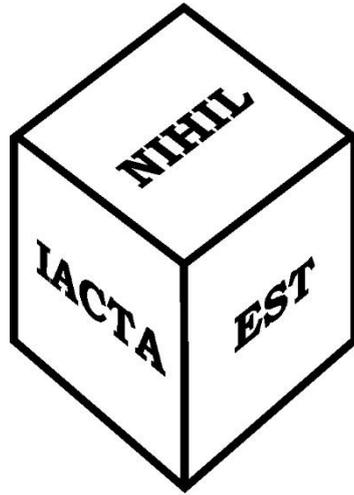




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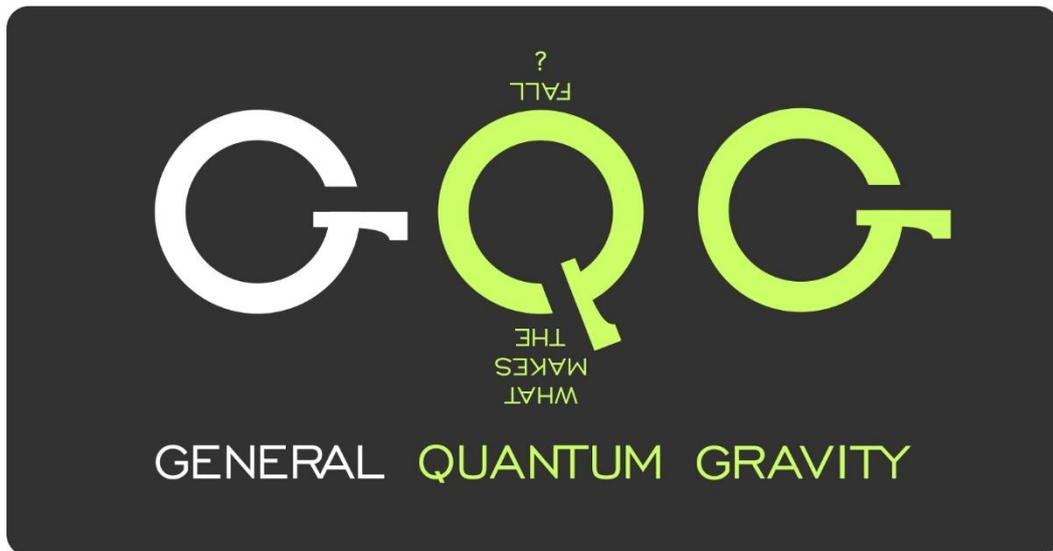


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Version 1.1

*Are not gross Bodies and Light convertible into one another,  
and may not Bodies receive much of their activity  
from the Particles of Light which enter their Composition ?*

Isaac Newton, 1718 [°]

*We could regard matter as being made up of  
regions of space in which the field is extremely intense...  
There would be no place in this new physics  
for both field and matter, for the field would be the only reality.*

Albert Einstein, 1938 [°°]

*The problem seems to me how one can formulate statements  
about a discontinuum without calling upon a continuum...  
...but we still lack the mathematical structure unfortunately.  
How much have I already plagued myself in this way !*

Albert Einstein, 1916 [°°°]

[°]

Newton I. 'Opticks: Or, A Treatise of the Reflections, Refractions, Inflexions and Colours of Light.' - Second Edition, with Additions - London, 1718

[°°]

Einstein A. and Infeld L. - 'The Evolution of Physics' - Cambridge University Press, 1938

[°°°]

Einstein A. - Letter to H.W. Dällenbach - 1916 - Referenced by Sabine Hossenfelder on Backreaction in 'Einstein on the discreteness of space-time' - The complete excerpt features in the reference list.

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*The road to simplicity is paved with complexity.*

# Preface

With his theory of General Relativity [° References p.39] Albert Einstein taught us a.o. *how the apple falls* [According to which trajectories?]. And that space itself entails an ever changing dynamic under the influence of matter, marked by a non-fixed rate of pace of time. He also made us understand that energy and matter are somehow exchangeable. But we still have to find out how all of that works at the smaller scales. Hopefully in this century scientists can find out *what makes the apple fall* [What initiates it ? And why does it seem to have a tendency to keep on going once it has landed because it keeps exerting a force on the earth surface ?].

Einstein struggled on the road to General Relativity and contemplated on several concepts, changing and adapting them towards his final version in 1915. He might have liked the idea of a quantized and finite yet malleable abacus for space, as the breeding ground for an emergent time, length units and energy, since he already plagued himself in 1916 with the validity of the continuum and the lack of the appropriate mathematical structure [\* References p.39]. His 1911-1912 concepts could have taken a new direction. In Chapter I we propose an adjustment of some of our philosophical views, apply logic and realize, as Einstein said, that you cannot solve a problem with the method that caused it.

New oxygen - Compiling his know-how in concept formation from Integrated Product Design [IPD] into Integrated Quantum Design [IQD], product designer Koenraad M.L.L. Van Spaendonck [Alumnus of the University of Antwerp - UA – 1995] injects new oxygen into the quest for a theory of quantum gravity with a unifying character. Entailing a.o. the breeding ground for a universal building block for space and matter, and a finite abacus for space from which time emerges.

New causal principles - All working together towards a theory of General Quantum Gravity [GQG], aiming to extend the applicability of General Relativity from the proposed new GQG-geometry. As opposed to GR's mathematical object 'spacetime', this geometry is closer to a one on one translation from the model to the physical processes which govern gravity and related items.

New solutions - The GQG-geometry intrinsically shows how renormalization can be avoided featuring the roots of a finite calculus from the self-organizing processes of the model. How to avoid concepts of dark matter and dark energy from an emanating illusion of the accelerated expansion of the universe. The geometry also shows how light 'stops' at the black hole horizon, time-reversal inside the black hole, and how space and matter could have a common origin. We also hypothesize on the falling apple and inertia: General Relativity tells us how [according to which paths] the apple falls, but not what makes the apple fall in the first place.

Less is more if less does more - This motto avoids bolt-on design or add-ons, towards a more elegant theory of gravity [and ideally matter] emanating from unified smaller scales. However, certain qualitative assessments are yet to be formalized quantitatively and will require complementary expertise. We also propose an experimental test to falsify an important prediction of the concept presented.

But first things first - Infinitesimal calculus, infinitesimally small intervals, dimensionless items and reference frame of scale are logically and philosophically evaluated in the context of quantum gravity, to justify a more finite abacus. As Einstein said : " You cannot solve the problem with the method that caused it. "

Concluding - GQG hypothesizes on how the discreteness of matter [ $E = mc^2$ ] invokes its counterpart as an electromagnetic gravitational quantum field [EGQ-field] with an intrinsic generalizing signature.



# The gist of it

## *°Matter curves spacetime on the subemergent level*

The essential novelty introduced : As the constituents of space and matter, quantum oscillators are binary [ 0 or 1 ] concerning their content, but not concerning their size. This allows the storage of more but smaller quantum oscillators [‘waves’] in the same original volume of a holographic shell of space. So the sequence is: Matter as concentrations of oscillators, and oscillators [the quantum field] as excitations from a background.

The evolution of time and gravity radially outward from a body M arises from the consecutive size difference of the quantum oscillators, which adapt according to the available space on the holographic layer. In the situation of the inertial equivalent, inertia can increase or decrease for matter through the sequence of acceleration followed by constant speed, thus concentrating more oscillators. [[See slide 4](#)]

Thus matter energy  $E=mc^2$ , in a constant state of pre-strain, causes a strain [‘the action’] on space invoking the equivalent of ‘data compression’ [[See slide 5](#)] from information theory. [cfr. Sakharov’s metric elasticity [Link : http://www.math.uwaterloo.ca/~akempf/sakharov.pdf](http://www.math.uwaterloo.ca/~akempf/sakharov.pdf) - p.365]. The data storage analogy for lossless data compression tells us that you can only put 4 bits worth of information into 3 bits, if you reduce the actual size of the bits. Because there is no escape from the Pigeonhole Principle [[Link : www.math.ucla.edu/~radko/circles/lib/data/Handout-123-153.pdf](http://www.math.ucla.edu/~radko/circles/lib/data/Handout-123-153.pdf)]

## *°Spacetime makes matter move on the subemergent level*

Newton’s law  $g = GM/r^2$  follows from the fact that the inertia of m in the gravitational field of M, consists of an increasing amount of oscillators per original volume of mass constituent [protons,...], according to the inverse square rule. Thus elementary particles act as flywheels with variable inertia due to varying ‘bit-density’. Energy units are distance units are quantum oscillators of varying size. The oscillator size [quanta of the field] is proportional to : Area of holographic layer / # mass const. in the bulk. And our concept : Smaller but more quanta ~ higher energy density ~higher acceleration. So g is proportional to : # mass const. in the bulk / A of hol. layer :  $g \sim M/r^2$  [[See slides 4 and 6](#)].

Note: Consequently up for further investigation : Does G determine the density of fermions which consist of these mass constituents ? Does G entail an ensemble of time dilatation factors on a cosmological scale? [This is outside of realm of the work presented here.]

## *°Generalizing Einstein’s signature through a physical principle*

Our geometrical model shows how these oscillators or quanta self-organize according to the available holographic on-shell space, leading to a shift of the radii: the radii go off their mark producing extra bit size increase or decrease. Inducing a stronger effect than the Einsteinian time assignment to the original radii. Hence possibly the illusion of an expanding universe due to an intrinsic bit size increase radially outward, but also tangentially : isotropic contraction and expansion is the key here. [[See slides 3,4, and Appendix 2](#)]



# CHAPTER I - NEW ROAD TO A NEW GEOMETRY

## I.1.Approaching the problem

### *° Complementary skilled experts climbing the ladder of coherence*

Should you manage one day to find yourself standing on the shoulders of a giant, you will barely be able to look further over the horizon... unless you are a giant yourself. A matter of elementary mathematics. Isaac Newton said in 1676 : “ If I have seen further, it is by standing on the shoulders of Giants. “ [1]. But then he was indeed a giant himself. And we know that such giants on average, only come along once every 100 or 200 years. In the meantime we, ‘the ordinary people’, had better get resourceful if we want to make progress on understanding the unknown. We could round up a group of complementary skilled experts to stand on a ladder next to the giant.

Standing on a ladder next to the giant, will not only allow you to look further over the horizon, but will also give you that extra angle on the unknown. As you climb the ladder, you try to introduce more coherence than was achieved before [Illustrated with a twist in Image 1 on page 6].

### *° Problem solving know-how from Integrated Product Design : new oxygen*

If we are dealing with the design of a universal building block for matter and/or space, then Integrated Product Design is definitely a relevant area of know-how. We have adjusted this problem solving model [IPD] [2] and the assessment model [T.H.E.-method] [3] to fit the needs of Quantum Gravity research [See Image 2 on page 7]. Clearly one could also adopt a model to fit scientific theory building in general. We do not only need complementary skilled specialists working together, a well known fruitful modus operandi. We also need people working together with complementary skills in problem solving, different angles of approach to problem solving.

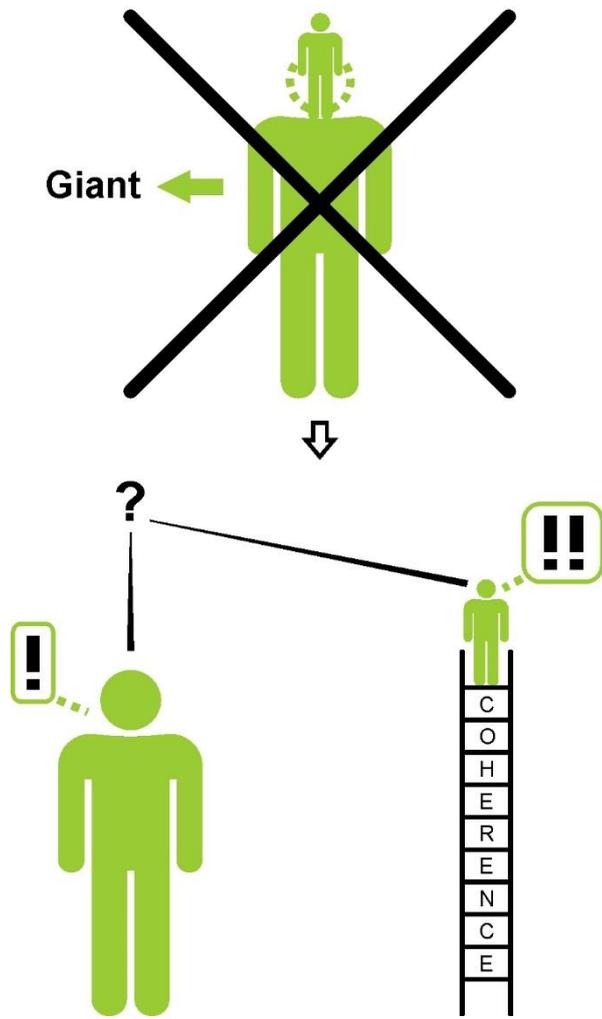
Vertical thinkers teaming up with horizontal thinkers will yield a synergy : the whole becomes more than the sum of the individual parts. Obviously nobody is strictly a vertical or a horizontal thinker, human beings are not binary, but their is clearly a ‘core skill’ to be taken into account for different types of problem solvers.

The problem solving file cabinets of a vertical thinker contain answers to previous questions. The problem solving cloud of a horizontal thinker contains building blocks for future answers. But those building blocks need to be developed into a mathematical formalism in conjunction with a profound knowledge of established physics, which are important skills of the theoretical physicist. A mutual respect could prove to be very fruitful. This is how you enhance group intelligence to gain more insight in nature : by means of diverse synergetic thinking at the foundations.

Do we fully realize the incredible success of complementary skilled people working together ?

History teaches us how Einstein worked with Grossmann, how Maxwell used his skills on the work of Faraday, yielding the most successful scientific theories we know.

The hybrid model loses [some of] the bad qualities and saves the good qualities of the previous generations towards a superior hybrid design, in your problem solving process. And so we mimic these hybrid dynamics of self-organization in our research approach, because it yields more intelligent solutions. [Genetic algorithms are used in Product Design, based on self-organization, self-evolution through mutation into hybrid concepts.



*Image 1 - The giant and the ladder of coherence - © K.M.L.L.Van Spaendonck*

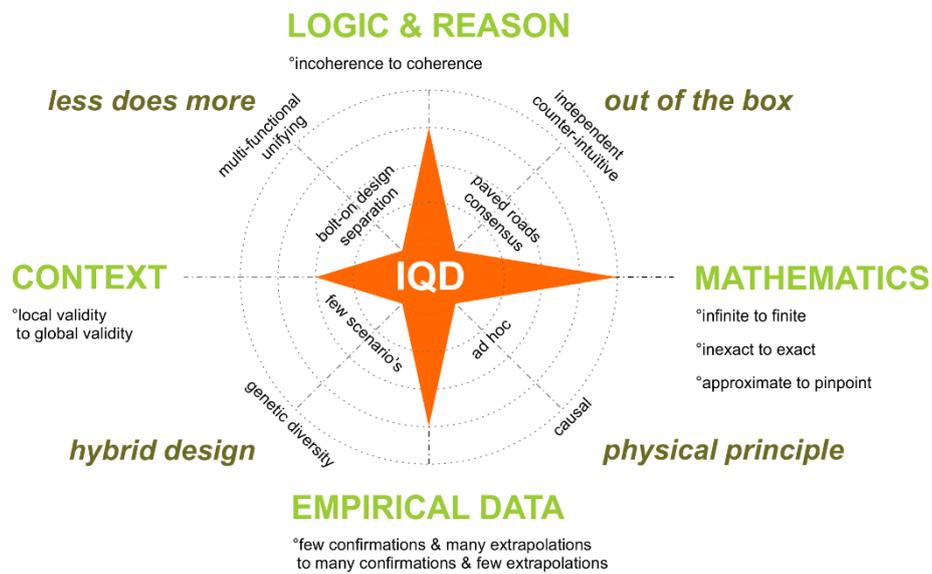
°Integrated Quantum Design [from IPD & T.H.E.-method]

**-domains of creative input :**

>less does more, hybrid design, physical principle, out of the box

**-DOMAINS OF ASSESSMENT :**

>mathematics, context, logic&reason, empirical data



°Interpretation :

- Larger shapes mean higher scores (radial score assignments 1 to 5).
- Symmetrical shapes are more balanced and pay off in the long run.
- Polygons are best & stars are mediocre.
- Everyone's preferred shape is also everyone's preferred philosophy.

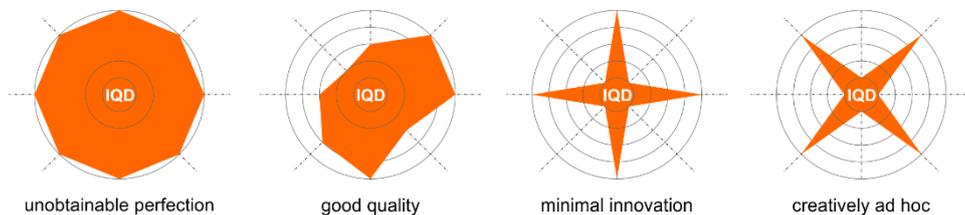


Image 2 – Creativity, mathematics, logic, context, data treated on equal footing

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## I.2. Defining and reformulating the problem

*°How does space assign a time coordinate along the straight line of the apple ?*

Emergent gravity, Microdynamics of underlying degrees of freedom of spacetime, Davies-Unruh temperature, Geometrogenesis, Causal Dynamic Triangulation, Loop Quantum Gravity, String Theory [4,5,6,7,8,9].

These are some of the notions and roads taken towards a theory of Quantum Gravity.

If gravity indeed arises from a dynamic of discrete constituents, then scientists face several difficulties to make such a dynamic consistent with the established macro-emergent notions and observations in modern physics. The problem of the transition from pre-geometric high energy phase to the relativistic geometrical low energy phase a.o. [10].

*°Several questions arise which are hard to solve*

-How to recover the Newtonian inverse square law ?

-How to solve this issue: Relative motion using a spacetime with discrete constituents, leads to inconsistency with a feature in Special Relativity : symmetry, invariance.

-How to construct a micro-level configuration of constituents that leads to a metric with relativistic effects such as relativistic mass increase, length contraction and time dilatation, bending of light ?

-How to implement a causal principle for gravity? What exactly makes the apple move the way it apparently does ? What makes the apple initially get into motion at all ?

If we take the Emergent Gravity Paradigm seriously, then this should lead to a reformulation of A. Wheeler's expression [11], into a new conundrum :

*How does matter make spacetime curve,  
and how does spacetime make matter move,  
on the subemergent level ? [\*]*

[\*] : Subemergent level : All microscopic processes responsible for emergent gravity reside here.

In 'Exploring the Nature of Gravity' [12], T. Padmanabhan formulates the first problem as follows: " How does such a discrete structure end up curving the continuum geometry ? ". But do we fully realize that this continuum is not a one on one translation from every point in space ? The apple does not fall to the earth along a curved line consisting of (x,y,z,t)-coordinates. That only happens in the world of the mathematical object 'spacetime', which is an abstract indirect translation modelling the real world.

We redefine the first problem: "How does space assign time to the straight path of the falling apple ?"

Can we make the hypothetical quanta of space self-organize under the influence of matter, to induce the Einsteinian time signature ? Time as emerging from the malleable construction of space.

### I.3.The need for causal principles and coherence

We just don't have the necessary detailed information yet, to uncover the highly organized logic behind unexplained phenomena. Therefore we must hypothesize on the deeper causes of phenomena around us, within a coherent story. And at a later stage we must push forward towards an experiment which should at least display measurable symptoms of the leap taken.

Philosophy and science are two sides of the same coin of knowledge gathering. If you study history, then you will notice that philosophical questions are in many cases unanswered scientific questions : Yesterday's philosophy became today's science, and consequently today's philosophy will become tomorrow's science. Even the philosophical questions surrounding Newton's first law of motion, a law we accept without any true causality, due to overwhelming empirical evidence, will one day shift from 'why' to 'how', and from 'how' to 'what happens at the smaller scales'.

So if we want to derive an improved theory for gravity, and matter, then we will have to make some changes or improvements to our basic underlying philosophy. This involves the question whether the math coherently succeeds in describing the processes at hand in nature, and whether we have defined sufficient causality for the observed phenomena.

If we are truly interested in progress, then we cannot remain satisfied with theories of gravity and matter which have inexistent or unclearly defined causal principles. In his essay on lessons from Einstein's 1915 discovery of General Relativity, Lee Smolin [13] addresses this and related issues, summarizing :

*"The lesson is that the task of formulating a physical principle must come first. Only when we have one in hand do we have a basis to look for new mathematics to express the new principle."*

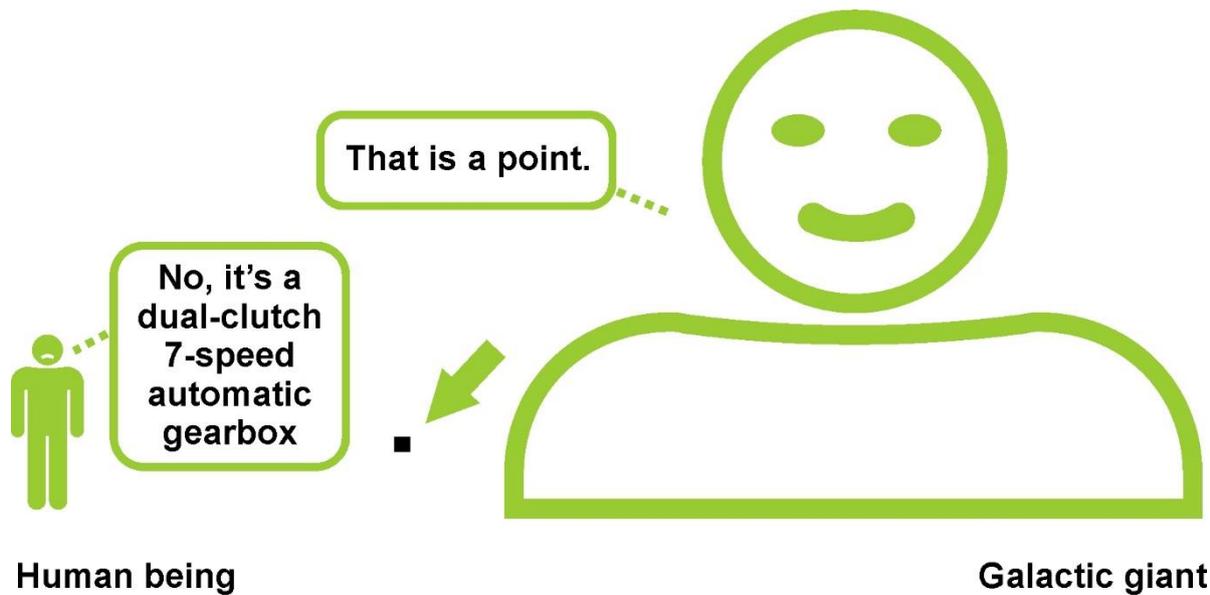
*"The start of the answer is that Einstein asked different questions than his contemporaries. Why? Because he had a deep need to tell a coherent story about the world."*

Further, we argue that our subemergent theory of gravity should be made finite, making use of a yet to be developed calculus that addresses the description of discrete spacetime appropriately [slide 2]. This way the generalization of General Relativity will automatically entail the characteristics of a quantum theory of gravity to be inserted with less problems into the subatomic level, and/or in Quantum Mechanics. We should no longer need renormalization procedures if things are formulated from first principles [[See slides 3, 4 and Appendix 2](#)].

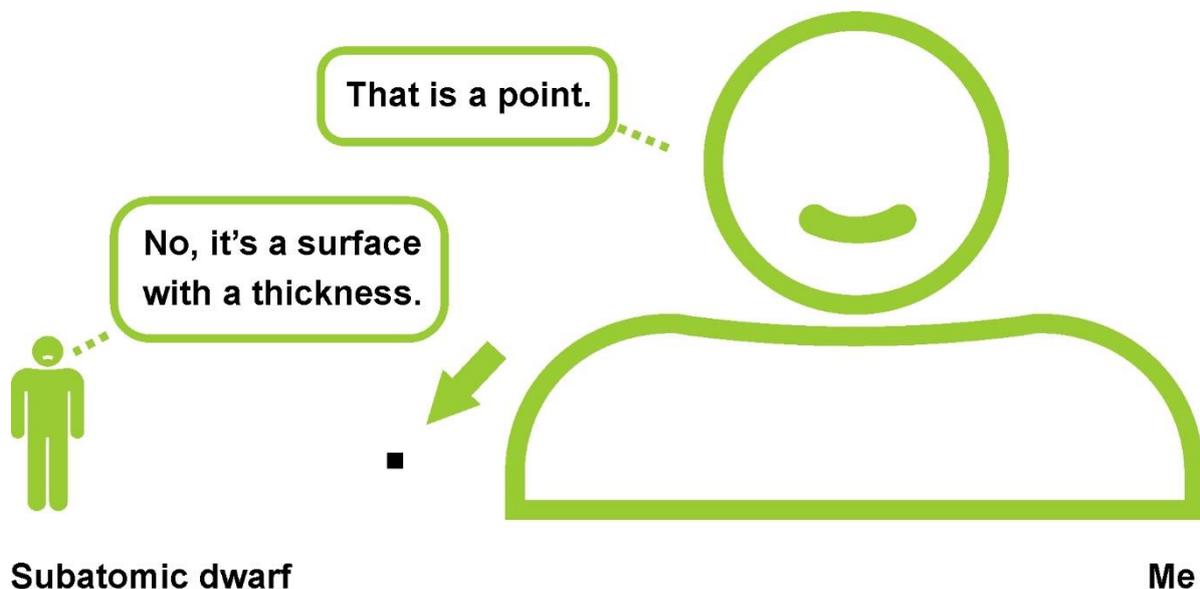
Max Planck showed us that energy comes in finite quanta. How do we address that with infinitesimal calculus ? And how do we avoid problems of infinities at the subatomic level ? We argue that the problem cannot be addressed with infinitesimal calculus, because it does not reflect the underlying processes involved in gravity adequately. [Obviously we do not want to criticize those areas where this calculus proved to be fruitful. The question concerns the application in a theory of Quantum Gravity.]

Infinitesimal calculus simply does not handle discrete elements very well.

On the following pages [[Images 3, 4, 5, 6 and 7](#)] we explain this clearly and illustrate it with a twist.

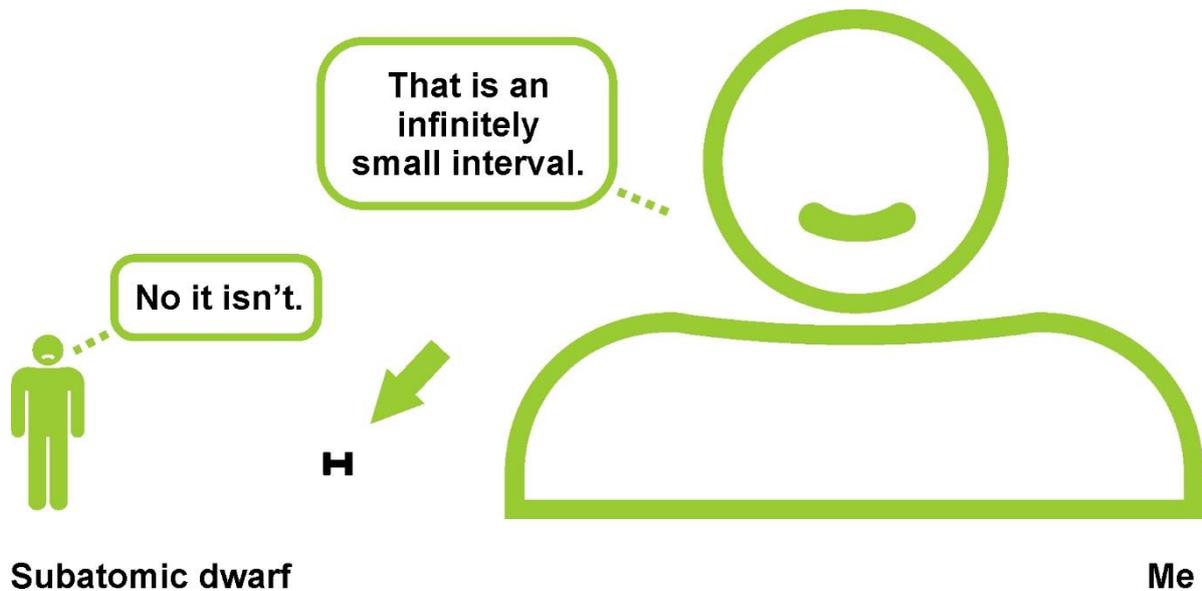


The galactic giant has neither tactile nor visual access to the realm of the gearbox. His scale of size prevents him to have access. Consequently he forgot about *his own reference frame of scale of size*, which made him conclude that he is looking at something totally insignificant. If he could shrink himself to the same level of size, then he would immediately have access to the realm of the gearbox. *Access to its mechanical nature, an option which cannot be excluded..*

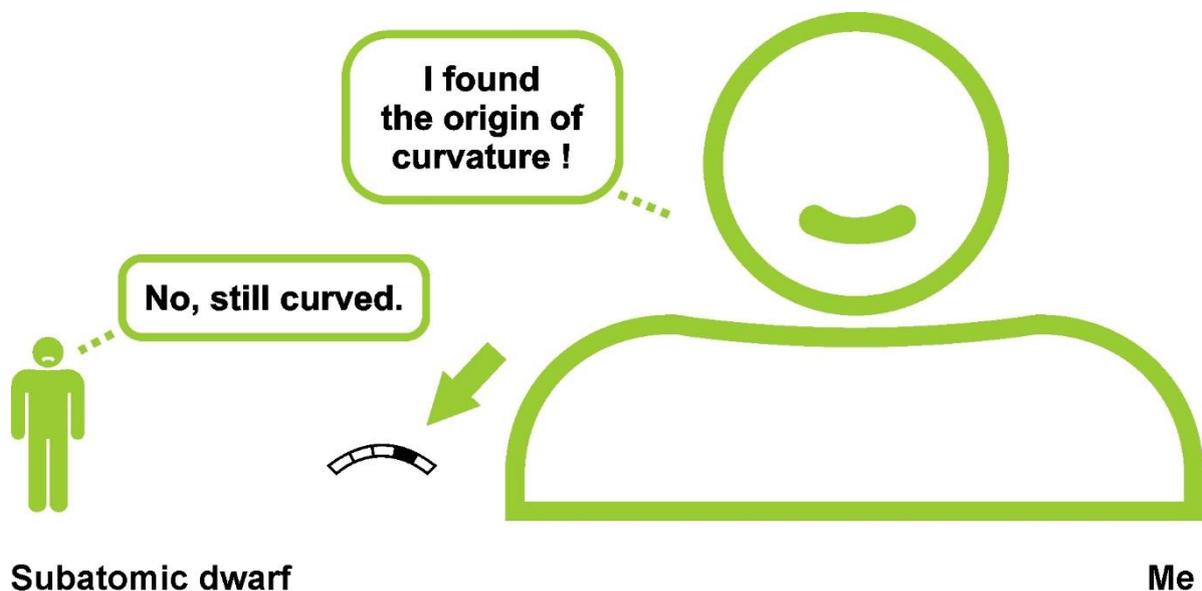


Consequently the same principle applies for the relationship between human beings and the smallest scales. If we were subatomic dwarfs as well, then we would immediately see that we're dealing with 'an object' here with spacial extensions, and not an abstract point. We can learn to incorporate these consequences of our own reference frame of scale of size, to obtain an enhanced understanding of the smaller scales. We argue that things on the same scale of size can interact mechanically, even though we cannot experience that from our reference frame of scale of size.

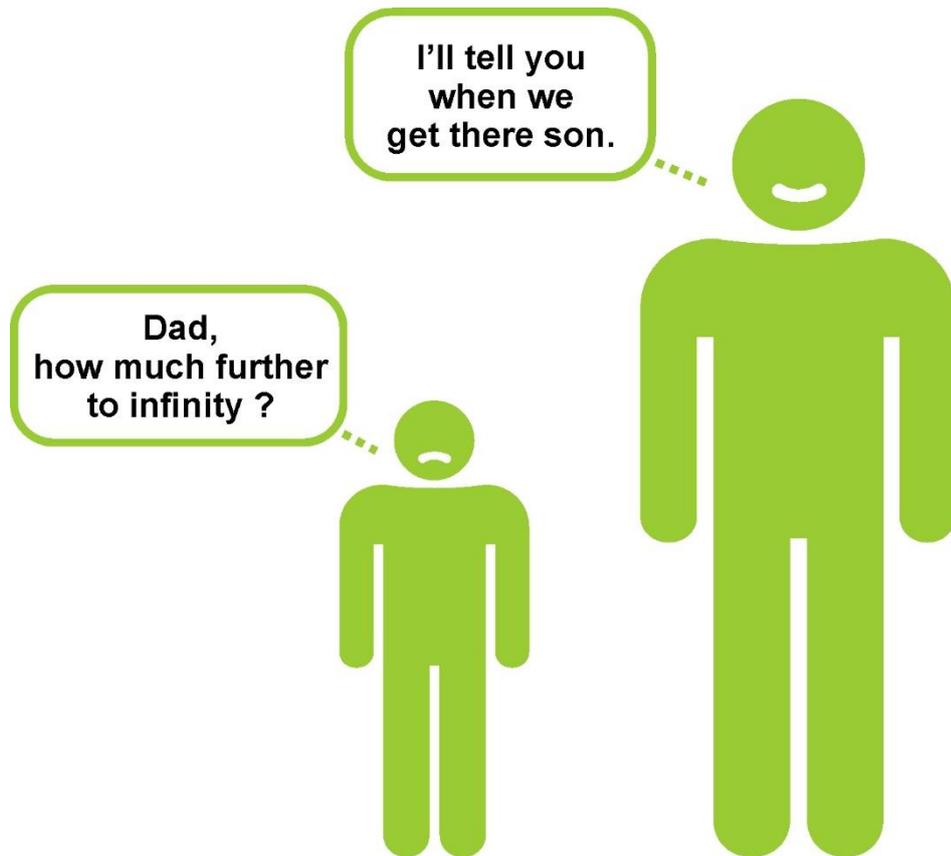
*Images 3 and 4 - © K.M.L.L.Van Spaendonck*



Infinitely small intervals do not exist, because you must indicate how small they are before they actually become an interval. Hence before they can be used in any type of calculation. And if you do assign a length to it, then it becomes immediately clear that there must be intervals smaller than the one you have chosen. Now suppose we introduced a smallest length like the Planck length, then the notion of an instantaneous speed becomes untenable. Because you either have the last smallest interval (hence a trajectory speed), or you don't, in which case you get a stand still, no relative speed.



By neglecting the consequences of our reference frame of scale of size, we risk to start adopting the notion that extremely short intervals in a curved spacetime, can qualify as uncurved. The subatomic dwarf will make you understand that, if only you could shrink yourself to his reference frame of scale of size.



The boy will never get to 'infinity' because dad hasn't determined how many steps they will have to walk to get to infinity. It is an ongoing situation, whatever it represents, hence one cannot assign a value or a number to this situation. Hence any use of infinite series can never be treated as a number in any calculation or any line of reasoning of any kind. Some series may have an approximate answer, which is nice for a low energy continuum theory. But those answers become useless in the context of the search for a theory of Quantum Gravity. Our mathematical understanding should incorporate this consequence. For instance: It creates problems for the basis of a String Theory in 26 dimensions, with the procedure of renormalization, to get rid of the mass contributions of the quantum oscillators. Where  $1+2+3+4+\dots$  and  $1-1+1-1+\dots$  up to infinity get fixed numbers assigned to them :  $-1/12$  and  $1/2$ .

*Image 7 - © K.M.L.L.Van Spaendonck*

Another question arises in a quantum context concerning a continuum as opposed to discrete steps :

Does gravity actually work up to infinity ? With a continuum the answer is yes. But with quanta ?

[Also see page 20 and 26]

Because if you can't move slower than one Plank length per unit of time, then after that it's zero lengths per unit of time : stand still : no gravity. And so that point must be somewhere, it could no longer be an ongoing situation, could it ? It would also entail an unacceptable infinite energy of gravitation from one body.

## I.4. Three Causal Principles underlying a new abacus

We propose 3 guiding physical principles leading to a quantized self-organizing relativistic spacetime, induced by matter, leading to geometrogenesis [8,9].

A self-organizing spacetime is neither deterministic nor indeterministic. There is no pre-determined outcome, and yet it doesn't evolve randomly : the configuration settles along the way due to physical constraints.

Remark : An important paper, as well as extra info-links from a well respected pioneer on self-organisation, Professor F. Heylighen, can be found in reference 14.

### **Principle 1** : [\[see slide 9\]](#)

If the density of a body  $M$  were to increase, then  $E = mc^2$  causes more energy absorption by the vacuum [cfr Sacharov strain]. Because the surface area of a holographic layer of spacetime will then be forced to harbor more quanta. Hence the quanta compress [more but smaller quanta], configuring time, length and energy density per holographic layer [emergent curvature].

### **Principle 2** : [\[see slides 4, 5 and 6\]](#)

Distance units assume an increasingly compressed quantized pattern radially inward [The number one difference with 'Newtonian quanta']. Because the holographic surface areas get smaller inward and because the quanta contract isotropically [assumed] which pushes the radii consecutively off their mark. So quanta which had isotropically precontracted dependent on the available smaller area of the consecutive holographic surfaces inward, to form an emergent curvage, out of selforganization. Compare it to the idea of a variable Planck length as the root of the quantum surface area.

### **Principle 3** : [\[see slide 1\]](#)

Light propagates by means of a momentum transfer between consecutive quanta of physical spacetime. The quanta are the stationary constituents of electromagnetic radiation - emerging as local excitations of the underlying field. Hence light [EMR] and gravity emerge from a different usage of the same field. This momentum transfer conserves energy, like the desktop toy 'Newton's Cradle' [[See page 14](#)]. So light does not literally propagate. It is a non-visible momentum transfer until the last shackle in the pre-existing yet malleable chain of energy quanta [physical spacetime], hits your eye-receptors. The slide on the next page shows the conceptual principles of our proposed system of propagation for light [EMR].

**The new abacus for physical spacetime to be developed**, could overcome the disadvantages of calculus with infinitesimals, by introducing a finite minimum length [e.g.  $L_p$ ] yet having variable local size due to compression [hence formation of more but smaller quanta from the background] from the matter sector. Hence avoiding infinities in advance, before applying gravity to the subatomic realm, in a unified picture. We could then avoid the use of renormalization procedures.

This subemergent geometry will at least qualitatively for now, feature connections to redshift, bending of light, time dilatation, and solutions for unknowns with black holes.

More importantly, the radial time evolution which follows the same formalism, indicates the illusion of the accelerated expansion of space, as derived from our exact GQG-geometry [[slide 3 and App. 2](#)]. And a comparative time dilatation experiment is proposed to falsify the new prediction [[see page 34](#)].

**In vacuum EMR propagates as momentum transfers between the quanta : size variable quantum oscillators ('waves') of the gravitational field, with emergent elasticity, following the principles of the analogy with the desktop toy 'Newton's Cradle'. GQG**

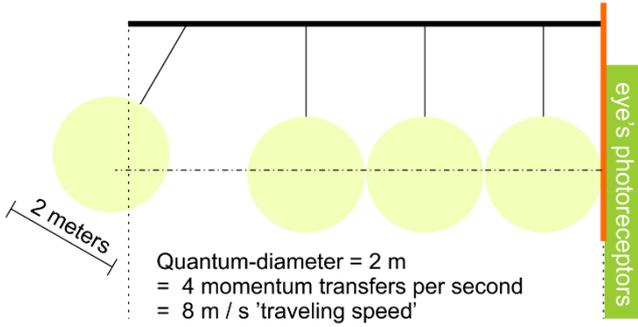
**1**

°The field unifying gravity with EMR : EGQ-field : Electromagnetic Gravitational Quantum Field

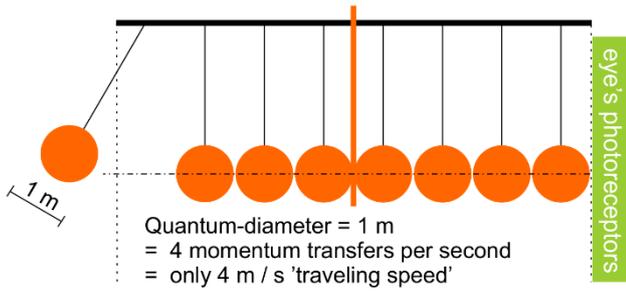
°1 field of energy quanta: used stationary for EMR and used dynamically in and out of matter for gravity/accll.

°In vacuum (EGQ-field) : Quantum size is : - proportional to speed of light  
- inversely proportional to frequency of light

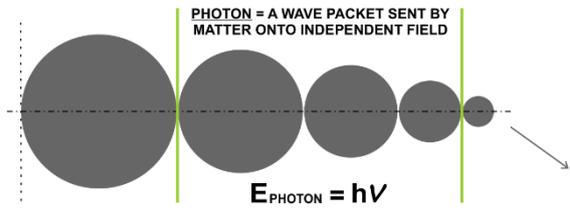
**1**



**2**



**3**



°Photon blueshifting towards potential well:  
-Constant content [same # of quanta/oscill.]  
-Varying size : quanta get smaller and smaller:  
the green lines are closer together when packet is closer to potential well : more packets per orig. size  
-Conform to Pound-Rebka 1959 experiment

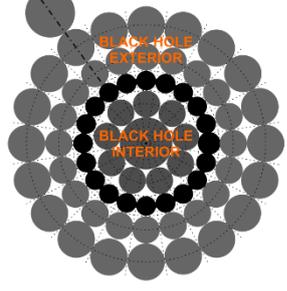
Consequence for gravitational redshift in Schwarzschild metric  
(Valid for a non-generalized GR, not in GQG : radii off the mark)

$$\frac{1}{\sqrt{1 - 2GM/rc^2}} = \frac{c}{\sqrt{c^2 - 2GM/r}} = \frac{\text{max. quantum size at outskirts}}{\text{local quantum size}} \gg \text{see App.2 : } \sim \frac{\lambda_{\text{obs}}}{\lambda_{\text{rest}}} \sim Q/q$$

Conforms to Einstein 1911 bending of light concept, interpreted with an extra factor 2 for bending angle due to spacial curvature



**4**



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° *Speculative consequences currently under development*

Speed of light as seen from a distant star – towards a subemergent explanation

This concept of the GQG-geometry has consequences for the interpretation of the speed of light, and for redshift in the context of the black hole metric, for the spherically symmetric, non-rotating case. As seen from a distant star, light will appear to be slowing down, because quanta closer to the potential well are more contracted, hence each transfer of momentum covers less and less distance [Imagine the Newton spheres of the desk toy to be smaller and smaller in diameter], compared to distances measured with uncontracted quanta : the ones at distant stars or outside of the gravitational field. Redshift and blueshift becomes a natural consequence of this configuration. The consecutive momentum transfers [EMR] will have covered a smaller distance as measured from a distant star, as timed with the original time units. The Pythagorean theorem is originally about surface areas,  $c^2 = a^2 + b^2$ . Take the root and you get a radial unit of length of space on a holographic. The largest quantum is at the outskirts of spacetime of for instance the earth, sized  $c^2$ . And the root gives a length size :  $c$ , comparable to a variable sized Planck length. [Be it a local value].

Redshift for Schwarzschild black hole metric – towards a subemergent explanation

Gamma, the Lorentz factor, can also be expressed in a way closer to the proposed physical processes underlying GQG :  $\gamma = c/\text{root}(c^2-v^2)$ . A comparison of the local size of a unit of length,  $\text{root}(c^2-v^2)$ , to the larger size at the outskirts :  $c$ . Redshift ‘as seen from the outskirts’ in the case of the Schwarzschild metric of a black hole, is now for instance 3 times the local size if the local size was 1/3 of the outskirt size =  $c/\text{root}(c^2-v^2) = 1 / 1/3 = 3$ . [Which is identical to the familiar  $1/\text{root}(1-v^2/c^2)$ . [App.2 and p.14] Remark:  $v^2$  gets replaced by  $GM/r$  here. I presented it as  $v^2$  to attribute the direct link with the inertial case. Because there we expect quanta to become smaller, but more will emerge from the background [absorption of energy], with increasing velocity.

Equivalence between inertial mass and gravitational mass – towards a subemergent explanation

We are aiming for an equivalence principle expressed with the dynamics of the quanta, instead of a low energy description. The goal is to construct a parallel between the following - under development:

- Black Hole interior ~ atom nucleus constituent
- Black Hole exterior ~ atomic orbital system
- Black Hole time-reversed field of quanta through self-rotation
- ~ structure of inertia for nucleus constituents. [App.2 and p.14]

HLC : Alternative interpretation of length contraction - towards a subemergent explanation

Density increase is currently perceived as contraction in the direction of motion : smaller volume with the same amount of constituents. GQG implies that this density increase consists of transitions to increasingly smaller but more constituents within the same volume, emanating from a background, with increased velocity This yields a more natural concept of inertia. But it also implies that with the LHC, we are *not discovering* smaller and smaller particles, *but are producing* them during the interval of acceleration. Scatter patterns with briefly existing constituents could now be explained as oscillators resolving back into the background, as the cause of their existence – increased velocity – has stopped due to the collision. Would it be possible at some point in the future, to use GQG’s geometrically discovered formula of intrinsic expansion, to find out more about the content of different masses of the particles, with LHC-experiments or with alternative interpretations of existing LHC-data ?

## I.5. The larger context and the smaller context

### °The role of time in this hypothesis

Time does not exist ‘out there’, it is a human-made abstract *tool of the mind* to structure events, giving rise to notions of past, present and future. But the only events *in reality* consist of “stuff moving” in the broadest sense of the expression imaginable, from planets to quarks and every other level of scale. So when General Relativity tells us that time is what clocks measure, then this is not about the tool of the mind, but about ‘the stuff out there’ responsible for geometrogenesis.

It sounds simple because it is simple, but hard to capture since we are not accustomed to place ourselves outside of reality to contemplate on it independently. And so we must really start to grasp the unspectacular notion that Supertimeman is not here to help us. We created him ourselves, as a Deus ex Macina.

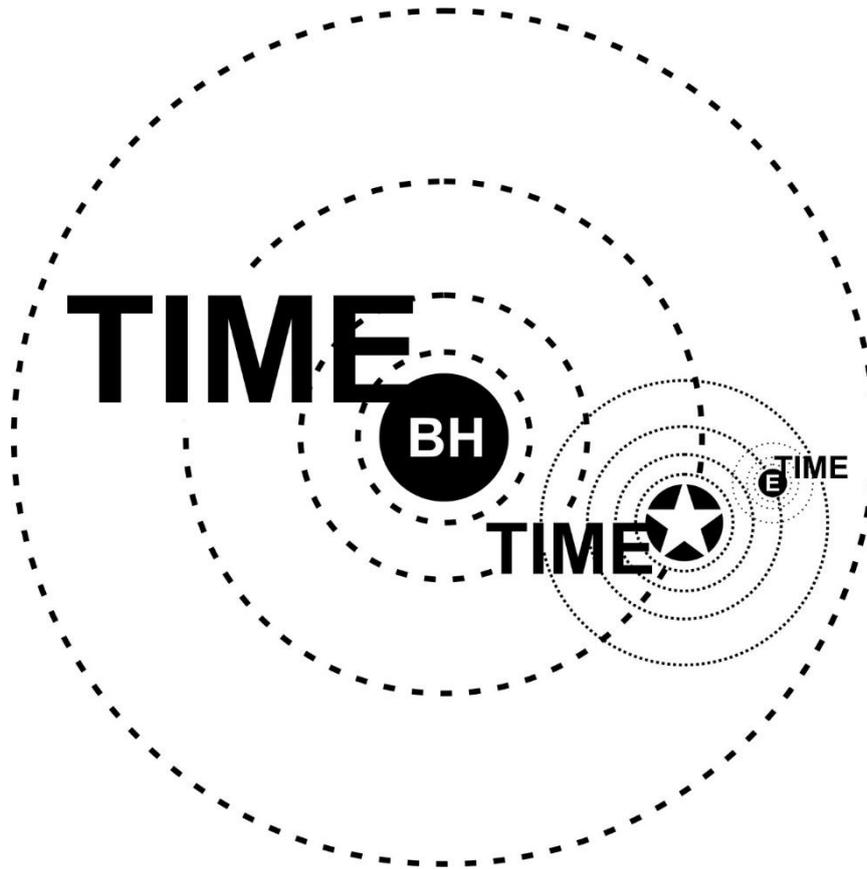
Remember, in this concept a unit of energy = a unit of space = a unit of time. So an atom clock slowing down as seen from further outward, is gaining momentum, expressed as more but smaller units *inside the atom*. That is why a light pulse from the atom will now take more time to travel the same distance *in the atom*, because it involves more consecutive transfers of momentum over the same original distance. So one ‘tick’ will have a longer duration before being completed. Note that an hour glass would not respond that way [yes, the individual atoms of the sand would] because here it’s gravity that will make the hours pass faster due to the gravitational effect on the sand grain.

And that’s exactly what the shift from an exodermic theory to an endodermic theory entails : The Lorentz factor occurs as an effect *inside the atom*, hence directly inducing the relativistic mass increase.

So ‘time’ is emergent from the sheer local size of the quanta, physically present. And observing a galaxy, it becomes clear that all the orbital speeds are linked to the center of the galaxy as the center of the preferred coordinate system. ‘Preferred’ means it is the one and only coordinate system that has a direct connection between the physical reality and the mathematical representation, whereas any other coordinate system would have to use coordinate time, which is detached from the physical evolution at hand.

Time becomes a cascading system handed down from galaxy to solar star system to planet-moon system, where one time dilatation factor becomes the starting value of the next time dilatation factor [See image 8]. But this is nothing more than the local size of the quanta of space, it is physical, there is nothing abstract about it in the sense of time linked to past, present, or future. But obviously our representation of that physical reality will be mathematical, hence incomplete, but closer to the physical local evolution than it is currently represented by General Relativity. Hence a hyperbolic continuum spacetime is avoided in favor of finite abacus with isotropically contracting quanta, using a one on one correspondence [See slide 2]

The inertial case mimics the gravitational case, inducing the quanta to get smaller, that requires energy input. Whereas the gravitational field of quanta already has the quanta pre-contracted before they get cycled into the atom : no extra energy input required. Equivalence of inertial and gravitational mass follows from it. Kinetic and gravitational time dilatation from the subemergent processes of the field of quanta.



*Image 8 - © K.M.L.L.Van Spaendonck*

In our galaxy for instance, the barycenter of the blackhole-star orbital system coincides with the center of the black hole. And from there that of the sun-earth system coincides with the center of the sun. And from there that of the earth-moon system coincides with that of the earth. [As an approximation for practical uses.] But do we realize that this also goes for an earth-satellite system ? And even an earth-airplane system? And hence also for an earth-train system [train going along the equator], and for a station-train system ?

So we hypothesise a cascading system of time dilatation factors as an overarching context. Clocks are placed at every barycenter, and the clocks of the orbiting bodies are all compared to the clocks at the barycenters. But of course one barycenter [say that of the earth-satellite system], becomes the 'orbiting clock' around another barycenter [that of the sun-earth system], etc.

Consequently we arrive at the conclusion that special relativity is in fact absorbed by this larger context. And the slowing down of clocks becomes a one-way feature in a spacetime as a field of quanta. Which leaves the coordinate speed and coordinate acceleration to be nothing more than an abstract human introduced book keeping device, baring no ground in reality. Thus opening the door to an appropriate understanding of inertia. However, the core of our work is the GQG-geometry, and not this more speculative concept of barycentric relativity.

*°Towards a cascading finite abacus (of size-changing quanta) for time in the galaxy*

How do we translate the above into the abacus to be constructed ? An abacus that should eventually handle multiple planets, stars and a black hole : a galaxy ? [Later on to be extended to the universe, given the assumption of black holes being present at the center of galaxy clusters, etc.]

We can regard the barycenter to be a physical location in the physical spacetime of the black hole for this purpose. The perfect locations to place a clock to compare as seen from the black hole. So orbiting bodies around their barycenter are not experiencing the same intensity of phenomena due to their different speed around their barycenter and due to their distance from the barycenter. I am aware of the 'wobble' of for instance the sun, due to its minimal 'rotation' around its common barycenter with the earth, but then the barycenter of the earth-sun system is orbiting nicely around the black hole. Note that we don't take the origin of this abacus is the center of the blackhole, but rather the collection of quanta on the horizon, each having their time evolution outward.

The black hole at the center of our galaxy induces orbiting stars near its horizon to move at a speed  $c$  [orbital speed], while at the same time, the clock of such a body would be seen as ticking at a rate of pace close to zero cycles per unit of time. On the other hand, if bodies are extremely far away from the black hole, the bodies will tend to have very slow orbital speeds relative to the black hole, while their clocks will run at a very high rate of pace compared to being very close to the black hole. In turn, for a star, the same reasoning can be set up concerning the rates of pace of the clocks of the planets, and in turn planets onto moons.

So in this concept, the locally preferred reference frame is the physical equivalent of the metric outside the black hole. [Conventionally reduces here to a spherically symmetric non rotating black hole with Schwarzschild metric.]. Symmetric experiences would still exist in the case of 2 bodies of equal mass and radius, orbiting each other, with the same orbit speed relative to each other, as viewed from the barycenter. Then they would experience indeed the same effects, given their identical speed around the barycenter. [If they are situated far away from any other graviational influences.]

Examining the experimental observations, any and all measured slowing down of clocks, was always observed from the same frame of reference : that of the body with much larger mass, looking at the frame of the insignificant mass, in which case the barycenter coincides with the center of the larger mass. Current experimental results in time dilatation would not be violated with this approach of 'barycentric relativity'.

To conclude : The barycentric comprehensive helicopter view of a cascading time scheme of time dilatation factors, holds the implication that our value of the speed of light, is only a local value, setting the stage for the spacetime of a certain planet, moon, or star. One time dilatation factor becomes the starting value of the next time dilatation factor. For instance: The size of the quantum of space at a radial distance  $R$  from the black hole horizon, where a star is located, becomes the starting value of the local speed of light for that star system, because from there on towards the center of that star, the quanta will get smaller [more quanta on the same surface, more transfers of momentum in the same length take longer, duration of 'a tick of the atom clock' takes longer].

We are to be guided by mainly one rule, once we have formulated the causal principles : the quantized endodermic deepened equivalence between inertial and gravitational mass, as a process taking place within the atom [protons,..], influenced by local speed or local density, to be calculated with the malleable yet quantized and finite abacus of physical spacetime. Working with cascading time dilatation factors from the black hole onto the stars onto the planets onto the moon or onto satellites etc.

### *°Important consequences for the abacus under development*

We contemplate on the following : If interpretations have been incomplete, then we may have implemented unnecessary compensations, hence needlessly complicating our understanding.

#### *\*Waiting for Godot*

There is nothing wrong with Special Relativity ‘an sich’, it is nicely consistent. Except that practically speaking, you will not find a single situation in the reality of a galaxy where it is applicable in the context of a search for a theory of Quantum Gravity, because there is no such thing as an uncurved spacetime here. [Also see section of infinitesimal intervals, where neglecting our reference frame of scale of size has misguided us into believing such a thing would actually exist.] There is no escape from using the barycentric approach, the strong 2-way relativity principle is not correct. Because if in the Hafele-Keating experiment, A and B are the airplane clocks, C is the earth clock and D is the ECI clock, then A is compared to D, B is compared to D, and C is compared to D. >>> Every other result follows from this primary comparison with the barycenter. <<<

Eventually this means that Hendrik Lorenz was right about his [locally] preferred frame of reference, but he was not right about the contraction of bodies, it’s endodermic, not exodermic: you get smaller but more quanta within the same volume, area of the atom [See Appendix 1]. So why the null-result in the Michelson-Morley experiment if there is no contraction of the body to compensate the proposed slowing down of light by ‘the aether’ ?

The light travels independently of the source: nothing is happening to the beam of the interferometer under the influence of traveling matter. So there is no effect to be compensated for [the contraction of matter]. They were waiting for Godot, looking at nothing happening exodermically speaking. But inside the atom, endodermically, you get more but smaller quanta, depending on the orbit velocity of the earth, depending in turn on the orbit velocity of the sun, etc. [Barycentric approach].

The light does not ‘travel’, it’s just consecutive transfers of momentum from one quantum to another, like the desktop toy ‘Newton’s cradle’, along the pre-installed field of the quanta. Although be it a malleable field according to the mass and volume [hence density] of the body M, and the consecutively larger bodies. We could conclude that ‘exodermically’ correlates to accordance with the low energy limit macroscale observations, and that ‘endodermically’ correlates to accordance with the high energy realm, microscale observations [as yet inaccessible].

#### *\*Matter and space with a common origin*

First of all it’s not an aether, it’s a malleable grid of multifunctional quanta used in different ways [EMR, gravity, energy, distance] that also make up the constitution of matter. Matter and space as two manifestations of the same phenomenon. Nature doing more [or the same] with less. Particles are groups of locally rotating quanta of that field. This rotation gives them the status of the equivalent of a solid little sphere [or disk], yet still connected and fed by the inflow of space. And this paper by J.O. Dabiri [link here : <http://authors.library.caltech.edu/1422/1/DABjfm06.pdf> - p.106,109,112] shows by experiment, in a hydrodynamic analogue, with a modification, that this rotating amount of water gives rise to an added mass, just like a solid sphere would in fluid flow. Particles as ‘excitations of a field’ now becomes a more concrete concept. Now add the concept of the constituents of this ‘emergent’ particle to contract isotropically when going into a state of increased velocity, and you get momentum increase [see ‘flywheel’ further]. Like a tropical cyclone forming above the sea: miniaturized it looks like a moving particle, but in fact the water molecules only move locally.

*\*Exodermic to endodermic dynamics*

The thought experiment of the transverse photon clock on the carriage and the Pythagorean triangle yielding the Lorentz factor, is an application of that exodermic theory. But the reality of the matter is that the photon travels independently of the source, every physicist is aware of that. It travels straight downward or upward when released, as the carriage moves away horizontally. So there is no bouncing vertically of any kind, it misses the opposite mirror right from the start. [In fact it does not travel at all as we hypothesized, it is series of consecutive transfers of momentum using the local existing field of quanta: electromagnetic gravitational quantum field or EGQ-field.] No diagonal [hypotenuse] behavior of any sort either, unless you take it as an optical illusion, which the theory of Special Relativity clearly does not support. Hence no 'lengthening of the path taken as seen from' as we adopt a higher speed for the carriage, as expressed by the Lorentz factor.

The solution is the endodermic explanation in this hypothesis, where quanta contract isotropically, resulting in more but smaller quanta within the same volume, area, increasing thus the momentum of the particle, the atom. A higher concentration of momentum expressed in quanta. Induced by the energy input [[See Appendix 1](#)].

*Now you could argue that it doesn't matter that the physical explanation of the photon clock thought experiment does not match the mathematically resulting correct Lorentz factor, but then you are embedding incoherence. And that is exactly what we must avoid. If we want to get higher upon the ladder of coherence, to see further over the horizon, then logic, mathematics, and philosophy should be treated on equal footing, to keep everything consistent.*

*\*Does gravity work up to infinity, within an explanatory quantum context ?*

No experiment ever proved that gravity works upto infinity. It's an assumption that follows from the assumption of a continuous spacetime [see page 12 and 26], which has no place in a theory using a quantized physical spacetime : You can't move slower than one Plank length per unit of time, after that it's zero lengths per unit of time : stand still : no gravity : no more difference in diameter between 2 consecutive quanta on 2 consecutive holographic surfaces of physical spacetime, to express it with the language of our hypothesis.

Furthermore, if a body M would induce bodies m to accelerate up to an infinite distance, then this means that every body M generates an infinite amount of energy. That contradicts the finite energy of matter :  $E = mc^2$ .

*°What happens in the apple ? Conservation of momentum*

GM in  $GM/r^2 = g$  (ultimately  $M=E/c^2$ ) represents 'the action'. Physical spacetime responds with 'the reaction': absorption of energy in an equal amount : consecutive quanta of spacetime get smaller radially inward ( a process of self-organization along the path of least resistance), hence storing different energy densities on the holographic surfaces. If a body m were to pass through the spacetime of M radially inward, then it will convert this energy density into motion according to the inverse square law, because the internal flywheel of the constituents of mass will gain momentum [mv] : It will pack more yet smaller quanta in the same virtual container.

This flywheel is constantly rotating, even if you stand on the earth. That's exactly the reason why you have weight, and why the apple starts to fall when you release it from a certain height. So you could state with a twist : Nothing makes the apple start to fall, it is already continuously falling internally. The flywheels never stop. We note that this peels only another layer of the union of the unknown, because the question arises: how does the flywheel keep spinning ? Let me know when you discover that. But then that is what science has always done with small increments over the course of history: unveiling slowly but surely, and gathering the fruits of those partial discoveries, like wireless communication from understanding EMR, or nuclear energy from learning about the constituents of the atom.

Remark : It has nothing to do with pressure applied as presented in various outdated theories of push gravity, they all considered matter to be something separate from space, even the best aether theory still held that source of inconsistency. Applying pressure could never explain how the apple would start to accelerate when dropped from a higher altitude into a denser medium. That contradiction is lifted when you understand that the space is rotating in and out of the mass constituents of the apple. That's the difference between an exodermic theory of gravity and the proposed endodermic theory of gravity. And the photon clock thought experiment is an exodermic interpretation and representation of an endodermic process of momentum increase, instead of time slowing down for the photon with the increased length of the hypotenuse (Its path contains smaller yet more constituents when velocity goes up).

Note : In 'New Version of General Relativity that Unifies Mass and Gravity in a Common 4D Higgs Compatible Theory', Jacky Jerome and Frederic Jerome [Sciences-Tech, France], also relate volume and surface as a defining factor for curvature or time, and did so before me. But our mechanism for gravity is not a pressure system à la Le Sage, precisely for the above reasons. And our proposal is constructed from a subemergent geometry of quanta [quantum gravity], not from a continuum, and it has several extra consequences and predictions, especially concerning accelerated expansion.

So every constituent of mass [whatever it may be or may look like] in the apple consists of such a flywheel. That's why a hammer and a feather fall with the same acceleration, because every single flywheel undergoes the same influence.  $F = ma$  thus  $F/a$  is constant here : If the hammer weighs 10 times as much as the feather, then 'the force' goes up 10 times aswell, so the acceleration stays the same. That's because 10 times more flywheels each experience the same influence of increased momentum.

And like a toy car with a flywheel : if it hits a wall it will keep on going, meaning it will continue to exert a force on the wall. That force depends on the momentum of the flywheel. Or like the front gear wheel on a bicycle: switch to a larger gear wheel and still make one round per second: you will obtain a new higher speed corresponding to the the number of teeth on the rim, but you had to put in more energy to achieve that. Bodies absorbing energy according to  $E = mc^2$  or  $E = ymc^2$ , by means of accelerating up, effectuate exactly the above: absorption and conservation of energy, conserved in every single constituent of mass separately. It also is the reason why a body stays in orbit 'when no external forces are applied to it'.

The teeth on the flywheel are simultaneously the constituents of physical spacetime recycled in and out of the atom (the mass constituents), the distance traveled per unit of time, and the energy units spent to achieve it. Nature doing more (or the same) with less. You could remotely relate this to strings or loops, but here we work from first principle, profound causality is fueling the entire proposal. With a geometrical model that stands closer to the hypothesized physical processes [translation from the mathematical object 'spacetime'], where the physical spacetime arises from a background.

# CHAPTER II - CONCEPT FOR A NEW GEOMETRY

## II.1.Modus operandi

We assign characteristics to the quantum to function as a universal building block of matter and space.

°Three principles from Product Design problem solving to model reality with direct geometry

- 1] Less is more, if less does more or the same. As opposed to bolt-on design.
- 2] Hybrid design with genetic diversity from associative thinking yields synergy effects.
- 3] Guiding creativity along an ensemble of constraints, towards functionality.

°Consequently we 'design' the quantum to be 'a triple double agent'

The quantum holds 3 x 2 functions, counting on emerging effects of the config. of self-organization : Space & Time, Energy & Gravity, Light & Matter. The latter follows from the former. The quantum itself has a constant internal momentum  $mv$ , but a variable size [see slide 6]. Its length is comparable to the root of a  $Lp^2$ . This is the basis of a malleable abacus for physical space with emergent time.

°Four causal physical logical principles guide this endeavor

- 1] Volume [with a certain density] of matter yields energy absorption by spacetime.

The presence of matter, having absorbed an energy  $E= mc^2$  to exist, induces energy absorption by the vacuum by producing smaller but more quanta per equal holographic surface area, from a background.

- 2] Isotropic contraction yields the radial time evolution.

The quanta resize isotropically [tangentially AND radially] in a self-organizing way along the available amount of area of a holographic surface, leading to an Einsteinian geometrogenesis.

- 3] Mass as a malleable flywheel made of a rotational quantized fluid flow with density, yields inertia.

Changing inertia arises from a mass  $m$  as an excitation of the field of quanta to change in density, with a variable flywheel-momentum function.

- 4] Gravity arises from quantum size differences between consecutive holographic layers of the field.

Inducing the flywheel [built from the flow of quanta, cfr Dabiri p.19] to gain momentum.

Inertial acceleration mimics this. Conservation of momentum is procured by the flywheel functionality.

## II.2. The geometry of General Quantum Gravity

*Hypothesis for a translation from infinitely many spacetime points (the mathematical object of hyperbolic 'spacetime') to a discrete physical space, with a set of size-variable field quanta from a background, inducing 'time' by self-organization, with a forced limitation of the number of holographic layers from first principles and geometrical constraints.*

Explanatory images on pages 26-33 [[slides 2-9](#)] and the elaborations on pages 42 and 43 [[App. 1 and 2](#)] and the introductory slide on EMR-propagation [[page 14 slide 1](#)] are provided for a concise overview.

°Fixed mass, volume, density of body  $M$  : 'settled metric'

Accumulative increase outward, decrease inward of field quanta size per holographic layer, with fixed percentage of increase along 'annual compound interest formula' [[see slide 3 and App.2](#)]. The formalism emanates from the causal self-organizing process of the quanta.

°Changing the density of  $M$  : 'settling metric' (assuming an increase here)

Causal principle of higher  $E=mc^2$  invokes more Energy absorption by the field of quanta. Practically that means for instance that 4x the density induces 2x smaller quanta on the same holographic layer. So 1 quantum reduces in size according to : Surface Area / root of Increase of # of bulk constituents, Hence 4 [that's the density increase] smaller quanta replace the larger one : increased energy-density for the gravitational field, increased inertia for the particle. [[See slides 3,5 and 6](#)]

°Elaborating on the geometry

°We hypothesize on space built with quantum oscillators ['quanta'] each consisting of an orbiting mass  $m_q$  and orbital velocity  $v_q$  for  $m_q$ , with a variable orbit radius  $R_q$ . The energy of a single constituent of matter  $m_m$ , will consist of  $c^2$  quantum oscillators having maximally contracted :  $E = m_q c^2$ .

°The amount of oscillators ['waves'] packed per holographic layer of space around a body determines the local gravitational energy. Hence their size difference [time evolution] per holographic layer induces gravitational acceleration  $g = GM/r^2$ , following geometrically from 2 causal physical principles introduced, including the intrinsic Einsteinian signature, and a generalization.

°An elementary particle [proton,...] as a mass constituent is an excitation of this field of quanta. Hence more inertia follows from an elementary particle packing more but smaller [isotropically contracted] quanta. Their contraction is induced either by inertial motion or by being closer to a potential well, thus interpreting the equivalence principle on the quantum level.

°Light 'travels' by means of consecutive elastic collisions of the same stationary quanta or oscillators inducing a number of momenta [ $m_q v_q$ ] to get transferred over the distance of their diameter [ $d=c$ ] of those oscillators, per unit of time [ $t$ ]. An analog here would be the desktop toy with colliding Newton spheres [[See slide 1](#)]. Hence the Planck-Einstein relation  $E_{\text{photon}} = hf$  is now expressed as an amount of momentum transfers through consecutive oscillators ('waves'), being the quanta of a physical spacetime, per fixed duration.

°More photon energy means more transfers because the oscillators are now smaller. Each transfer covers an instant distance of the diameter of the oscillator [~‘variable Plack length’].

We hypothesize it to have a lenght between 1 and c. Thus  $E_{\text{photon}} = hf$  is a [wave-]packet of momentum transfers  $[m_q v_q]$  inversely proportional in # to the local oscillator length  $[1/ 1 \text{ up to } c]$ , per fixed amount of duration  $[t]$ . This has indeed the dimensions of  $mc^2$  :  $\text{kg} \times \text{d}/t \times \text{d}/t$  with the last d being  $(1 \text{ up to } c)$  :  $E_{\text{photon}} = m_q v_q (1 \text{ up to } c) / t$  [see slide 1]. Is  $v_q$  equal to speed c ?

°The oscillator has a diameter [or radius – under investigation] of 1 up to c units. [specifications are under investigation, inferring the equivalent of a variable Planck lenght] This size difference is induced by gamma in the inertial case, and by the gravitational time dilatation factor in the potential well of M. Hence the relativistic result :  $E = \gamma m c^2$  has its equivalence in the gravitational field.

°Connecting to the pre-1915 concept of Einstein stating that the speed of light varies with the gravitational potential. We argue that his 1911 paper on the bending of light [\*\*] was not wrong but simply lacked this extra interpretation : A factor 2 for the bending angle arises indeed from the radial time evolution, but the extra factor 2 simply arises from the spacial curvature, yielding a factor of 4.

°‘Curvature of spacetime’ is thus translated from a mathematical highly abstract object to a geometry [transition: see slide 2] closer to the physical processes : evolution of quanta sizes radially outward. Thus responsible for redshift and blueshift [see App.2] : e.g. the length of group of 4 field quanta gets shorter when closer to the potential well [see slide 1]. From our proposed geometry we, derive Newton’s law with an intrinsic generalization [see slides 4,5].

°Maximally isotropically contacted oscillators are obtained at the black hole horizon resulting in zero elasticity per oscillator, hence no more EMR is possible as consecutive momentum transfers are stopped at the horizon, either trying to ‘go’ out of or into the black hole. Thus matter holds the highest concentration of quanta, and space [the vacuum] holds a radially inward increasing concentration of quanta. [See slide 7]

°We arrive at a physical spacetime consisting of quantum oscillators formed from a background and in turn elementary particles formed from a background of these oscillators. The unifying character of a malleable quantum oscillator emerges from our problem solving method along the directive of ‘less does more’. The background is not specified further in this work, except that it consists of the masses of the oscillators. It could be ‘uncurved’ or more likely ‘curved’, depending on the large scale structure of the universe. But that is guesswork because we have no access to that information. No background seems like an illogical option because how would something emerge from nothing ?

°Hence in the long run we work towards the goal of a multi-functional quantum oscillator :

Unit of distance - Unit of EMR propagation - Unit of energy - Unit of matter - Unit of space and Constituent of emerging time [See a.o. Appendices 1 and 2]

°In this context we quote Einstein from ‘The Evolution of Physics’ [A. Einstein, L. Infeld, 1938, CUP]

*“ We could regard matter as being made up of regions of space in which the field is extremely intense. . . There would be no place in this new physics for both field and matter, for the field would be the only reality ”*

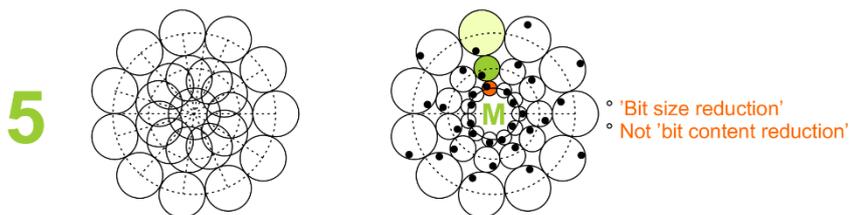
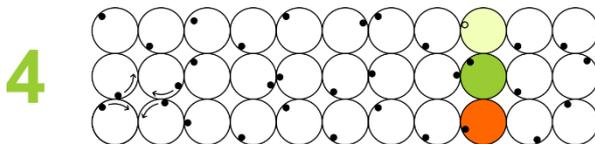
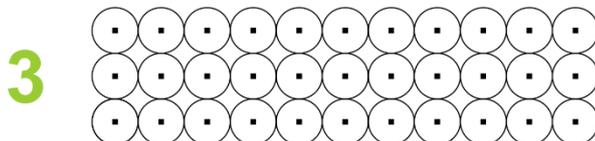
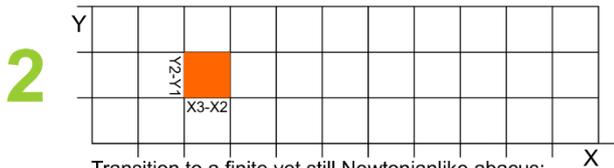
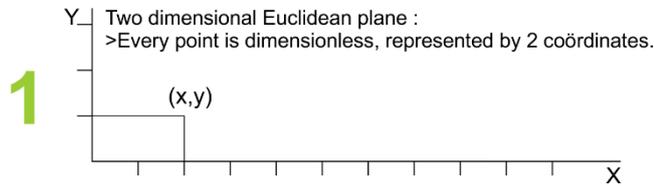


From infinitely many abstract spacetime points to a malleable discrete physical spacetime with a set of size-variable quanta, GR closer to QM. Allowing energy-absorption as 'lossless data compression' due to the principle of 'bit size reduction'. (And avoiding Pigeon Hole Theorem.)

GQG

2

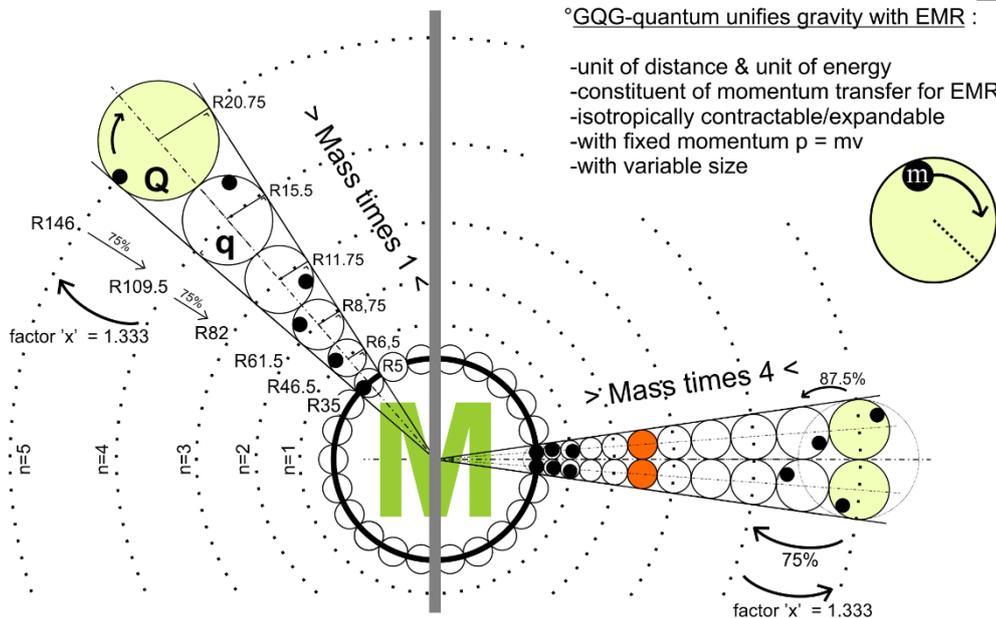
TOWARDS A NEW ABACUS FOR PHYSICAL SPACETIME



Extending to 3D yields holographic layers holding size-reduced, not content reduced 'bits'.

This slide is an extract of publication ISBN: 9789402149999 authored by K.M.L.L. Van Spaendonck ©

~ inertial case of isotropic mass-constituent contractions : Appendix 1



°GQG-quantum unifies gravity with EMR :

- unit of distance & unit of energy
- constituent of momentum transfer for EMR
- isotropically contractable/expandable
- with fixed momentum  $p = mv$
- with variable size

°GQG-geometry : Looking under the hood of hyperbolic spacetime

> Yields a limited fixed number of holographic surfaces from first principle :

Radial contraction follows tangential (concentric) contraction along available space. (solving the Ehrenfest "paradox" in the inertial equivalent)

> Repeating radial quantum radius decrease here of +- 75%, or increase factor 'x' 1.33 inward, from first principle: self-organising quanta going off the Newtonian radius mark

> Math. formalism manually derived from self-org. geometry = exactly compound interest. !

$r$  - size at present time 't'  $r_0$  - size at origin time 't<sub>0</sub>'

$Q = \text{larger quantum}, q = \text{smaller quantum}, n = \# \text{ of hologr. layers} : Q = q(1+x)^n$  !

\*Hence number of holographic layers ~ difference between past time and present. !

°GQG-geometry : consequences

! Dark energy merely a characteristic of expanding/contracting field quanta settling along the available space on each holographic layer. Dry & unspectacular : no Big Bang ? Natural explanation for homogeneous larger scale universe.

> Expansion derived from the redshift is an illusion due to the intrinsic pre-expanded radial spacial distances which mimic an accelerated expanding metric over time. !

> Black Hole extrapolation for radially inward contraction : momentum transfer for EMR incapacitated at horizon (max .contraction). Hence no light in/out.

> Unifying extrapolation to subatomic discrete E-levels deserves elaboration.

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**Further elaboration on self-organizing finite # of layers : Appendix 2**

**Physical principle of quantum-contraction & radii going off the mark leads to emergent holographic time evolution and generalization of General Relativity** **GQG**

**4**

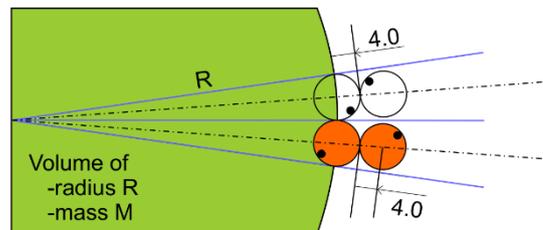
$E=mc^2$  of matter causes space to absorb energy

- >Einstein's 'curvature of spacetime' = succession of quanta of varying size
- >Space quanta change size ~ available space on hologr. layer (thickness = 1 quantum).

*Remark: The blue V-shaped radial quanta separating lines force the quanta to fit around. Thus ensuring the De Broglie Matter Wave constraint in a unifying picture: 'Only those radii whose circumferences equal a multiple of the electron's de Broglie wavelength are allowed.'*

**SELF-ORGANISING STEP 1 :**

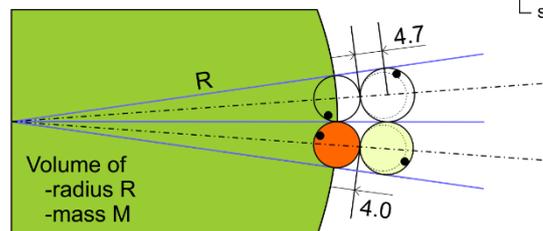
- >The mass constituents of individual atoms occupy a certain volume within the volume of the body M.
- >So the mass constituents cause field quanta to take position on the surface of the volume of M.
- >Quanta increase in size now proportional to : Area of hologr. layer / # mass const. in the bulk [ $\sim r^2/M$ ]
- >Reaction: The quanta on the next holographic layer are forced to take place further radially outward.



**SELF-ORGANISING STEP 2 :**

└ radially and tangentially

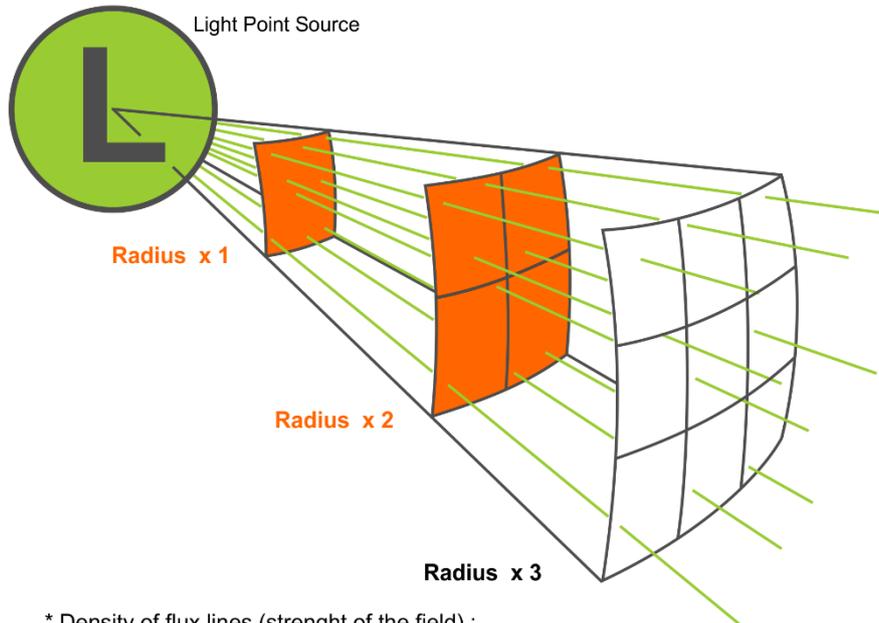
- >The quanta isotropically adjust size according to available space on the holographic layer. The oscillators are hypothesized as disks with axial freedom. They behave like 'a room-filling gas with vorticity' (to give a non-exact analogy)
- >Consequences: [ Radius of holographic layer 1 is R ]
  - Radius of holographic layer 2 is NOT  $R + 4 + 4$  BUT  $R + 4 + 4.7$
  - Stated differently: holographic layer one has thickness 8, and layer 2 has thickness 9.4
- >>> The time magnitude is not assigned to the ordinary radius [like in GR], but comes naturally into existence as an enlarged magnitude, thus causing the radius to go off the mark.



**Further elaboration on self-organizing finite # of layers : Appendix 2**

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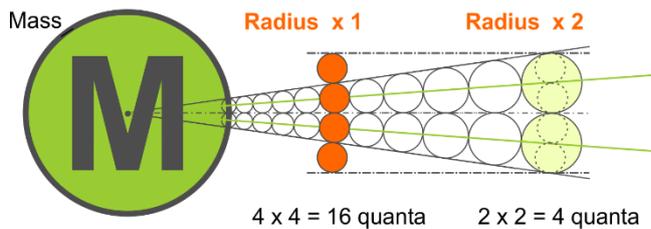
°Light (EMR) intensity :



- \* Density of flux lines (strenght of the field) :
  - >Inversely proportional to the square of the distance from the source.
- \* Number of flux lines :
  - >Proportional to source strenght
  - >Constant with increasing distance

°Graviational energy intensity - 'lossless data compression'

\* 'Lossless' here means perfectly reversible with e.g. density changes.

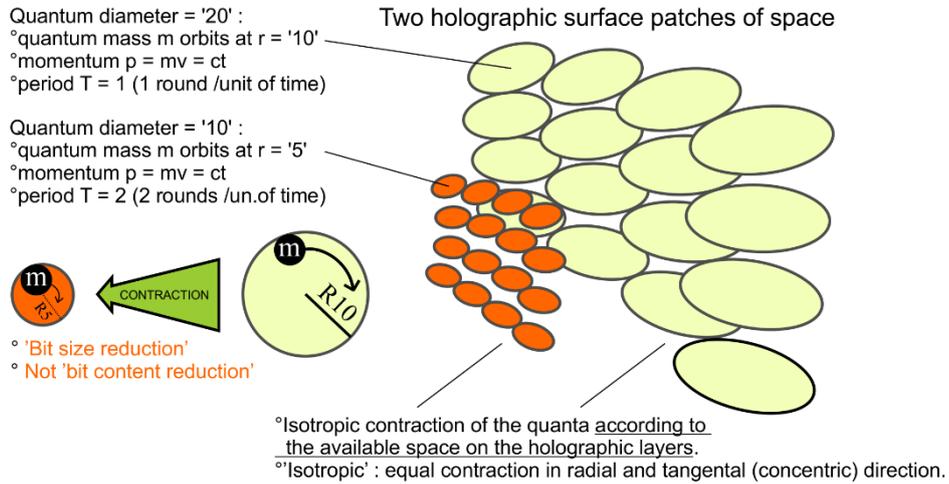


- \*Same surface area packs 4 times the quanta.
  - >Mass constituent packs 4 times the quanta.
- \*Bit size reduction, not information or content reduction (='data compression')
  - because  $m=ct$  and  $v=ct$  so  $p=mv=ct$  for quanta of any radius ( $r/2 \gg Tx2$ )**
  - = energy absorption by the vacuum (response to matter-energy)
  - = cause of rate of change of momentum per holographic layer = source of acceleration.

**Isotropical contraction of quanta per holographic layer induces Newton's gravitation:  
Packing more wavelengths in the same physical space [EQG-field]**

GQG

6



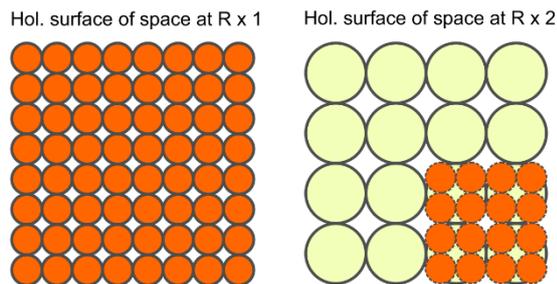
Mass constituents made of spacetime at  $R = 2$   
 contract isotropically (tangentially AND radially) resorting  
 4x the amount of quanta per holographic layer > 4x energy density.

**>More but smaller wavelengths per unit of volume/area/rooted area**

Each quantum entails an equal boost for the mass constituent :  
**Because  $p=mv$  is constant for quantum of any radius ( $r/2 \gg T \times 2$ )**

> At  $R = 4$  :  $a = 16$  distance units / unit of time / unit of time  
 > At  $R = 2$  :  $a = 64$  distance units / unit of time / unit of time

**Newton's law :  $a = GM/R^2$  : At half the Radius : 4 x the acceleration**



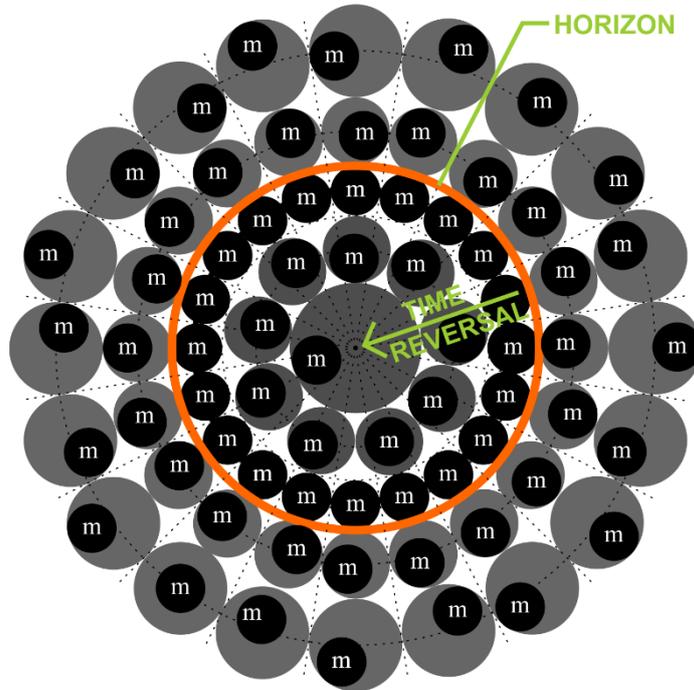
>Same surface area packs 4 times the quanta.  
 >Hence mass constituent packs 4 times the quanta.

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Action : Black hole interior forms more but smaller quanta outward.  
 Reaction : Black hole exterior forms more but smaller quanta inward.  
 Leading to inelastic quanta near horizon hence EMR stopped, and time reversal.

GQG

7



\*Black exterior :

- Size of quanta follows from principle of increased available space per holographic layer.
- Consistent geometry without holes, from self-organisation

\*Black interior (time reversal from first principles) :

- Size of quanta follows from principle of relativistic rotating disk inducing more but smaller quanta per holographic layer *according to rotation speed at each radius.*
- Remotely comparable to more rotons with rotation speed increase of container in BEC.
- (Black hole exterior torsion not displayed)
- Under developement: inconsistent holes between the quanta

\*Black hole horizon: 'the lights go out'

- Momentum transfer at horizon is stopped due to formation of inelastic quanta just inside the horizon : EMR disabled both in and out >>> see slide 1 for 'propagation' concept

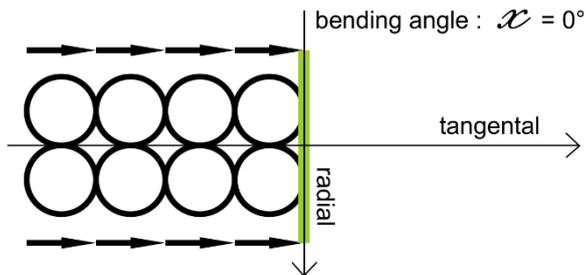
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Physical spacetime geometry with wavefront inclination [bending of light] due to different distance 'traveled' by the momentum transfers reflects Einstein's 1911 concept plus extra interpretation of addition of spacial curvature effects.

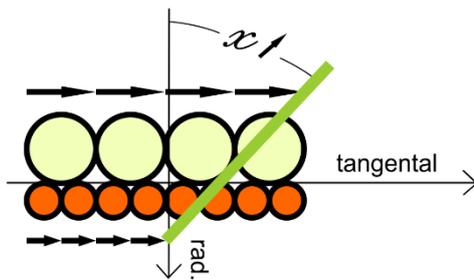
GQG

8

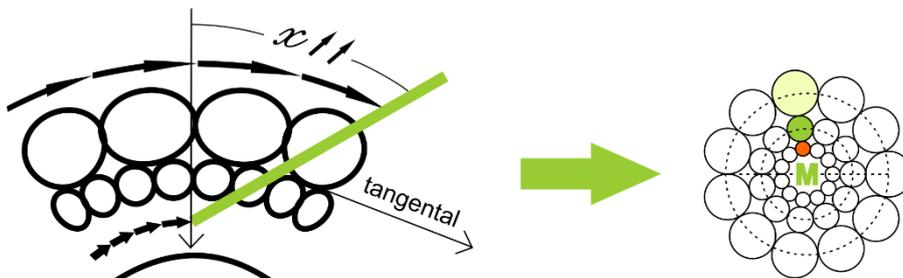
CONCEPTUAL SETUP OF QUALITATIVE EFFECT - quantitative elaboration needed



Quanta of equal size in the radial and tangential direction.  
 > equivalent of uncurved spacetime



Quanta closer to potential well smaller : intermediate stage :  
 > equivalent of time curvature [radial time differences inducing bending]  
 > towards an extended interpretation of the 1911 paper

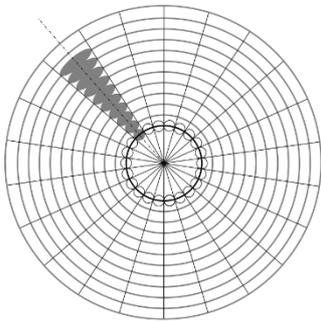


Quanta closer to potential well smaller,  
 plus spacial adaptation to the body M :  
 > equivalent of time curvature + spacial curvature  
 > towards the equivalent result of the 1915 paper

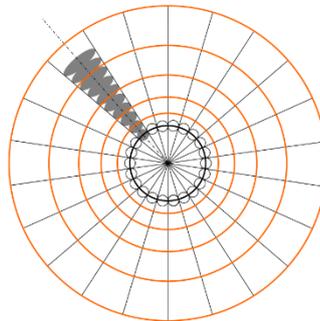
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GQG geometry generalizes Einstein's cosmology with intrinsic 'accelerated expansion' of distance units. GQG

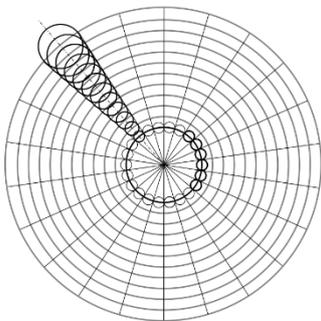
9



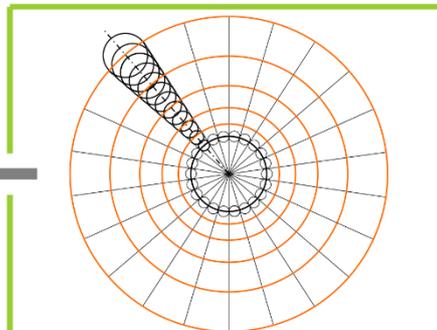
- °Newtonian quanta on Newtonian field
- Quanta contract tangentially, *not* radially
  - Newton's law applies *over short distances*



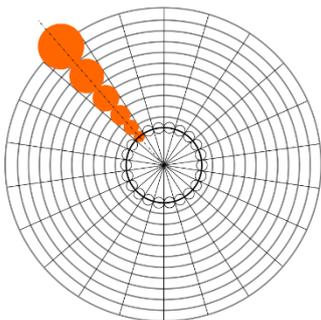
- °Newtonian quanta on GQG-field
- > True lengths of distance units are *structurally expanded*
  - > Yielding the *illusion of an expansion* of the universe



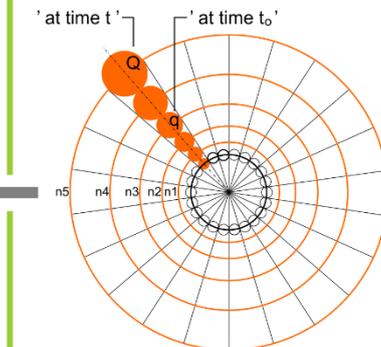
- °Einsteinian quanta on Newtonian field
- Quanta contract tangentially, and radially
  - But are *assigned to Newtonian radii*
  - Einsteinian cosmology works *without accelerated expansion*



- °Einsteinian quanta on GQG-field
- > True lengths of distance units are *structurally expanded*
  - > As opposed to 'time' assigned to the Newtonian radii



- °GQG-quanta on Newtonian field
- Quanta contract tangentially, and radially
  - Are assigned to GQG-expandend radii
  - Intrinsic expansion of distance units *overrules* Newtonian radii



- °GQG-quanta on GQG-field
- > Quanta contract tangentially, and radially
  - > Intrinsic expansion of distance units becomes important at large distances and serious 'curvature'
  - > Intrinsic accelerated expansion in the GQG-geometry

$$Q = q (1+x)^n$$

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## CHAPTER III – EXPERIMENTAL TEST

### *°Hafele-Keating with a twist*

We introduce a preliminary concept with qualitative indicators towards an experimental test, remotely based on the 1971 Hafele-Keating time dilatation experiment [15]. Instead of having 1 airplane flying west and 1 east around the world along the equator plane, with cesium atomic clocks aboard, we make sure both airplanes take permanent position closest and farthest from the sun.

#### *\*Setup*

We take our hypothetical physical spacetime of field quanta of the earth orbiting the sun, as the setting here. On the side closer to the sun, the quanta will experience a countering effect: the outside quanta of the earth's spacetime will start off smaller in size inward, reducing 'curvature'. So this will reduce the gravity of the earth locally, hence giving the impression of more 'pull' from the sun. On the far side of the earth's physical spacetime [farthest away from the sun], we get the opposite effect: The inside quanta of the earth's spacetime will start off with a smaller value [diameter, radius] outward, inducing the equivalent of a stronger curvature.

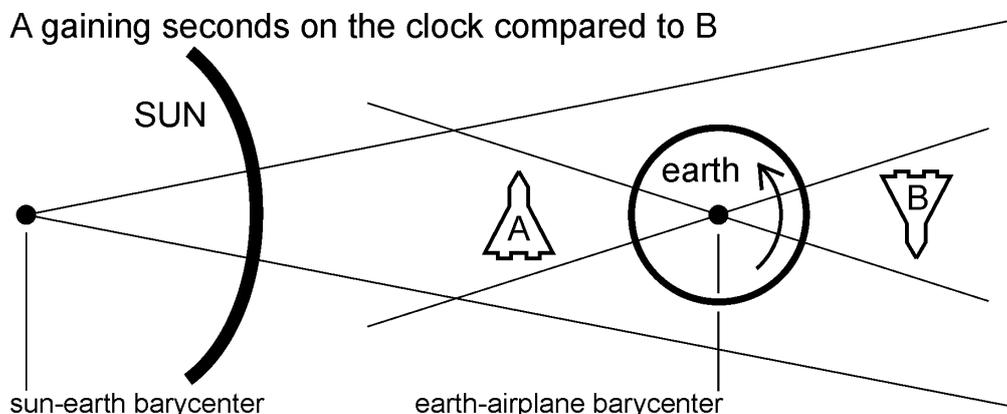
The experiment has 2 airplanes with atomic clocks both flying westward around the earth but at opposite sides of it. Because they are set to maintain the self-rotation  $v$  of the earth but in opposite direction, they will 'hover stationary': one set closest to and one set farthest from the sun. Thus any gravitational time dilatation differences due to the sun's presence, which might have remained unnoticed because of the HK all around flights for both the airplanes [and the earth clock], are now testable, as desired for this experiment.

#### *\*Prediction for the clocks*

The clock closest to the sun is predicted to gain more seconds [had been ticking faster than the latter during flight] compared to the the clock farthest from the sun [had been ticking slower than the former during flight]. This is not predicted by current theory which is only concerned with the earth-airplane system. This result will show up after the clocks are returned to earth. Note that is not required that both measurements start exactly simultaneous, as long as both of them are given the same length of start-stop-interval. This can simply be done by transmitting a signal from clock A to clock B, after the clock A interval is initialized.

#### *\*Conclusion*

This result would be in support of our barycentric view [see pages 17 and 18] of the larger galaxy context of the blackhole-star-planet-moon system of cascading time dilatation factors, and of the role of time in our hypothesis. [see page 16]. Extending to a test at different heights could support the GQG-geometry featuring an intrinsic expansion of radial distances outward [see slides 3,4,9, App.2].



# CONCLUSIONS

## *°Looking under the hood of hyperbolic spacetime*

We introduce a conceptual change for theories of quantum gravity, to solve standing issues. We coin the term General Quantum Gravity : GQG. Because first we work towards a generalization of General Relativity from causal physical principles. To create a model representing a physical spacetime with one on one translations from paths taken to points [or rather size-varying quanta with internal momentum] in space. Hence no hyperbolic paths which belong to the realm of the mathematical object 'spacetime'. [\[Images 9 and 10 on pages 36 and 37:Conceptual steps of the transition\]](#)

## *°A new breeding ground for quantum gravity research*

The GQG-geometry under construction shows how space and matter could have a common origin as matter features as a compressed state of space. This is the consequence of the hypothesized cooperation between matter and space [action-reaction] consisting of the equivalent of lossless data compression [reversible with e.g. a density increase of the body M] where more but smaller quanta per volume/area fulfill the role of more energy density of the vacuum. Simultaneously the GQG-geometry shows how the extremely compressed state of the quanta of the field at the Black Hole horizon, provides an explanation of how light 'stops' at the horizon due to quantum oscillator's [quanta of the field] inability to transfer momentum [EMR]. Currently cosmological redshift is interpreted as the witness of an accelerating expansion of the universe over time. Whereas our GQG-geometry shows how the accelerated expansion of the universe has the same mathematical formalism as the compound interest factor which emanated from a self-organization of a settling EQG-field of quanta. Hence not from an artificial implementation but from causal principles. The far reaching consequence is a shift from a historically dynamic universe expanding over time, to a static universe with intrinsically 'accelerated' expanded spacial distance units stretching over space, inducing 'time'.

## *°The road to simplicity*

Several roads to Quantum Gravity have been known to exist for many years [16]. General Quantum Gravity [GQG] provides an alternative under construction for String Theory [ST does not look under the hood of hyperbolic spacetime], and provides new oxygen for LQG and Emergent Gravity theories. The Big Bang Theory receives the alternative of a static picture with an intrinsic spacial expansion from self-organizing causal principles, naturally explaining the smooth nature of the observed universe when zooming out. Furthermore our abstract understanding of time in General Relativity receives a purely physical explanation now. The road to simplicity is paved with complexity.

## *°Note: Speculation concerning our current interpretation of heavy ions collisions in the LHC*

Density increase is currently perceived as contraction in the direction of motion : smaller volume with the same amount of constituents. GQG implies that this density increase consists of transitions to increasingly smaller but more constituents within the same volume, emanating from a background, with increased velocity This yields a more natural concept of inertia. But it also implies that with the LHC, we are *not discovering* smaller and smaller particles, *but are producing* them during the interval of acceleration. Scatter patterns with briefly existing constituents could now be explained as oscillators resolving back into the background, as the cause of their existence – increased velocity – has stopped due to the collision. Would it be possible at some point in the future, to use GQG's geometrically discovered formula of intrinsic expansion, to find out more about the content of different masses of the particles, with LHC-experiments or with alternative interpretations of existing LHC-data ?

**COHERENT CONCEPTUAL CHANGE RESPECTING EXPERIMENTAL DATA - PART 1**

Incoherence & <i>current approach</i>	GQG-approach towards coherence
<p>Ehrenfest 'Paradox' [rotating disk] : Radial distances remain unchanged while circumference of disk contracts.</p> <p><i>Contraction in direction of motion only. So install non-Euclidean geometry including a time value assigned to the radial radii.</i></p>	<p><u>Isotropic [equal radial and tangential] contraction of quanta</u> solves the incoherence and introduces the need of a new idea : the equivalent of a <u>size varying Planck length</u>.</p> <p><b>1</b> The quantum corresponds to Planck length squared and defines energy units, and its root defines distance units. So the Planck length is only the local smallest unit of length. 'Time' emerges from consecutive quantum size variations.</p>
<p>Photon clock thought experiment deriving Lorentz factor : The photon does not travel independent of source.</p> <p><i>Photon should travel vertically. Accept the mathematically correct answer anyway, in spite of no guiding logical dynamical process.</i></p>	<p><u>Exodermic mathematical path lengthening</u> (t increases) changed to <u>endodermic physical principle of more but smaller wavelengths within same volume/area/length</u>.</p> <p><b>2</b> That is the significance of a relativistic mass increase, which is absorption of energy. Density increase becomes more but smaller constituents in same volume, instead of smaller volume with equal const.</p>
<p>HK-experiment : Comparison between airplane clocks and control-tower clocks is indirect, arises from a primary comparison to the ECI [earth centered inertial system].</p> <p><i>SR handling of rotating frames needs including of the ECI. No follow up of larger context consequences is done here.</i></p>	<p>Accept first comparison to the frame of the ECI, and acknowledge <u>the larger context of consecutive time dilatation factors in a galaxy</u> [and perhaps beyond that] contributed by the Blackhole-star system and star-planet system onto the planet-control-tower system and the planet-airplane system.</p> <p><b>3</b></p>
<p>Instantaneous speed for symmetry in SR : There is no value assigned to the infinitesimally small interval.</p> <p><i>Symmetry unacceptable, but defended with infinitesimally small interval. Hence SR-contraction imported into GR.</i></p>	<p>Respect the <u>consequences of your relative size of scale</u> to realize that <u>infinitesimally small intervals are not intervals</u> at all, and that mathematically <u>curved spacetime is never to be approximated by flat spacetime</u>.</p> <p><b>4</b> We require an abacus for space with finite size of quanta, inducing 'time' as emerging from varying spacial lengths. Hence the <u>matter discontinuum induces an equal and opposite reaction within the vacuum discontinuum</u>.</p>
<p>Energy in SR with relative motion : Say we replace the station by a train B : Fuel tank of train B [station] loses no fuel. Fuel tank of the train A does expend fuel.</p> <p><i>This asymmetry is accepted. No link made between E-expendure and slower clock rate of pace [more inertia].</i></p>	<p>Accept <u>one-way time dilatation</u> : for the <u>energy-expendng body only</u>, to be in concordance with above larger context. Acknowledge that a <u>coordinate speed is a mathematical theoretical abstract reciproke baring no ground in reality</u>.</p> <p><b>5</b> Hence 'the low energy limit' symmetry does not exist. only the underlying 'high energy' asymmetry exists. Thus naturally explaining momentum increase.</p>
<p>Infinite quantity of quantum harmonic oscillators in QFT when summing over all possible oscillators at all point in space.</p> <p><i>Momentum cut-offs are performed. But without guidance by physical principle or any compelling reason.</i></p>	<p>Infinities are avoided because the guiding physical principle of <u>isotropic expansion/contraction of quanta with radii going off the mark</u> leads directly geometrically to the existence of only a certain/limited amount of holographic layers.</p> <p><b>6</b> <u>Quanta emerge from the background and resolve back into the background</u> as a result of gravity increase/speed increase and gravity decrease/speed decrease.</p>

Image 9 - © K.M.L.L. Van Spaendonck

## COHERENT CONCEPTUAL CHANGE RESPECTING EXPERIMENTAL DATA - PART 2

Incoherence & <i>current approach</i>	GQG-approach towards coherence
<p>Inside the black hole horizon 'time reversal' of the metric is expected. Yet at the center we expect a singularity : an infinitely small space holding a gigantic gravitating mass. But time reversal should result in gravity reversal, conflicting with that central mass.</p> <p><i>The problem is unsolved and coincides with the mystery of light being unable to escape from the black hole.</i></p> <p style="color: green; font-weight: bold;">Hypothesis for propagation of light</p> <div style="border: 2px solid green; padding: 5px;"> <p>-Imagine the desktop toy 'Newton's Cradle': Collisions of <i>elastic</i> spheres induce momentum transfers without actually moving spheres from left location to right location.</p> <p>-Compare to photon (= packet of transfers): Zero rest mass with wave-particle duality, yet with an energy <math>E = hf</math>.</p> <p>-Frequency increase now means packing more waves (oscillators) per original length measure. Replace spheres with disks.</p> <p>-Now imagine the Newton spheres to have variable size: 10 momentum transfers with halve sized spheres cover half the distance. In GR that is 'the speed of light seemingly slowing down as seen from a distant star'.</p> <p>-Cfr. Compton effect of photon energy partly transferred to recoiling electron in case of <i>inelastic</i> scattering by charged particle ?</p> </div>	<p>Replace the central gravitating point mass with a <u>rotating physical space of quanta (mass contributing oscillators)</u>.</p> <p>-Then from the rotating disk analogy: At radii further outward: forming increasingly more but smaller quanta tangentially as well as radially more but smaller quanta.</p> <p>-The end result looks like the equivalent of an AdS-space <i>inside</i>, and a reaction as a de Sitter space <i>outside</i> of the horizon. <u>The inside <math>p = mv</math> induces the gravitation outside.</u></p> <p style="text-align: center; font-size: 2em; color: green;">7</p> <p>-Natural physical consequence : <u>At the horizon quanta at both sides of the horizon now reach an inelastic state : no more momentum transfers : EMR stops (Inelastic Newton-cradle spheres don't work).</u></p> <p>-The light is not 'unable to escape' from the black hole, no, it never got in their in the first place : The horizon disables all momentum transfers - which is the <b>mechanism of propagation of light</b> in this hypothesis - because of this extreme <i>radial</i> entanglement of the space quanta in GQG.</p> <p>As for <i>tangential</i> entanglement: Superluminal speeds to convey info indeed cannot be true, and non-local magical transmissions are unacceptable. Solution : There is no transmission of any kind, the 2 states 'know' nothing of each other. The measurement does not convey anything to the other state at all. Solution: <u>The matrix of quanta is already there.</u> If you introduce the principle of adjacent oscillators to have opposite direction of rotation, then at equal distances, no matter how far away, you will always find opposite [clockw/count.-clockw] states.</p>
<p>GR explains paths taken by the apple, but not what makes the apple fall initially.</p> <p><i>Problem is accepted, but remains unsolved. No link is suggested to an mechanism of internal conservation of momentum.</i></p>	<p>The internal flywheel from 'fluid flow': A new idea joins momentum increase and Newton's first law of motion.</p> <p>And explains why a constant force by the apple is felt by the earth ground or by the tree branch attaching the apple.</p> <p style="text-align: center; font-size: 2em; color: green;">8</p> <p><u>Particles in QFT are excitations of the background field: Nucleus mass constituents are these flywheels with a changing momentum depending on how many oscillators are packed, how many waves are packed within the same volume/area.</u> Conservation of momentum becomes natural.</p> <p>We hypothesize on a unifying analogy with the above described Black Hole AdS/dS physical metric mechanism.</p>

*Image 10 - © K.M.L.L. Van Spaendonck*



# REFERENCES

[\*] : Excerpt of Einstein's 1916 letter to H.W. Dällenbach [Referring to the Preface]

*“But you have correctly grasped the drawback that the continuum brings. If the molecular view of matter is the correct (appropriate) one, i.e., if a part of the universe is to be represented by a finite number of moving points, then the continuum of the present theory contains too great a manifold of possibilities. I also believe that this too great is responsible for the fact that our present means of description miscarry with the quantum theory.*

*The problem seems to me how one can formulate statements about a discontinuum without calling upon a continuum (space-time) as an aid; the latter should be banned from the theory as a supplementary construction not justified by the essence of the problem, which corresponds to nothing “real”. But we still lack the mathematical structure unfortunately. How much have I already plagued myself in this way!”*

[Referenced by Physicist Sabine Hossenfelder on Backreaction, as “ Einstein on the discreteness of space-time ”]

## [°] General and Special Theory of Relativity

°Einstein, A. (1916), *Die Grundlagentheorie der allgemeinen Relativitätstheorie*, Annalen der Physik, 354 (7): 769–822 (10)

°Einstein, A. (1905), *Zur Elektrodynamik bewegter Körper*, Annalen der Physik 17, 322 (10): 891–921.

## [\*\*] Einstein's 1911 paper on the bending of light

°Einstein, A. (1911), *On the Influence of Gravitation on the Propagation of Light*, An. der Physik, 35 : p.898–908

## [1] Standing on the shoulders of giants.

°Turnbull H.W. (1959), *The correspondence of Isaac Newton, volume 1*, edited by HW Turnbull, p. 416

Note: About 300 years ago Isaac Newton speculated that light particles and matter particles were interconvertible [The equivalent of today's unifying concept of a universal building block for space and matter?], in Query 30 of his work *Opticks* [1718] : "Are not the gross bodies and light convertible into one another, and may not bodies receive much of their activity from the particles of light which enter their composition ? ".

## [2] Integrated Product Design (IPD)

°Braet J. and Verhaert P. (2007), *The practice of new products and new business*, Acco, p.51-64

Note: Paul Verhaert is a Belgian internationally respected Product Development pioneer, who received the Henry van de Velde Career Award 2015 - Link: [///C:/Users/User/Downloads/HVDVCATALOGUS15\\_5259.pdf](C:/Users/User/Downloads/HVDVCATALOGUS15_5259.pdf)

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[Go to My Research - List of publications - numbers a.o. : 204, 218, 227, 245, 250 ]

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## APPENDICES

Two appendices can be found on the pages 42 and 43 :

°Appendix 1 : referring to slide 1 on page 14

°Appendix 2 : referring to slides 3 and 4 on pages 27 and 28

**Appendix 1**

SEE SLIDES 1, 2

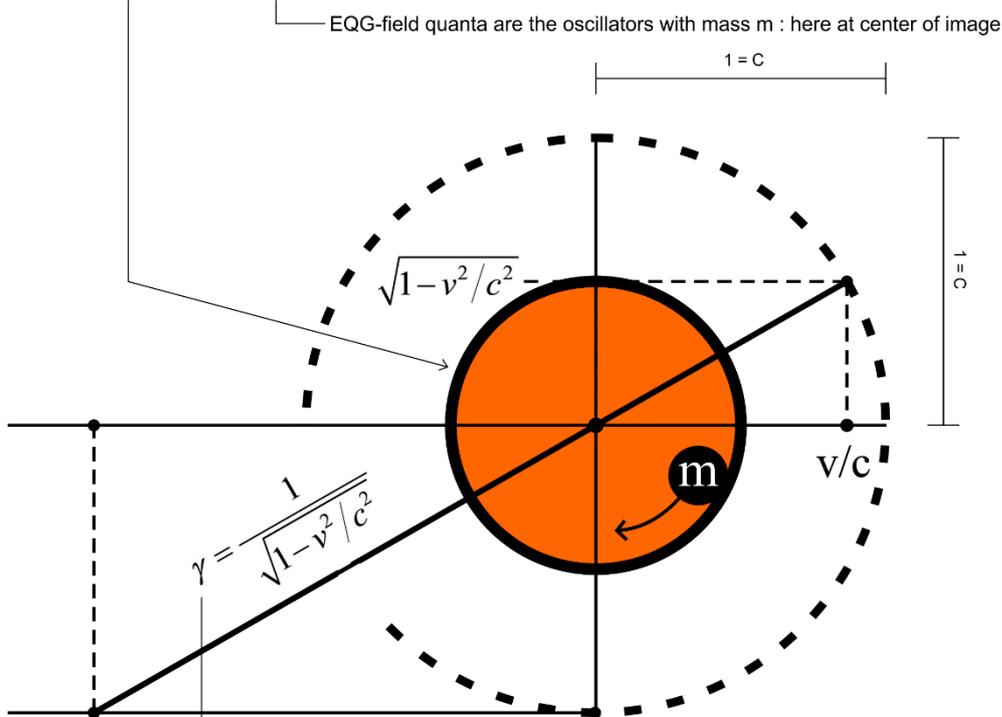
**Inertial case > graviational case : replace  $v^2$  with  $2GM/r$**

Isotropic contraction of particle [proton,...] constituents [more but smaller quanta] due to increase in relative speed.

[A consequence for the equivalent gravitational case : Singularity is avoided : Minimum quantum size coincides with size of the oscillator's mass at complete compression at the black hole horizon. EMR is then incapacitated.]

[Slide 1 on EMR-propagation]

- °Isotropic contraction [radially and tangentially] of particle constituents
- °More but smaller quanta ['waves'] in the same volume/area/length



EQG-field quanta are the oscillators with mass  $m$  : here at center of image

°Gamma indicates a finite amount of oscillators in  $E = \gamma mc^2$

°And equivalently per holographic patch of physical spacetime [EQG-field] as measured with the oscillator's size at the outskirts of that physical spacetime.

°Oscillator with mass  $m$  = particle (proton,...) constituent = EQG-field quantum = unit of energy = unit of distance = constituent of emergent time.

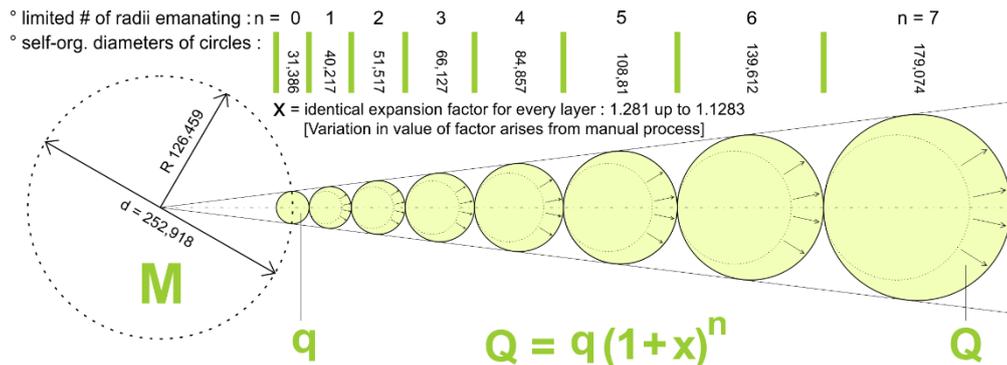
[Slide 1 on EMR-propagation] °On emerging time here: One 'tick' of the cesium atom 'clock' will take longer to form, because a transfer over more but smaller quanta takes longer to effectuate.

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**Self-organizing GQG-geometry from physical causal principles - Isotropic quantum expansions causing a limited # of possible hologr. layers with intrinsic illusion of accelerated expansion. GQG**

**Appendix 2**  
SEE SLIDES 1, 3, 4

- [1] First quantum q (circle here) takes place on horizon:  
Done 'manually' with CAD-application, no a priori formula inserted, follows from geometry.
- [2] Forcing second quantum to take place more to the right, on the next layer.
- [3] But due to isotropic expansion, that layer receives a larger radius from the origin.
- [4] In a totally natural way, from this dynamic arises an evolution which exactly follows the compound interest formula
- [>] This happens to be an accelerated expansion, but it is the characteristic of a static situation [!].  
[Static as long as density of M stays constant]



**Conclusion for cosmology :**

The self-organizing features of space with emerging time (GQG-geometry) invoke the illusion of an accelerated expansion of the universe. The geometry features the generalization of General Relativity where time was assigned to the Newtonian radii, instead invoking the radii to go off the mark and settle at a limited amount of distances. And the GQG-geometry works for any chosen density and diameter of M.

**Important elaboration on the above image :**

Q = larger quantum - q = smaller quantum - n = # of holographic layers -  $Q=q(1+x)^n$

Hence the # of holographic layers ~ difference between past time and present over the history of the universe. So in the following definition 'observed' ~ time t (observed now) and 'rest' ~ time  $t_0$  (as emitted originally).

Cosmological redshift :  $z = \frac{\lambda_{obs} - \lambda_{rest}}{\lambda_{rest}}$

So z in our GQG-geometry above :  $z = (Q-q)/q$  And  $Q = q(1+x)^n$  So  $z = [(q(1+x)^n) - q] / q$   
For instance : outer quantum size Q = 6 and inner quantum size q = 2.

Then  $z = (Q-q)/q (6-2)/2 = 2$  : the difference between Q and q is twice the value of q  
Which is to be developed as the generalization of  $1 / \sqrt{1-2GM/rc^2}$  or  $c / \sqrt{c^2 - 2GM/r}$  :  $\sim \frac{\lambda_{obs}}{\lambda_{rest}} \sim Q/q$

Consequently concerning the illusion of an accelerated expanding universe over time :

- If we find out x, we know n
- If we find out n, we know x

X is the size increase between any 2 consecutive holographic layers of physical spacetime [EQG-field].  
For instance : a size increase of 20% means  $x = 0.2$ . A denser body M will invoke a smaller increase, but between more but smaller quanta radially outward : 'The metric re-settles' to an EQG-field with more E-density.  
—see right half of top image on slide 3

The X is the exact equivalent [in economics] of the interest on a starting capital, to be used in the compound formula, leading to 'an increase of the increase' of your starting capital, or 'an accelerated expanding capital',

accumulated over a number of years. Years equivalently are the number of holographic layers 'n' in our concept.

And thus the illusion consist of having mistaken radial holographic accelerated expanded layers of distance in

a static picture, for [light]years over the course of history accompanied by an accelerated expanding metric.

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