. C. Maxwell from permittivity and permeability of vacuum and as such it is invariant in GR. If there are no changes in space between the source of light and observer, massless photons cannot travel at variable speeds. Thus, the theory should imply that vacuum properties are changing with time, yet the author claims this is not the case.
Space with plastic geometry but no physical properties is non-intuitive already. Introduction of new *absolute* constants that change with time but with no correlated physical changes is only deepening the abyss between theory and reality.
Furthermore, detected acceleration in spacecraft is only constantly present but not constant in absolute value (it oscillates). This is ignored in VSLT, but predicted with mass oscillation.

5.1.2 Evidence for photon mass and its oscillation

Experimentally confirmed photon acceleration is a strong evidence for its rest mass being in the predicted range (10^{-68} - 10^{-72} kg).

However, generally, photon mass may be obtained from linear (angular) momentum. Since most of its effective mass is in spin momentum (v $\approx$ 3.5 * 10^{26} m/s), experimentally obtained photon mass will be significantly higher than the calculated rest mass. Using conservation of momentum, one can calculate these masses for various pairs of half-photons, ie:

$$mv = mc$$

$$M_{\tau\tau} = 6.335068208 * 10^{-69} * 3.5 * 10^{26} * \frac{1}{c} = 7.39603 * 10^{-51}\, kg$$

$$M_{\mu\mu} = 3.767055455 * 10^{-70} * 3.5 * 10^{26} * \frac{1}{c} = 4.39794 * 10^{-52}\, kg$$

$$M_{ee} = 1.821876712 * 10^{-72} * 3.5 * 10^{26} * \frac{1}{c} = 2.12699 * 10^{-54}\, kg$$

c = 2.99792458 * 10^8 m/s

Indeed, experimentally obtained photon masses range from 10^{-50} to 10^{-54} kg[11].

> Note that here the same velocity has been used for all photons. Obviously, in reality, some difference in orbital velocity of half-photons will exist, for heavier half-photons it should generally be higher, giving photon mass on the order of 10^{-50} kg.

5.1.3 Photon/graviton range

Obviously, photon can indeed travel vast distances and that would not be possible if its rest mass would range from 10^{-50} to 10^{-54} kg.

However, it is possible that some photons do behave as such or indeed have such rest mass. If so, these would have the following ranges:

$$r_{\tau\tau} = \frac{\hbar}{c}\frac{1}{M_{\tau\tau}} = 47561.69\, km$$

$$r_{\mu\mu} = \frac{\hbar}{c}\frac{1}{M_{\mu\mu}} = 7.99846493 * 10^8\, m$$

$$r_{ee} = \frac{\hbar}{c}\frac{1}{M_{ee}} = 1.653828596 * 10^{11}\, m$$

These ranges are interesting because they could be correlated with celestial bodies. Ie. for a photon mass of 5.52 * 10^{-50} kg the range would be equal to Earth's radius.

I hypothesize that such particles do exist and are carriers of electro-magnetic and gravitational fields for large scale (U_1) gravitational maximums.

Photons with lower rest masses (10^{-68} - 10^{-72} kg) are carriers of such fields for real mass (U_0 scale) - atoms, filling the wells of large scale maximums.

In that case, empty large scale gravitational wells should be devoid of, not only standard atoms, but these photons/gravitons too (they are transparent for such photons but cannot produce them due to absence of real mass) unless escape velocity of a maximum is > c (black hole maximum).

That implies that gravity of such wells has a shorter range.

However, another possibility exists - perhaps the very shielding effect of real mass in a well manifests itself in the reduction of range (rest mass increase) of constituent gravitons of the well once these are absorbed.

Indeed, that seems the most plausible explanation for shielding effect and allows [even] complex living beings to have photon (or graviton) souls. Once the body [of real mass] couples with a soul, the spin momentum of the soul is extremely reduced. This increases its rest mass but reduces range of its gravity, which is now effectively replaced with gravity of real mass beyond the soul's radius.

How full is the capacity of a well can thus be determined from the spin momentum of its soul.

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 * 10^8 m/s, nor any other number > 0.

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

> Speed limit is determined from density and pressure of space. Since density and pressure of space are relative [to scale], for a body of infinite mass, density and pressure are such that speed limit is 0.
> If standard photons are quanta of space they will (or can) travel at the

speed limit (c) determined from pressure and density of such space only if they don't have mass relative to that space.
However, when they do have kinetic energy relative to that space they must have mass, therefor they must travel at speed < c. Effectively, while in motion relative to space, they are no longer quanta of space.
Note that this implies that a photon particle from the previous chapter is at rest as quantum of space, while this space has an [angular] momentum with velocity of $\approx 10^{26}$ m/s.
Since this is a spin momentum, it can exist even *in* space where speed limit is much lower, ie. equal to standard c.
To exchange this spin momentum for angular momentum in such space, it will have to slow down to < c, increasing mass [to conserve momentum].
This explains why all photons and neutrinos in standard vacuum travel at equal speeds and almost equal to c - they have been slowed down.
All *static* standard photons thus have a spin momentum with angular velocity » c. This makes the [magnetic] spin momentum of electron intuitive - its polarized space is indeed rotating at speeds > c with a real charge radius (its neutral mass though might be rotating < c).

Speed limits for particular mass are thus relative to [the scale of] that mass.

Since rest mass is also relative, at the point speed limit is broken, rest mass of the body increases to another level, speed decreases to *rest* velocity, while 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 U_0 energy level, one pair inflates to U_1, other collapses to 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 $c = 2.99792458 * 10^8$ is the speed limit for U_0 particles (ie. standard electrons) in space of U_1 bodies, speed limit for U_1 scale is generally lower, while for U_{-1} scale particles (standard photons) in space of U_0 bodies it is higher (note that this implies that charge of the electron is rotating in space formed by U_{-2} scaled quanta).

Standard photons can travel faster than c even though one cannot detect such photons *directly*. However, spin magnetic momentum of electron should be interpreted as evidence of half-photons (photon scale electrons) orbiting at velocities faster than c.

This is a proper interpretation in CR and it is a proper interpretation if one wants to conserve rationality.

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 best preserved between 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 a 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

In CR, nothing can be absolute, even *continuum* of space must be, like all energy, discrete at some scale. Relativity implies it has variable properties, such as density and pressure.

7.1 Relativistic space

In General Relativity space is absolute and has a geometry but no variable properties such as density and pressure. It also has a fundamental speed limit, which is assumed equal to speed of light in case of massless photons:

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

ϵ_0 = vacuum electric permittivity = 8.85418782 * 10^{-12} F/m
μ_0 = vacuum magnetic permeability = 4π * 10^{-7} H/m

However, this can be rewritten in terms of energy density ρ and pressure p:

$$\epsilon_0 = K_\epsilon \frac{F}{m} = K_\epsilon \frac{s^4 A^2}{m^3 kg} = K_\epsilon \frac{s^4 N^2}{m^3 m^2 kg T^2} = K_\epsilon \frac{s^4 kg^2 m^2}{m^3 m^2 kg s^4} \frac{1}{T^2}$$
$$= K_\epsilon \frac{kg}{m^3} \frac{1}{T^2} = K_\epsilon \frac{kg}{m^3} \frac{1}{T} \frac{C}{N} \frac{m}{s} = \rho_s \frac{1}{B_1} \frac{1}{E_1} v_1$$

$$\mu_0 = K_\mu \frac{H}{m} = K_\mu \frac{mkg}{s^2 A^2} = K_\mu \frac{mkgm^2 T^2 s^4}{s^2 kg^2 m^2}$$
$$= K_\mu \frac{ms^2}{kg} T^2 = K_\mu \frac{ms^2}{kg} T \frac{N}{C} \frac{s}{m} = \frac{1}{p_s} B_2 E_2 \frac{1}{v_2}$$

for $E_1 B_1 = E_2 B_2$:

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

K_ϵ = 8.85418782 * 10^{-12}
K_μ = 4π * 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 an absolute rest frame (v_r = c), which may be referred to as CMB (Constant Microwave Background) rest frame due to omnipresence of CMB and negligible photon mass relative to that frame (space).

The energy of that frame is thus considered intrinsic and without a momentum, setting v = 0 above.

In QM discrete energy is limited to horizontal levels and bound by counter-intuitive limitations of the same absolute rest frame.

In CR there are no such restrictions, no rest frame is absolute, each gravitational well has its own space and there are, not only horizontal but vertical energy levels corresponding to scale of discrete packets of energy.

In CR, the CMB rest frame is space of a large-scale graviton with [angular] velocity (v) equal to c, relative to a rest frame v_r > c, and with a *rest* mass < $mc^2/{v_r}^2$.

Obviously, absolute rest mass is fictional - using recursion:

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

In non-equilibrium conditions (ie. in the event of spin change, or acquisition of additional energy) characteristics of the rest frame will change along with the speed limit associated with such rest frame.

7.2 Omega factor (relativistic change)

Omega factor is a non-dimensional relativistic factor, a generalization of the Lorentz factor. It is a necessary modification in order to allow relativity in reference space (density and pressure of space), further allowing relative size of energy quanta and scale invariance of laws of nature.

Energy is relative to a specific reference frame and omega factor will generally be relative to a specific graviton in whose space energy is contained.

Space of a graviton is characterized by its $\epsilon\mu$ product (or density and pressure).

Omega factor represents change in energy due to momentum:

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

c = standard speed of *light*

where k 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, as shown in Fig. 5.

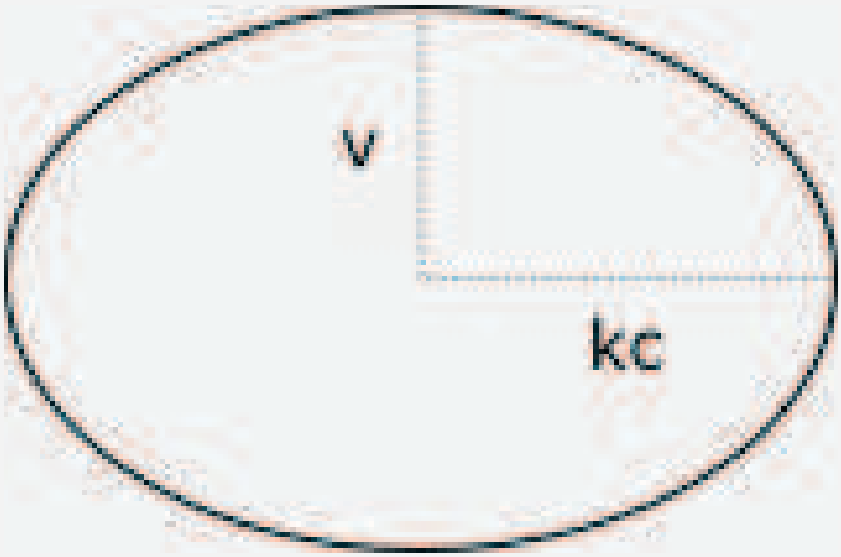

Figure 5: Relativistic ellipse

With k = 1, width is fixed to c and omega factor degenerates to Lorentz. Note also, if k itself has the form of ω^{-1}, degeneration to Lorentz becomes degeneration of a variable ellipsoid to an ellipse of fixed width.
In GR, for an *relativistic* ellipse it is absolutely forbidden to form a circle (v = kc).
However, in CR, this must be only relatively forbidden.
Assume v is the angular velocity of a rest frame 1 contained within a rest frame 2 having angular velocity equal to kc.
It is not forbidden for a rest frame 1 to reach velocity kc and no infinite energy for that is needed either (infinity also must be relative!) - however, needed energy is equal to energy of rest frame 2. Thus, rest frame 1 can reach velocity kc by using all available energy of rest frame 2. This is then simply a transformation or exchange of rest frames - rest frame 1 was born (inflated) into rest frame 2, while rest frame 2 died (deflated) into rest frame 1.
With rest frame 1 becoming rest frame 2, its speed limit is now increased to angular velocity of rest frame 3 which contains rest frame 2.
This is all relative to a reference frame 3 or higher. From the perspective of rest frame 1, due to its change in scale, speed limit may be relatively invariant.
Note that energy can also be applied externally, rest frame 2 (generally a graviton) can merge with another such particle, changing its angular

velocity and speed limit for rest frame 1.
Another way to change energy is through changes in energy level - all energy is discrete, rest frame 2 can jump to a higher or lower energy level.
While energy invariance for rest frame 1 may remain conserved during these changes, these cannot be absolutely instantaneous and invariance will certainly be broken during non-equilibrium conditions.

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:

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

ϵ = rel. const. (ie. 8.854 * 10^{-12} F/m)
μ = rel. const. (ie. 4π * 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 q_0 its velocity and charge (radial 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 $U_{n-2} \ll U_{n-1}$ ($v_{r_{(n-2)}} \gg v_{r_{(n-1)}}$):

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

Fixing all discrete packets of energy to single scale where $v_{r_{n-1}} = v_r = c$ 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:

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

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

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

q_0 = rest charge = rel. const. (ie. 1.60217733 * 10^{-19} C)
M_0 = img rest mass = rel. const.
M_{0-1} = 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 (q_0, M_0, 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 sole 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

In case of negative polarization it increases with velocity, for positive it decreases.

7.3 Energy

A distinct form of energy can be composed of one or more discrete scales of energy. Total energy is:

$$E = \sum E_n = \omega mc^2$$

where mc^2 is rest energy relative to a rest frame with rest velocity c (generally $c = c_{n-1}$), while ω represents increase due to kinetic energy scaled relative to a reference frame of choice (generally the same).

Since kinetic energy of a system is stored in gravitons, its distribution will depend on the scale of these gravitons.

Each graviton with its associated gravitational well (space) is characterized by its ω factor the value of which is relative. However, due to oscillation, its scale invariance and relativity in time, its nature will also be dependent on the frame of reference.

Consider the interaction of particles a_n and b_n in space of a U_{n+1} universe - from the perspective of a particle c_{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, assuming associated gravitons oscillate between neutral and polarized states (they should, to conserve relativity).

7.4 General force

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.

Source of the force is a general rotating graviton with its field spread through the well:

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

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

with charge/mass radii reduced to infinitesimal value:

> Even though the particle 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 (*4π)
μ = magnetic permeability of space (/4π)
g = 1/G = real density of space 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 (effective graviton) at r

where m_r, q_r and v_r are mass, charge and velocity, respectively, of the field maximum, r is the distance between the graviton and the moon particle.

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

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

For n = 0 (c_0 = c), using substitution:

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

, with the angle ϕ between v and (v_s x r) being equal to the angle between 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, 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 $v_s = v$ ($v_s v$ becomes ${v_s}^2$), and, using the above substitution for ${v_s}^2$, 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 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 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 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:

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

Furthermore, due to compression and expansion of space, general force components will have additional terms (non-zero variable field carrier particle mass). General potential should thus be expanded into a Yukawa type potential.

7.4.2 Mechanism of exchange

Exchange of electro-magnetic potential for gravitational potential is done through the change of scale. In example, radii of charge maxima may be deflated with inflation of a mass radius of a gravitational maximum. This doesn't affect only orbital radii of maxima but also spin radii of maximum quanta - effectively, 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 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, absorption of such wave will trigger 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, 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.

7.5 Evaluation of G

Gravitational constant (G) 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 = gravitational mass of the maximum

ρ = mass density of the maximum
v_s = orbital velocity of the maximum [space]
T_s = period of rotation of the maximum [space]

It is relative to a particular gravitational maximum (real graviton) 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 maxima.

While the 3-dimensional (spherical) form of one maximum will cloud the existence of inner maxima, outer maxima can have different spin momenta. Even if the whole system changes spin, changes cannot be instantaneous across all maxima, 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 ${v_s}^2$. Even if outer maxima have collapsed (fragmented) to multiple satellite maxima 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. maxima can thus remain naked for long times, proportionally to scale and inversely proportional to mass (energy) field density, before [another] equilibrium is established and 1/R becomes proportional to ${v_s}^2$.
Real mass required for equilibrium can be obtained through conservation of angular momenta:

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

m_{img} = mass of the naked gravitational maximum = imaginary mass
v = orbital velocity of the maximum
r = radius of the maximum
m_{re} = acquired smaller scale mass = real mass
$v_s = v_{n-1}$ = spin velocity of the [collapsed] maximum
$R = r_{n-1}$ = radius of the [collapsed] maximum
$M = M_{n-1}$ = 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:

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

For a completely naked maximum, $m_{re}(n) = 0$. If the energy for collapse does not come from real mass, $m_{img}(n)$ must be decreased to match $m_{re}(n)$. This is achieved with the increase in $v_n r_n$ product.
Since increase in v_n is not [absolutely] simultaneous with the collapse of 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 M_{n+1} is the total mass of the body M_n is orbiting.
In order to conserve momentum, one must allow for imaginary mass m_{img} on one scale to be exchanged for real mass m_{re} on another. However, in that case G is not conserved.
Note that, if $m_{img}(n)$ is relativistic, increase in v_n will increase it, so, in order to match 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 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 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:

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

But even that one cannot be invariant absolutely.
Assuming that Earth's gravitational maximum has the same gravity as Sun's [surface] gravitational maximum (274 m/s^2), its radius will be roughly equal to inner core radius, and one can now calculate v_{n-1} for 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 * 10^9 m
$v_s = v_{n-1}$ = spin velocity of the current Earth's maximum [space]
$R = r_{n-1}$ = radius of the current Earth's maximum = 1206115 m
G_{n-1} = 6.673899 * 10^{-11} m^3/kgs^2
M_{n-1} = total mass of current Earth = 5.9723 * 10^{24} kg

using $G_n = G_{n-1}$ (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 M_n as img mass $m_{img}(n)$, 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:

$$\begin{aligned}[m_{img}(n) + m_{re}(n)]\, v_n r_n &= [m_{img}(n-1) + m_{re}(n-1)]\, v_{n-1} r_{n-1} \\ &= M_{n-1} v_{n-1} r_{n-1}\end{aligned}$$

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* - $G_{n-1} \neq G_n$.
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 for, or effect of, scale invariance.

Due to relativity of infinity, universes are self-similar, and an atom is relatively equivalent to a planetary system.

9 *Immortal* numbers

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 (space graviton and time graviton) moved some distance apart from each other, leaving the third component (event horizon) in between, but all remain weakly entangled, exchanging radiation.

Assuming distance in space from the event horizon 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 graviton) and *right* side (ie. time graviton) 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 Scale 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 discrete vertical energy levels, it is reasonable to assume that the center of the observable universe (point it is revolving about) is outside of it.

Thus, all observable galaxies orbit a barycenter 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 6p6n 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 (10^{13}) light years, 10^3 times the diameter of the observable universe. *Sadly*, for carbon galaxy species, all other energy levels are outside of the observable universe.

However, considering the number of galaxies and the state of evolution, this is not the best interpretation (although some layering may be present).

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.

The most appropriate interpretation of observable universe is a part of space of a large scale graviton, in a form of a torus - as stated already.

It may have been deflated from an even larger scale, however, evidence suggests it has been inflated from smaller scale, probably in an annihilation event.

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) energy levels (layers) of the atom.

What if properties of standard scale atoms are strongly correlated with properties of U_1/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 redshifted frequencies.

> One might even argue there are 6 distinct wavelengths (after 6th, 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 6th 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 case of em force and gravity, dependent on 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 U_{-1} scale, particle/wave on U_0, while on 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 graviton which may or may not acquire real mass.

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 (graviton) 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

Evidence confirming complete relativity of universes will be presented in follow-up articles. Mainly in the analysis of the Solar System in CR context[12].

> Evidence of CR can be found everywhere. It might just take some *time* for some to admit that reality is intuitive.

14 Conclusion

With complete relativity of everything, time and momentum form the intrinsic and fundamental signature of a universe.

It appears that everything must be relative in order to exist, and conservation of energy through transformation (evolution) is inevitably equivalent to conservation of relativity.

Acknowledgement

This would not be possible without all the work of all the observers of observables of different scale, theorists who tried to describe physics of such universes and promoters and propagators of knowledge and science.

This would also not be possible without Earth providing souls and energy for all these creatures, without the Sun providing soul and energy for Earth and without the galaxy providing soul and energy to Sun. ...

Last, but not least, this would not be possible without the universes of my body entangled with my soul, often enduring sleepless nights with understanding rather than rebellion.

Every *thing* is impossible without everything else.

Thus, I thank everything for every *thing* and every *thing* for everything.

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