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Quantum Gravity

Reasoning with New Physics

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Intellect vs. Dogmas

Compared to other organized cell clusters, human beings have the opinion to be characterized by their **intellect**.

As parts of nature, humans try to create images of their **sensory** impressions on their own embedding in the enclosing nature. As time goes by, the wealth of those particular images will consolidate to their individual **conceptions of the world** consisting of memories of sequences of events, which step by step are condensing to some “if ... then ...” patterns. In some abstracted or even skewed way, those accumulated sequence patterns are providing the base of the intellect his behaviour will be following.

Progressively, his behaviour will rest upon the experience how previous events had passed by – remembering those ones his brain has stored in some order of priority and, now, is putting at his disposal as his **experience**. “Experience” is based on **reproducibility**.

Consequently, natural sciences by definition are based upon patterns of behaviour which are reproducible, while theologies, essentially, require support by “miracles”, which are not reproducible:

**Patterns not (uniquely) reproducible
are *not* subject to natural sciences!**

This reproducibility of a schedule pattern might fail either due to the complexity of its composition of details – this would be a failure by statistical reasons (too many alternatives to be checked) – or they are of principle nature. The latter would include what we popularly are assigning to the result of a “**free will**”.

While a process accountable to natural sciences still will be considered as inevitable, we are attributing a decision out of one’s free will to an individual responsibility according to some **moral** category: actions will be judged to be “good” or “evil” depending on their “public” welfare or harm.

Historically as well as in the present time, the fuzziness of the notion “public welfare“ pushed the gates wide open towards the misuse of notions like “good“ and “evil“. In the historical context, thus, interested “elites“, again and again, went restricting the “common“ welfare to their own, subjective welfare. For the purpose of camouflage, people, in daily life, then are going to lay the blame of their own responsibility for such a corrupt behaviour on alleged orders by superior authorities.

If there is no such “authority“, then they are going to invent some. In prehistory, thus, little goblins teasing us (compare the Burmese „Nats“, e.g.) commuted towards a world of gods the blame for everything inexplicable could be pinned on. Particularly, those mental clan chiefs loved to make use of this comfortable method in their role of a shaman.

We are well familiar with that kind of patronizing arrogance of the stronger or of the varmint, respectively. We are ascribing those barbaric excesses like inquisition, Kali rituals, or Djihadism to the dark Middle Ages before the Age of Enlightenment, and we prefer to dissociate ourselves from such a blind fanaticism.

On the other hand, however, still in our present era said to be that objective, a failure due to reproducibility by statistical reasons based on some personal insufficiency often will be sold as some principle failure, provided that misinterpretation just is fitting well into the actually dominating zeitgeist. Thus, the arbitrary restriction of generality of a thesis formulated more generally would be inadequate.

There are *those* well-intentioned dogmas born out of the arrogance of an anticipatory obedience towards the just prevailing mainstream which often are thwarting scientific progress for decades, if not for centuries to come (remember those “strings“, e.g.).

Meanwhile, medicinal and scientific evidence more and more is pointing in the direction that our “intellect“ only might be regarded as the *operating mode* (not yet perfectly elucidated) of some kind of “software“ (“soul“) of some basic physical “hardware“ (“body“) and that without that substance of “hardware“ it could not endure:

**Something like a „free will“
apparently does not exist in nature!**

In order to maintain historically grown prejudices – if of religious nature (“good and evil”) or of some generally dogmatic nature (for the sake of domination) – the myth of a “free will” is cultivated still to-day thus massively impeding progress in fundamental research.

Insofar, research on a scientific base, which only applies truly reproducible events but, nevertheless, admits statistical effects, too, will give results lying on the safe side – provided it defines:

**Statistical ambiguity is evidence
of insufficient knowledge.**

The ultimate target of fundamental research is it to trace all natural sciences back to physics – as it could be achieved successfully for chemistry already.

Now, physics itself is plagued by the conflict between simple, atomistic statements on the one side and often hopelessly complex, statistical effects as they are originating cumulatively from assemblies of a great multitude of individual data on the other side. Classical continuum physics is gluing up both effects. Except in quantum theories, physics always succeeded in reducing a continuum to its atomistic components. Continuous systems, then, according to the “law of great numbers“, are to be interpreted as artificially continuized interpolations of a multitude of individual effects. – Topics: **emergence** (see below), **measuring process**, (cf. later).

Thus, it might be disputed splendidly if the limits of measuring accuracy are of purely statistical or of principle, non-recoverable nature. The history of physics is teaching us that – up to that special case of quantum theories – recoverable effects of statistics always had been active so far.

By the advance of technique, the apparent continuity always resolved itself as a temporary insufficiency to separate neighbouring details from each other when their values had been extremely great. Premature assumptions allocated by brute force roughly reflected the results temporarily, but they did not withstand a later, more precise check.

Exactly this still is the case with **Schrödinger's wave mechanics**. At the top level of physical institutions claiming for themselves to call the shots on the field of all research, a social class tending to dogmatism tries to cut the Gordian knot of a "Quantum Gravity", which, at least *officially*, is said not yet to be discovered, by the totally inaccurate assertion that, by **Bell's no-go theorem**, quantum theory and General Relativity are contradicting each other.

"According to Bell" there are no "**hidden parameters**" in quantum theories permitting Schrödinger's wave statistics to be reduced to standard statistics. Their call for some totally "**New Physics**" means enshrining a binding commitment for an *asymptotic* description where just its *disintegration* into detailed substructures is the requirement of the hour! (Cf. Einstein's unsuccessful reminder: "God does not play dice".)

Now, in the course of a BBC interview, Bell himself had pointed to the fact in 1985 already that his no-go statements are based on the existence tacitly assumed of a free will:

**Without the existence of a "free will"
Bell's no-go theorem is irrelevant!**

Apart from eliminating a wealth of **mathematical inconsistencies** in the field theories having wormed in there during the last century [1] – that "New Physics", hence, would exactly have to introduce those "hidden parameters"!

When simply denoting those "atomistic" physical substructures connected to those hidden parameters as "**quanta**", we conclude:

**Quanta are making up a layer far below
the layer of quarks and leptons.**

They are the key elements to admit a consistent unification of Planck's quanta with Einstein's General Relativity giving a common, uniform "**Quantum Gravity**" [1]! Physically this means the strict adherence of reproducibility – excluding the classical assumption of a free will to exist. (Otherwise, it would not be "free".)

This exclusion of a “free will”, i.e. taking seriously the scientific **principle of reproducibility**, already will remove the majority of all those problems actual quantum theories are afflicted with.

Example: Their substructure of an underlying layer made of “quanta” will ask for the logical

**Split of a particle hitherto considered
as elementary into 2 substructures:
a *valence* and a *non-valence* part.**

Its **valence** part will provide its discrete quantum numbers (i.e., the mathematical “labels” of field theories like spin, charge, lepton number, etc.), while its **non-valence** part [1] will reproduce the quantum numbers hitherto considered as “continuous” (i.e., the mathematical “arguments” of field theories like location, time, momentum, mass, etc.) in terms of superposition effects of some very great number of quanta in a statistical approximation. The latter “arguments” only apparently had been continuous by some statistical, approximate way of consideration (law of great numbers). Literature names them **“emergent” parameters**.

The composition of one particle made of a very great number of discrete “quanta”, then, also will explain the results of double-slit experiments, e.g. – why, by repeating the experiment, a single particle is able to produce an interference pattern behind the slit. According to actual quantum theories this is absolutely inexplicable! In New Physics, however, not complete particles, but their individual quanta obviously are passing through different slits before they are reuniting themselves to some compact particle again, as we will identify it by a measurement!

After excluding the existence of a “free will”, Bell’s **“superdeterminism”** means that the structure of our entire world is fixed uniquely once and for ever – without any exit options. Trivially, this solves **Schrödinger’s cat** paradox (is it dead or alive – depending on the state of some radioactive decay process), as well. And in cos-

mology, this will reactivate the discussion on the facts “**cosmic inflation**” [1] is based upon.

When strictly observing the rules of reproducibility, then *one* “unexplainable particularity” of the world of quanta after the other turns out to be primitive standard physics. Quantum theories “are putting on their trousers one leg at a time”, too! We only should steer well clear of those miserable, elitist dogmas: Religion has no business in physics! Still missing is the courageous step forward towards an “**Enlightenment 2.0**” brushing away those unbearable dogmas.

Space and Time

The reason for the reaction that violent on Einstein's theories of relativity was the philosophically explosive fact that the independence of space from time, which had been considered as true as long as anyone can remember, had been nullified at a stroke: Einstein had shown that both of them – in principle, at least – can be converted into each other. As a barrier against this conversion capability he had found the speed of light in a vacuum.

Relativity, however, did not only work between space and time but also between energy and momentum, e.g., where, until nowadays, the existence of mass is a philosophically unsolved mystery to be clarified only by a Quantum Gravity to come. In addition, the relation between electricity and magnetism had proved to be rather laborious, where only Einstein's introduction of the **photon** as some new elementary particle had provided more clarity.

The identification of time as some sort of a 4th dimension to be added to the 3 dimensions of space still masked another special aspect: Mathematically considered, classical physics, essentially, is based on functional analysis in 1 dimension. The 3 dimensions of space, then, had been condensed to the 3-tuples of the vector calculus rather hesitantly only. However, the associated algebra of matrices in 3 dimensions soon prevailed in physics.

But that 4th component of Einstein's time adding to the 3 real dimensions of space, in addition, proved to be of imaginary nature – rather an impertinence towards mathematically uneducated philosophers!

However, it even came worse. For, the action mode of matrices also is different from that of numbers we are familiar with: For (real and complex) numbers, the order of their factors does not matter ("commutativity law"); this "**commutativity**" of factors, in general, does not any more hold true with matrices! A matrix, when applied to a vector serving as a physical "**state**", will have the meaning of an "**action**" changing that "state". And actions, of course, are depending on their order!

We are familiar with that non-commutativity of actions from the rotation of rigid bodies in 3-dimensional space. Mathematicians are used to classify that kind of rotations more elegantly as "**orthogonal** transformations in 3 dimensions". The set of all such transformations, then, is abbreviated by **O(3)**. (For a better "understanding", this formalism, unfortunately, is indispensable!)

We are coming across those "rigid bodies" in the transition from point mechanics to multipoint systems. Their characteristic is that their "scalar product" of the vector calculus we can construct out of 2 of their point differences are conserved unchanged with orthogonal rotations.

This is countered by the so called "**unitary** transformations", which are changing these "scalar products" – staying invariant, however, if we are using the complex-conjugated form for one its two vector differences, each. Mathematicians are demonstrating that this just is corresponding to **probability conservation**. (In the scalar product of a unitary transformation, the complex components of a vector with its complex-conjugate opponent, according to Pythagoras, just are summing up to the square of its unchanged total length.) With n dimensions, a unitary transformation is abbreviated by **U(n)**. A $U(n)$ is a (c-number) extension of the $O(n)$.

Do not let yourself be intimidated by notions like **SO(n)** or **SU(n)**. That letter "S" (= special) placed in front only is pointing to a mathematical quibbling which generally will not specifically matter the layman. (An $O(n)$ will include reflections not present in an $SO(n)$, e.g.)

An **SO(n,m)**, however, will belong to some totally different class of transformations connecting n imaginary dimensions with m real ones giving a total of $n+m$ dimensions. One of them is the "**Lorentz-group**" **SO(1,3)** connecting the 4 components of Einstein's "**spacetime**" with each other. Its imaginary dimension will be denoted as "**time-like**", the 3 real ones as "**space-like**" directions – the reverse is familiar, as well. (For the "S" placed in front, the same will apply what is said before, already.) An $SO(n,m)$ is called "**pseudo-orthogonal**", an $SU(n,m)$ "**pseudo-unitary**".

Significant with all that is that particle **reactions** within a "closed system" of thermodynamics in any case must be (truly) unitary; for, according to the physical principle "**nothing will come from nothing, and nothing gets lost**" probability conservation is essential to them! On the other hand, **Einstein's dynamics** is pseudo-orthogonal; hence, it will violate probability conservation. Hence, it will be a component of some "**open system**", in fact! In Quantum Gravity [1] we shall call these thermodynamic systems "**channels**":

particle reactions : **closed channel,**
Einstein's dynamics : **open channel.**

Actually, neither particle physics nor cosmology is properly separating these two channels that different from each other! In the so called "**standard models**", both channels even are identified with each other, in fact, or wildly jumbled up, respectively. It should be clear what powerful contradictions necessarily must result from it! Thus, **Feynman's diagrams** are brimming with singularities. Hence, he is unable to calculate **coupling constants** by his diagrams, e.g. The same holds true with "**QED**" (quantum electrodynamics), which merely is some subsystem of those diagrams.

As another case, "**entanglement**" will have to be mentioned. Unambiguously, it is a phenomenon of the closed channel, while, equally clearly, for the case of "**causality**", the open channel will have to be applied. Einstein named this contradiction, which was unexplainable for him, a "spooky interaction at a distance". Hence, again and again we are hearing the demand for a "**New Physics**", which should restore balance to all those inconsistencies. Ironically, people, then, just are appealing to Bell's no-go theorem, although it is not at all responsible to it as we observed. In Quantum Gravity [1] all that has been clarified and is well understood.

Last but not least, the speculations about "**Dark Matter**" is part of that game, too: After having boosted individual, *unitary* particle reactions to *continuous* "transformations", people went going to handle them within the framework of the open, *dynamic* channel!

For, as we know from astronomy, our universe is subject to a long lasting cosmic expansion. As time goes by, hence, more and more quantum pairs are transformed to “space” at the expense of energy, momentum, etc.; Einstein’s General Relativity is describing it – though insufficiently. The transformation process itself is a property of the closed reaction channel underlying probability conservation. On the other hand, its statistics (more and more quanta are taken into account) will follow the rules of the open, dynamic channel.

Quantum Gravity shows [1], that a part of these quanta (in their combination to orbital angular momenta) will be converted to heavy mass, as well. The latter will happen the more intensely the greater the gravitational potential is in its neighbourhood, extremely intensely, hence, close to the event horizon of a black hole. These are terms of *third and fourth* order Einstein had overlooked in his General Relativity. By the way, similar results hold true for **Dark Energy** resulting from additional terms of *second* order, which Quantum Gravity automatically is supplying, as well.

These two effects together – the *dynamical* inclusion of more and more quanta combined with their *reactive* transformation – are explaining a part (type A) of the nature of Dark Matter. (According to this, the experimentalists of the “Standard Models” still might search a long time for their “particles”, those “wimps” = weakly interacting massive particles, Dark Matter is said to be composed of: These above “**quantum pairs**” are no “particles” but abstractions, building blocks (essentially originating from the non-valence parts) of some whatsoever “matter” taken out of context in terms of a statistical approximation!)

Apart from the now consistent coexistence of entanglement and causality side by side, this coexistence of two different channels still will provide a huge field of emerging techniques undreamt-of to experimental physics. We still shall observe that dynamics will have to stay *finite*. In this case, both channels even will be commutable into each other (“expansion” of one channel in terms of the other channel”).

Dimensions

The mathematical equipment for classical physics had been real numbers. Their multiplication and addition is independent of the order of their terms: r -numbers just are 1-dimensional, i.e., they are no matrices.

With the emergence of **field theories** this changed. Still during the 19th century, people tried to overcome the problem of fields purely by using numbers. Electromagnetism, however, soon proved that its description needed more than just *one* equation: Maxwell applied even 4 equations for it. It took some time until people identified that this was a manifestation of 4 "components" of one single field (the "4-dimensional vector potential" of the photon).

Nevertheless, it still lasted until 1925, until people detected that the electron, too, is fitted with components – in the non-relativistic version (Weyl) with 2 of them, and in its relativistic version (Dirac) with 4. The total object made of 2 or 4 "components", respectively, then was called a "**spin multiplet**" or a "**field**" or a "**state**" (of dimension 2 or 4).

On the other hand, such "**multiplet**" structures had been known from classical mechanics, long since, in particular from rotations in 3-dimensional space. People knew quite well that the result of 2 rotations executed one after the other (i.e., their "product") in this "triplet" space depended on the order of both actions.

Generally, we can state that the **multidimensionality** of a field automatically will result in a fundamental non-commutability of the temporal sequence of actions executed on them. This derivation from applying the vector and matrix calculus on physics marked the birth of quantum physics in its proper sense:

Multidimensionality
 ↔ **quantum physics !**

Hence, Einstein's **General Theory of Relativity** (GThR) will have to be subject to some quantum formalism, as well!

Now, the electron spin had been discovered only after Einstein's release of his GThR. Thus, still nowadays it is working without paying tribute to the spin properties of matter. The more amazing is it how far Einstein had come at all without this "**quantization of space and time**"!

In its quantized version, the extension of his GThR including its consistent integration of spin, actually, is known as "**Quantum Gravity**". Einstein had to duck and dive considerably in order half-way to sail round the missing spin and, with it, round the quantum properties of his theory.

The main detail he had been missing all the time, essentially, had been that dominant notion of "**irreducibility**", which concerns the additive decomposability of a field into smaller parcels of components, which, for their part, cannot consistently be decomposed further any more with respect to some given group of transformations. (*In functional analysis, this notion is known under the somewhat lengthy catchword "expansion in terms of some complete system of functions".*)

To Einstein that mathematical notion somewhat bulky of "irreducibility" at that time had been strange, and neither did he introduce it afterwards into his model. Some deficient copy of this far more general "irreducibility" is known as his closely related notion of a "**background independence**" Einstein had felt himself obliged to introduce in order that his model should not completely get out of hand.

A long-term objective of fundamental physics has it been since to reconcile Einstein's General Theory of Relativity of r-numbers with the quantum formalism of multidimensional "fields" to give some consistent "**unified field theory**" (Quantum Gravity).

– In the course of the 19th century, already, people had found that a **wave** could be described more comfortably with the aid of complex numbers. For Einstein's 4-dimensional photon this meant a description according to a U(4) or SU(4) in the reaction channel or according to some of its pseudo-unitary derivates in the dynamic channel, respectively.

During the first third of the previous century, some theoreticians loved to apply the mathematical discipline of "**group theory**" onto the physical level, as well. In 1900, Young's publication of his classification of transformation groups according to the method of "**Young Tableaux**" he had invented generated great interest.

However, not only Einstein ignored this new mathematics. Since the late 1920s, some veritable "shitstorm" has rushed through the coffee shops: some people adored it, in the eyes of others it degraded to a "**group pestilence**". Commentary (German proverb): "The farmer doesn't eat what he doesn't know"(!)

In any case, mathematicians detected that – apart from mathematical hair-splitting ("topology") – a *unitary* group in 4 dimensions is equivalent to an *orthogonal* group in 6 dimensions. The same applies to its pseudo variant:

$$SU(4) \cong SO(6), \quad SU(2,2) \cong SO(2,4).$$

The dynamical $SO(2,4)$ also is listed as "**conformal group**". It is an extension of the Lorentz group $SO(1,3)$ by one time-like and one space-like dimension, each. When "expanding" Einstein's GThR in terms of representations of this conformal group, we straightaway are verifying its 1+3 special-relativistic dimensions. The problem left, hence, is: what do those 2 additional dimensions signify?

Now, the rotations of an $SO(6)$ are representing the rotations within the surface of some 6-dimensional sphere or, with *different* radii in those 6 directions, transformations of an *ellipsoid*, *respectively*. The dynamical $SO(2,4)$ will have the same effect, only that it will be *hyperbolically* distorted on some hyperboloid in 2+4 dimensions.

Let us now shrink its radius in one of its 6 directions and observe some area shrinking, as well, of the 5-dimensional surface perpendicular to this arbitrarily marked axis at the poles of that axis. Then, we recognize that this area will locally approach its tangent plane more and more. (The effect of an apparently plane surface of the earth!)

With respect to that 6th direction pointing, say, "upwards", those previous "rotations" within the two directions of some curvilinear surface perpendicular to it, thus, are transforming into 5 **translations** within an apparently plane surface. This effect is called "**group contraction**".

This would be its limiting case. In real physics, however, that 6th radius scarcely will tend to zero, indeed. It just will become "very small". Some weakly pronounced surface curvature still will survive, like that Einstein is describing within some lower number of dimensions. On a sufficiently rough inspection, however, the above limiting case will be locally present to the observer, all the same.

When denoting the 4 Lorentz dimensions of Special Relativity by the labels 1,2,3, and 5, we may identify the additional dimension 6, in a pairwise combination with these 4 Lorentz dimensions as the 4 dimensions of **energy-momentum** ("rotation" plane 6/5, 6/1, 6/2, 6/3). Together with the Lorentz group (3 rotations 1/2, 2/3, 3/1 and its 3 Lorentz boosts 5/1, 5/2, 5/3) the above 4 pairs of energy and linear momentum just are denoting the relativistic "**4-momentum**").

This identification of a "**Poincaré group**" $ISO(1,3)$ (= inhomogeneous Lorentz group) had been detected with the gimmicks having led to the dirty word of "group pestilence", already. At that time, deSitter had already cast an eye on 2 different "**deSitter groups**" in 5 dimensions, each: an $SO(1,4)$ and an $SO(2,3)$. He only did not know which of them to choose as the correct one for deriving the Poincaré group. Now, in Quantum Gravity this is clarified long since: it is the $SO(2,3)$. (The $SO(1,4)$ variant would provide an imaginary value for heavy mass.)

Now, it would be natural to try to gain Einstein's spacetime by an additional group contraction using the remaining dimension 4 together with the four directions of the Lorentz group in analogy to the construction of 4-momentum. This attempt failed completely, however. For, even in classical physics space and time – differently from energy and linear momentum – are showing up a **non-linear** behaviour: a particle at the point x and another one at the point y do not settle down at the "total" point $x+y$!!

That problem of the **non-linearity of space and time** survived unresolved for one century, from deSitter's time up to the present day – though its solution is well-known to all bachelors of physics, already, since point mechanics had been invented. It is an integral part of Quantum Gravity: It is not Einstein's classical spacetime X which is characterizing an additive spacetime, but the spacetime Q related to the center-of-mass system (CMS) multiplying Einstein's spacetime X with heavy mass M :

$$Q = M \cdot X .$$

By using Q as (CMS) spacetime, the above direction 4 combined with the 4 Lorentz directions 1,2,3,5 do satisfy all conditions of physics, indeed. This "**New Physics**" automatically is fully quantized, and it is proceeding on a curvilinear surface!

Like those rotations in 3-dimensional space and like the Lorentz transformations of Special Relativity, here, in Quantum Gravity, heavy **mass M** , **4-momentum P** , and **spacetime Q** all are "actions", represented by (square) matrices – and not scalar numbers nor 4-vectors!

Trials of a quantization by using 4-vectors (instead of matrices) in order to represent spacetime have led to the well-known classical dead ends which literature is offering us under the keyword of a "**Loop Quantum Gravity (LQG)**". By its "*canonical* quantization", LQG has little in common with a realistic Quantum Gravity quantizing according to General Relativity) – it just is representing some sophisticated, "better" kind of quantum mechanics needing a great deal of computational effort without, however, showing up any perspective towards a more realistic Quantum Gravity (off great-great-great-grandfather's dusty **Lagrangian formalism** of faded centuries).

As a square matrix, we are recognizing **spacetime** as a **2-quant** construct. (One of its quanta is a "destruction operator", the other one a "creation operator".) I am still returning to it. Before, however, we should derive the numerical value of the dimension Quantum Gravity is working with in its fundamental form.

The dynamic channel contains probability statements. For their normalization (“number of cases *in favour* divided by the number of *all cases*”), we need a system of numbers within which a **division** can be defined. According to number theory, the highest “dimension of an irreducible system of numbers” admitting division is 8; its numbers are called “**octonions**”. (These are systems having 1 real axis and 7 additional, distinguishable imaginary axes.) Quantum Gravity, (actually) only is needing the fact that these are 8 dimensions altogether. (For a comparison: the “complex plane” we are familiar with is 2-dimensional.)

Quantum Gravity is 8-dimensional.

But why, then, do field theoreticians (Dirac) work with 4 fundamental dimensions only? Now, **Dirac** does not only know “particles” but, in addition, “**antiparticles**”, as well. He is assigning a 4-dimensional “**spinor**” (vector) to both of them separately. Altogether, these are just $4+4=8$ components!

Contrary to the string theoreticians with their 10 to 11 dimensions which they are unable to assign to physical entities until today, Dirac’s 4 dimensions, each, are well-defined in physics! Instead of drawing a line between particle and antiparticle, however, as Dirac does it, Quantum Gravity is combining both partial “states” to a *common* spinor of $4+4=8$ dimensions. While its, say, upper 4 components are fitted with a particle number equal to +1, its lower 4, then, are it with particle number equal to -1 .

On the one hand, there should not exist any transitions between both spinor halves; on the other hand, we are quite well familiar with the violations of the 3 “parity” types (P = local reflection, C = charge conjugation, T = time reversal) by Weak Interactions, which are relating our upper half to our lower half! Thereby, we observe that the parities **C** of **charge conjugation** (= mutual antiparticle-particle exchange) and **T** of **time reversal** are relating both spinor halves in a way similar to that Special Relativity is relating space to time!

The transition probability between both spinor halves might be extremely small with those technical means being at our disposal, actually; however, we cannot ultimately exclude them for every times: Who knows which surprises future experiments still are preparing for us! More in the next chapter.

Event Horizon

Quantum Gravity describes the physics of a black hole completely and consistently [1]. Two features are of major importance.

First of all, we already discussed the duality between Einstein's classical, **non-linear spacetime X** opposed to the **linear CMS-spacetime Q** Quantum Gravity is using. We might be more familiar with the totally analogous duality between the **non-linear velocity V** and the **linear energy-momentum P** – in a relativistic formulation:

spacetime:

$$Q = M \cdot X,$$

velocity:

$$P = M \cdot V.$$

Heavy mass M takes on a mediating role between both features. It is corresponding to a simple "rotation" within the (4/6)-plane of our "conformal group" $SO(2,4)$.

Secondly: In its variant of an $SU(2,2)$, this $SO(2,4)$ is showing up an equal number of time-like and space-like (*pseudo-unitary*) components, i.e., 2 of them, each. Its extension by particle number N (N positive = particle, N negative = antiparticle) to a complete $U(2,2)$ does not change this fact.

Provided we, now, are exchanging both component types against each other, in addition (*mathematics is managing that quite simply by multiplying with the imaginary unit*), then we are staying with this $U(2,2)$ – only that, now, the upper 4 components (N positive) formally slipped down and the lower 4 (N negative) went up (reflection property).

The combination of both 4-dimensional individual structures to some common, 8-dimensional structure will return us our $U(4,4)$ Quantum Gravity. The physical cutting plane separating both partial substructures $U(2,2)$ is its "**event horizon**". On our side of it we are living inside "**our universe**"; the other side beyond it, then, is called a "**black hole**".

Both sides of an event horizon are equivalent !

Those notions “inside” and “beyond” an event horizon, obviously, are purely relative:

The world inside a black hole equals the world outside !

How can that be? Now, when passing the event horizon, “**parities**” will change as well. Parities are reflection properties. Two of them, time reversal T and charge conjugation C , are properties of their embedding group $U(4,4)$ or $U(8)$, but not of their 2 subgroups $U(2,2)$ or $U(4)$, which in particle physics are characterizing Dirac’s physics (below in white).

Here, those mathematical “quibbles” will take effect, which I mentioned already. In cosmology, parity T (“time reversal”) – i.e., the reflection at the horizontal line in the sketch below – will “separate” the ranges before and after the “big bang” from each other, and its vertical line, there, is representing the event horizon of a black hole:

$U(2,2)$ particle no. > 0 time > 0	$U(2,2)$ particle no. < 0 time < 0
$U(2,2)$ particle no. > 0 time < 0	$U(2,2)$ particle no. < 0 time > 0

On the other hand, in its representation by the conformal group $SO(2,4)$ equivalent to the $SU(2,2)$, the reflection of the two white ranges onto each other will give some $SO(4,2)$. This “imaginary” $SO(4,2)$, however is equivalent to an “ordinary” $SO(2,4)$. As a matter of principle, structures do not change in a reflection!

In 8 dimensions, Dirac's one world in 4 dimensions ("after the big bang"), hence, will yield $2 \times 2 = 4$ dynamically separate worlds! This means something like a multiple reinterpretation of the old situation, where all 4 will have the same structure, in principle.

Now, we could show that with all those variabilities taking place when **passing the event horizon** of a black hole, just the special-relativistic properties are conserved, and the same holds true for heavy mass:

special relativity:	unchanged
heavy mass	unchanged

The reason can be understood quite simply: The transformations executing this transition are representing some rotation in the (4,6)-plane of the original conformal group; but Special Relativity is exclusively acting on its axes no. 1,2,3, and 5. A conflict with it, hence, can be excluded. And heavy mass itself just is "generating" this rotation within the (4,6)-plane, whence it does not collide (with itself), either.

On the other hand, those linear operators of 4-momentum (P) and CMS-spacetime (Q) in Quantum Gravity are generating" rotations" within the (6,x)- and in the (4,x)-planes. A transformation by heavy mass (as a generator), hence, just is exchanging spacetime Q against its energy-momentum:

spacetime Q	\leftrightarrow	4-momentum P
spacetime X	\leftrightarrow	4-velocity V

From the point of view of our own partial world on our side of the event horizon, those points behind it are not sorted any more according to equal *spacetime X* to give some heavier gross point, but according to points of equal *4-velocity V*, instead! Although nothing will change with that transition, the observer will have the impression as if compact matter will have been torn apart in order to be recomposed in a resorted way behind the event horizon.

In classical physics it has well proved useful to align dynamics according to the *linear* entities of energy and momentum (P) and not according to their *non-linear* velocities (V) – i.e. to a certain extent, according to their "CMS-velocity". Quantum Gravity, now, demonstrates that we wisely should use linear CMS-spacetime (Q), as well, instead of Einstein's classical spacetime (X). Only this way "New Physics" will stay comprehensible for the philosophically interested layman, too.

As an additional point, time reversal (T) and charge conjugation (C) still will join this radical rethinking towards the linear operators at the event horizon: An observer in the interior of a black hole will reinterpret a particle, which by our point of view from outside is falling into the black hole, as an antiparticle (i.e. charge conjugation C) leaving that black hole (i.e. time reversal T) from there into our partial world outside the black hole [1].

Still observe, however, that a "particle" will be composed in front of a black hole with respect to its spacetime X, behind the event horizon, however, with respect to its velocity V.

(Let me mention by the way: A key issue highlighted by this also will be the behaviour of individual quanta involved in scattering experiments at a grid: It is a matter of our **measuring method** what we really are going to interpret as some uniform particle. The grid will be passed by separate quanta, each one by itself. Only their subsequent reordering will retransform that quantum chaos to a particle.)

The nature appearing to us as "our world" dotted with myriads of black holes will appear to an observer inside such a black hole as some system of disconnected "black holes" consisting of islands of our world within his own world, while our black holes, according to his point of view, will all merge to his own coherent world. This reinterpretation, as discussed already, has its origin in the differing methods of compiling points to particles on either side of the event horizon (according to X or V, respectively). Beyond it, all regions we on our side are interpreting as separated black holes will be interpreted as one united section from his perspective. All that is proven by the reflection symmetry of a $U(2,2)$.

In a global consideration of all partial worlds it is *as though* each of it would permanently lose matter *leaving* it across the event horizon without any new matter coming in, however, in order to fill up the gaps again. Some time, then, just one huge black hole should be left without our previous world around it.

However, this conclusion would clearly be missing the point: “early” times on our side are corresponding to “late” times behind the event horizon (and v.v.). A depletion of matter on our side (in the white field top left) of the event horizon with time increasing since the “big bang” (i.e., at time = zero) will formally correspond to an accretion of matter in the course of our time beyond the event horizon (in the pale blue box). There, however, it will implicitly be reinterpreted (charge conjugation!) as a depletion of (anti-) matter in the opposite direction of time [1]. The additional, explicit time reversal (in the white box downright), then, will put things right again.

A steadily decreasing concentration off from the “big bang” within the area considered, hence, will be consistent with each other in all 4 areas! This continuous interplay of a depleting concentration on one side of the event horizon paired with a mutual accretion of concentration on its opposite side, due to the time reversal (implicitly contained in charge conjugation, as well) will provide some

**continuous, never ending exchange of matter
between both sides of an event horizon.**

As a result of this temporally antagonistic matter cycle, that classically still postulated existence of a singularity in the interior of a black hole cannot be kept upright any longer.

**In Quantum Gravity, a black hole
is free of singularities !**

When switching from this dynamical way of considering a black hole in the framework of a *pseudo*-unitary $U(4,4)$ over to consider it in the **reaction channel** of its related, really unitary $U(8)$, this picture will simplify drastically. That “**hyperbolic rotation**” within the (4,6)-plane of an $SO(2,4)$ generated by heavy mass will become a really unitary rotation within an $SO(6)$, there.

The partition of our world into parts before and after the “big bang” will disappear, there, as well as that of separating our world from that beyond the event horizon: All 4 parts, here, will be “continuously” merging without “crunching” at their borders. That “bumping” in its dynamic channel has its origin in those hyperbolic distortions our total world has to suffer from the transition of its way of description from a unitary sphere $U(8)$ (reaction channel) towards that pseudo-unitary hyperboloid $U(4,4)$ (dynamic channel).

The most simple plausibility check can be made in 2 dimensions. A circle (representative of a sphere) is some compact structure. On the other hand, a hyperbola has 2 disconnected branches. In order to transform a circle into a hyperbola, first of all we shall have to cut it in its centre. In addition, we shall have to compress and stretch both branches until they finally are adopting the form of two hyperbola branches. That “tearing process” will correspond to the existence of an event horizon. (*When considering CMS-time (4,5) to replace heavy mass (4,6), it will yield that 2nd break at the sign switch of time.*)

As both structures are resulting from each other purely by an adequate coordinate transformation, it will be a matter of the art of an experimentalist to conceive practicable experiments which do not always remain stuck to the classical dynamic channel with its causal limits by the velocity of light, as hitherto practiced, but which will increasingly include the reaction channel, as well. (Undreamt-of generalizations beyond “entanglement” might turn up!)

In the reaction channel of particle physics, this fluent transition of those 4 partial ranges into each other also will lead to the existence of “**virtual states**”. These are particle states whose spacetime behaviour does not correspond to that of “**free particles**” we would obtain by applying a Lorentz transformation to “real” particles in their states of rest.

The reaction channel, thus, will be providing us with "tachion"-states, in addition. (A tachion is spreading at a **speed faster than light!**). This might totally contradict classical relativity, where everything has to be organized such that it will move in a **causal** way – last but not least, that classical limitation by the velocity of light is resulting from it. But in particle physics those tachyon states, since Feynman's Nobel Prize for his **Feynman diagrams** long ago, are a common practice and no-one should be scandalized because of it.

Here, the gross contradiction between Einstein's dynamics, which are playing in the (secondary) *dynamic* channel, and the physics of the (primary) reaction channel particle physicists are claiming for themselves is demonstrating itself. Only, the "**Lagrangian**" formalism Feynman's diagrams are based upon is mixing up both channels in an inconsistent way!

Thus, for particle reactions, the rules of the reaction channel are applied, there. For the spreading of those particles, however, the rules of the dynamic channel are applied simultaneously. Both channels are working with different normalizations, however! Feynman is tacitly identifying both channels with each other instead of first *converting* the states of one of those channels at their interface into the states of that other channel. Thus, the entire world of particle physics is inconsistent right from the beginning!

Sadly, this is not its only inconsistency [1]; almost all particle physics can be considered as a synonym for mathematical inconsistency. From the part of the responsible institutions, actually, no tendency is recognizable that anybody could imagine of thinking of corrections. Hence, probably only the takeover of Quantum Gravity to replace those "Standard" Models, sometime in a distant future, will have a chance to restore order in the theoretical part of fundamental physics. Until then, our slogan must be: Stay the course!

Now, you could ask yourself: "What do those Black Holes matter at all? Technically we (actually) cannot reach them anyway."

But far from it: By their *double* time reversal inside that white box on the bottom right (cf. a couple of pages back) we return to their spacetime coordinates lying within a range familiar to us. Thus, they do become accessible to our measurements – and this happens in terms of **antiparticles**! Antiparticles, hence, unexpectedly reveal themselves to be witnesses bearing testimony to a world behind the event horizon before the big bang.

V.v., this “**TCP theorem**” of particle physics, accidentally, is providing us with a connection of the two bluish regions with each other as well, i.e., it relates those states before the big bang to states allocated behind the event horizon of a black hole – and v.v.

This, however, is a deductive, i.e., some top-down derivation from Quantum Gravity. On the other hand, American science rather is used to apply inductive, bottom-up derivations like those we are familiar with from the “standard” models. This might produce short-term competitive advantages for technical, experimental physics.

For theory, however, in the long run, such instinctive reactions short of breath will give rise to the risk of ending up in hopeless deadlocks: a large-scale stagnation will be the result! Just remember Einstein and his “world formula”. After his emigration to Princeton his scientific career abruptly stopped in unending discussions about God and the world. Practical results: negative. –

But let us return to physics. The reaction channel clarifies all those *relations* and transitions related to those horizons more significantly – while the dynamic channel, v.v., is calling the *differences* to our mind more pointedly. Last but not least, however, we have to do it with a homogeneous physics.

Finiteness

Nobody can count up to infinity. This has consequences:

(Non-recoverable) **infinities** are **physical nonsense**.

For, they are not measurable. Hence, they neither can be validated nor disproved!

Those infinities (“**singularities**”) are starting with the transition from discrete to **continuous spectra**, already. For, mathematically, the number of points which can be settled continuously between two discrete points is infinite! Thus, both – relativity theories as well as classical quantum mechanics – are contradicting original physics by their *continuous* spacetime structures. Hence, they are to be considered as mere **approximations** working with **statistical interpolations**!

In fundamental physics, **space** and **time** are existing **exclusively** as **quantized** entities.

The same applies to heavy mass, to 4-momentum, to spin, to the 3 components of the Lorentz booster, and to particle number, i.e., to all of the original, linear parameters of our $U(2,2)$ – at least as far as their reaction channel $U(4)$ is concerned (i.e., leaving aside those statistical interpolations). And this will apply to Quantum Gravity in its 8-dimensional $U(4,4)$ and $U(8)$ versions as well, and, finally, even to the entire “New Physics” we still have to discuss explicitly:

At least in its primary reaction channel, **fundamental physics** will have to be described by an **atomistic model**.

The *linear* parameters (or “**operators**”) of a transformation group are “its **generators**”. In “New Physics”, they are represented by **pairs of quanta**. Each pair, here, will consist of one quantum called a “**creator**” and another one called a “**destroyer**”, each. Let me explain it more thoroughly:

In order to classify transformation groups, the mathematician “Young”, in 1900, invented his “Young Tableaux”. He only needed one kind of, say, “quanta”. But physicists wanted to scrutinize changes in a system consisting of such “quanta”, as well. Hence, they necessarily had to distinguish 2 systems of quanta: one system of “input” quanta and another one of “output” quanta.

In order not to confound both systems with each other, they agreed upon calling the quanta of one of the systems “creators” and the quanta of the other system “destroyers”. Through the decades, a special branch of mathematics called “**2nd quantization**” developed out of it. Only, it has not been the clean result of mathematicians but some sloppy, interim, ad hoc result of physicists. Meanwhile, we sadly have to deplore that kind of “mathematics” to be highly **inconsistent** [1]!

Quantum Gravity, now, went removing all those inconsistencies of “2nd quantization” by re-establishing its consistent base once set out by Young himself. *His* input system had been made only out of “creators”, and *his* output system exclusively consisted of “destroyers” – omitting those awful, mixed cross-structures which had made fundamental physics that inconsistent!

This exactly corresponds to converting both separate, 4-dimensional Dirac spinors of classical particle physics into some combined, common, 8-dimensional structure as Quantum Gravity is representing it. Both opposed particle numbers of particles and antiparticles, now, are considered as some doublet. This is the real “secret” of Quantum Gravity. Both components of that doublet equally are “creators”, i.e., all 8 components of a $U(8)$ or a $U(4,4)$ input spinor exclusively are creators!

Mathematically, the transition from an input system towards an output system is accomplished by "**operators**". They are producing their outputs by being applied to that input. Equivalently, we could formulate: they "**destroy**" that input, "**create**" another one, and put it onto the former input place.

In physics, the most simple (*non-trivial*) operators are those above "**generators**" consisting exactly of *one* creator quantum plus *one* destroyer quantum, each. Their characteristic, thus, just is their "bilinearity" within the framework of *two* systems, i.e., of both an input and, independently, an output system.

**Generators (like space and time, e.g.)
are quantum pairs.**

Hence, within a system it is applied to, a generator will count the number of creators of a certain type by its destroyer quantum in order to replace that type, there, by the type of its own creator quantum. This will apply to the generators of space and time, as well:

**In the CMS system of the Q's, the generators of
space and time are counting
the creator quanta of a certain type.**

The result of such a count, thus, always must stay finite:

Space and time are finite!

But the 4 **spacetime** components are **not "commensurable"**, i.e., not all of them are measurable independently of each other! By **statistics** using the **law of great numbers**, this can approximately be corrected, however.

Space and time are “very great” numbers!

(The “law of great numbers” approximately will set $n+1=n$.) That much on the more philosophical problem of “What is space? What is time?”

Now, due to the coexistence of space-like with time-like points in the frame of a “pseudo” group, they do not generate an ellipsoid as the set of all its points but a **hyperboloid**. From school we know, however, that the branches of a hyperbola will range to infinity. Hence, that hyperboloid will include unphysical points, as well!

But in physics, the challenge is not the “geometrical location” a physical point *would* come to be located at, but the *real location of the physical point* itself! Thus, a hyperboloid will mathematically contain much more points than realized physically. Physically, this hyperboloid will consist of an accumulation of some finite number of quanta only. Thus, it hardly will contain more than just voids, essentially! Its “few” physical points being allocated, indeed, thus, will necessarily be located within some finite range!

It is a matter of taste, now, if we follow Einstein in considering all those physical points to be dispersed all over the surface of some huge, unlimited hyperboloid (dynamic channel with asymptotes) or if we admit our consideration to stop just behind its last point which happens to be realized physically, indeed. Then, if everything remains finite, this would correspond to some logics similar to that of our reaction channel – only in a somewhat awkward, distorted formulation.

Provided we are sticking to such a hyperbolic description all the same, that representation still would formally remain that of a pseudo-orthogonal or pseudo-unitary group, respectively. However, that representation would not be of infinite dimension any more; it would stay finite-dimensional, i.e., it would terminate somewhere! In disguise, this would mean some

finite-dimensional representation of some pseudo-group.

Particle physicists recognized that only *unitary* representations will guarantee probability conservation. Hence, they try to square the circle by “preferably” admitting unitary representations of their finite-dimensional pseudo-groups only. Both claims are *physically* contradictory, however. Hence, those representations will result in an unphysical way, i.e., in an infinite number of dimensions. Those singularities are artificial, however!

In actual particle physics, those infinite-dimensional and finite-dimensional representations of groups are mixing up continuously. Day by day, this fact is pointing to their basic mathematical inconsistencies: Both channels, thus, will have to be properly distinguished from each other!

Let us, however, return to those “**distortions**” necessarily arising from the transition from that physically primary ellipsoid towards that secondary hyperboloid. This “transition” means introducing the imaginary unit “*i*” as a factor into the “time-like” parameters. By squaring, that sign change will appear, there, distinguishing a hyperbola from an ellipse.

Now, a different choice of **measuring units** on the axes of the original *sphere* will transform a formerly uniform distribution of points on its surface to that of an *ellipsoid*. Then, a *hyperboloid* will give rise to an even much more distorted point pattern. As a new, “**emergent parameter**” not present before, now, a **point concentration** will occur. Up to a sign depending on the special case, such a point concentration also is called a “**potential**”. (As a constant it had been irrelevant on the primary sphere.)

In physics, the **negative gradient** of a
potential is called a “**force**”.

The occurrence of a “**force**” [1], hence, is the automatic result of the transition from the reaction channel to the dynamic channel!

From a statistical consideration we deduce that the probability of coming across with quanta within a delimited area of spacetime will achieve its maximum when following the gradient of its point concentration – the “faster” the greater the force.

Thus, in physics, all “**dynamics**” will arise from some **static base** being fixed invariably!

Motion is the result of a statistical consideration of some non-constant, static **point concentration**.

Philosophers would reformulate it: “Motion” is not real; it is just some (not only) human **illusion**; in “reality”, our world is purely static. Physicists, then, will have to supplement: In terms of our actual knowledge on nature, these statics will describe the entire world (theoretically accessible to us).

In physics, dynamical **actions** usually will result from summing up generators to exponential functions. “Time-like” generators are characterized by their negative sign distorting the original, static ellipsoid to a dynamical hyperboloid. Sign reversal in the exponent, however, will change an “action” A into its inverse action $1/A$. Hence, we should accept that those “time-like” actions in our hyperboloid better should have been represented by their inverse actions.

With sufficiently high absolute values of the points a and b , in association with a *sufficiently small difference of their distance*, an “ordinary” representation of points ranging from a to b hardly can be distinguished qualitatively, in its purely local surrounding, from those of its inverse representation ranging from $1/b$ to $1/a$. Their difference only is in normalization (*and in higher, non-linear terms of the Taylor expansion of $1/A$ around some point inside the range between a and b*).

Thus, it still is an open problem, actually, if the **red shifts** measured by astronomers can be reduced merely to relative stellar speed differences, indeed, or if they are not associated with inverse absolute distances on the time axis, in addition, as Quantum Gravity is offering us as an alternative.

By the latter alternative using inverse values on the time-like axes of the dynamic hyperboloid, its zero position, which by the model considered hitherto still is located in the centre of the hyperboloid, formally would drift towards infinity on some newly created asymptote ($1/0 = \text{infinite!}$). Then, the present hyperboloid fitted with times ranging from minus to plus infinity would split into 2 hyperboloids using logarithmic scales one of which would embrace positive times only and the other one negative times only.

This corresponds to an additional division of our world like that we are familiar with by the separation of the partial world lying behind the event horizon of a black hole. Such an artificial split ("**time horizon**") between positive and negative times at the "big bang" would supplement our old split given by the event horizon, already. Conceptually, it would treat time on an equal footing as heavy mass (cf. the 4-partition in the previous chapter).

From the point of view of the model, such a formal procedure of "shifting off" the "big bang" position towards some asymptotic region as well would mean some rather organic treatment because it would correspond to a simple, numerical renormalization on the time axis.

The **open million-dollar question** to experimental physics, hence, reads: Is there any evidence that CMS-time might not be linear, indeed, i.e., do we just not yet notice that – by some adaptation to the law of great numbers – we are measuring it in an inverse way without recognizing it because we had not yet been able to leave our **local neighbourhood** in space in order to obtain some survey over larger, global distances "from outside"??

The “World Formula”

Historically, the notion of “mass” had been “invented” twice independently of each other – once in terms of some linear, i.e., of an additive expression (“**heavy mass**”), and a second time in terms of some squared, i.e., of a non-linear expression (we are extracting the root of, calling the result “**inertial mass**”). Now, Einstein’s ansatz had been to correlate both independent entities with each other (“theory of **relativity**”).

In order to relate both entities (coinciding measures!), he had to square the linear, heavy mass. We are familiar with the result: In particle physics, it is the “**Klein-Gordon equation**” – Einstein himself called it his “**equivalence principle**”. In hindsight, this equation means some first, strongly simplified application of the “**world formula**” for some more general version of which Einstein had searched for in vain during all his life.

Angular momentum had a similar destiny. Its linear realization – contrary to “heavy mass” it is present in 3 components – is called “**spin**”, its non-linear expression of 2nd order is its “**orbital angular momentum**”. Their addition is “**total angular momentum**”.

The respective discipline of mathematics we are executing such calculations with is “group theory”. Its “**invariants**” are called “**Casimir operators**”. Separately for every Casimir needed, the “world formula”, then, trivially reads:

World formula: Casimir = const.

(Besides: Casimir operators are nothing more than polynomials in its bilinear “generators” of group theory where all its labels are summing up in pairs.)

From the point of view of Quantum Gravity, the Klein-Gordon equation, above, is using only some selection out of all dynamical parameters of the quadratic Casimir of our $U(2,2)$. Hence it is incomplete. By supplementing its missing parts, we automatically obtain **dark energy** [1], e.g.

Correspondingly, total angular momentum emerges as terms within the dynamic Casimirs both of third and of fourth order. Up to my knowledge, until to-day, nobody has examined their physical content *officially*, yet. Einstein did not even foresee its existence. Only Quantum Gravity is making it a regular topic. As a result, both of them combined just are providing (“part A” of) that mysterious **dark matter** [1] astronomers are measuring in the centres of galaxies.

By his exclusive restriction to the use of **differential geometry** for describing General Relativity, Einstein even could not detect these effects of modern astronomy at all! For, differential geometry is an instrument of treating a **bottom-up** model. A bottom-up model, however, is working according to the principle: Just describe the most necessary only; add more and more “balconies” to theory only if needed – as long until you – possibly or not – once will have got everything together. By an extreme formulation, a bottom-up model, thus, will predict only what is explicitly put in, before.

On the other hand, Young’s group theory is working according to the **top-down** principle: Potentially keep ready all options – this is the model; reduce it to the problem[s] demanded *only then*. The predictive power of a top-down model, hence, will be based much more broadly than that of a bottom-up model. Actually, after more than 100 years, physicists still are struggling along with Einstein’s differential geometry just at the rim of physical cognition – while Quantum Gravity immediately and directly went hitting its centre with flying colours. In addition, QG is **solving** those **problems** the differential-geometrical method of cosmology and the “2nd quantization” of particle physics are deferring unsolved.

Quantum Gravity is raising the claim to

describe the subatomic world of **particle physics**
and our **cosmos** simultaneously by means of
 their common **“world formula”!**

The long series of experimental success in this field is confirming this claim. I extensively discussed the **dynamic hyperboloids** obtained by applying the world formula of 2nd order as a geometrical location elsewhere [1], already. The present e-book rather is treating the general **logics of Quantum Gravity**.

Here, the special way of translating the reaction channel into the dynamic channel rather is asked for, e.g.: One and the same “object“ will have to be analyzed according to 2 different methods. Purely by classic functional analysis, we then would have to talk about 2 independent “systems“ of functions. Fundamental physics, however, prefers to talk about “**states**“ replacing the notion of (multidimensional) “systems of functions“. According to Young, group theorists are used to organize their systems on the base of “**irreducible representations**“.

Thus, the 3 components of spin are not “**commensurable**“ on the “microscopic level“, e.g. Nevertheless, angular momentum does seem to be so on the “macroscopic level“. “Microscopic“, here, will denote “*small*“ values of angular momentum on the level of *individual* elementary particles (or quanta); this is the reaction channel. Its “macroscopic“ view, however, is more relaxed by averaging over some huge number of “neighbouring“, *large* values of angular momentum.

As a key notion let me briefly mention a “**wave packet**“. Macroscopic statements usually are applying statistical arguments; and macroscopic angular momenta usually are excessively greater than Planck’s constant h , only on the level of which it will be felt that the 3 spin components are not commensurable with each other.

Such a rougher, statistical treatment will eliminate those finer deviations from commensurability. A “wave packet“ will embrace some multitude of individual “waves“ (= states). It will be evaluated by some **statistical** method. This is the handling of the dynamic channel, however!

A “state“ of the dynamic channel will decompose – a more distinguished expression would be “expanded“ – according to some greater number of “states“ independent of each other of the reaction channel.

Transferred to cosmic dimensions, this means: One *dynamic* “universe” will be expanded in terms of some multitude of universes belonging to the *reaction channel*. Such a “multitude” of universes is called a “**multiverse**”.

V.v., we could expand a single universe of the reaction channel in terms of some multitude of universes of the dynamic channel, as well; on principle, these arguments apply to both directions. According to Young, however, all that will just correspond to some “**redialization** of components” of some altogether irreducible representation of sufficient size: each individual “component” will correspond to some individual “universe”; and the irreducible representation itself – this is the related “multiverse”:

multiverse	=	representation
universe	=	component

When considering our “multiverse” at some special time t , then, by definition, we are considering one of its components (i.e., some “universe”) characterized by that time= t . A “**universe expanding over time**” when taken seriously, thus, is no *universe* but some multiverse in the interior of which we are mentally jumping from one of its components (universes) to another one.

But each of those universes will belong to a *different* (consecutive) value of t , e.g., the position components of which are increasing by growing time from component to component. This leap from one component (“universe”) to its neighbouring component will give the illusion of an apparent motion within that multiverse (like in a “flipbook”). (*Colloquially, both notions – “components” and “representation” – are mixing up continuously. This might lead to bad confusions!*)

A representation (= **multiverse**) is fixed, static. Its components (universes) are something like “**conic sections**” cutting through such a multiverse! According to the direction of such a cut, we might obtain differing types of “universes”!

Both “**channels**“ of Quantum Gravity ($U(8)$ and $U(4,4)$, respectively) are representing just different “directions“ of such “conic sections“ within their common multiverse. And to each of both special directions, there will be some great number of related universes:

multiverse: static, fixed
universe: variable, (internal) parameters!

In Quantum Gravity, an elementary particle is considered as some especially “small“ multiverse – though composed of some multitude of quanta, again. If we define a “multiverse“ as some “irreducible“ representation not allowing a further decomposition, however, then there is a formal dilemma:

Either that multiverse is irreducible, indeed – then this will exclude the coexistence of particles in its interior as irreducible as well. Or it is *not* “irreducible“ (i.e., it is decomposable further) – then it *might* contain irreducible particle representations.

Hence, that multiverse on the cosmic level and the particles in its interior cannot be irreducible simultaneously! The escape mode is obvious: particles are not “irreducible“. They will have to represent **superpositions** of “components“ of their multiverse:

**Elementary particles are
constructive superpositions of universes.**

This does not only refer to their badly limited extension with respect to the 3 space directions but also to their time direction: the life time of an elementary particle is basically limited, i.e.,

**An elementary particle will either decay
or pass the event horizon.**

(However, see our chapter “Genesis”!) On principle, their half-live periods would allow to be calculated by Quantum Gravity, as well – provided we would know their exact composition made of quanta. Especially, it would be our job soon to decode their non-valence parts. Allow me to point out that the classical “canonical” quantization and the uncertainty relation resulting from it, in Quantum Gravity only has the significance of a quantum-mechanical approximation; for extreme values of CMS-*spacetime*, measuring precision will more and more shift away towards *4-momentum*.

Our individual “quanta”, by the way, are “components” (of the 8-dimensional fundamental spinor) – and not “representations”!

An additional step further up, it should be assumed that the above multiverses one day will prove to be constructive superpositions of components of some still higher “monster” representation made of multiverses interacting with each other – like those superpositions we recognized already in the case of elementary particles regrouping their individual quanta among each other like in a continuous pool game.

In this sense, in Quantum Gravity, the pragmatic chance of

**inter-universal or inter-multiversal contact
cannot be excluded.**

Conventional models strictly are banning it by their dogmatic bottom-up definition of a “uni”-verse. However, it only will prove to be a matter of the state of the art of their respective technology. Our principle is: **“Somehow, everything is linked to everything!”** It is mankind again and again to install barriers in terms of artificially delimiting models in order to conserve its survey over nature.

The “Internal” Subsystems

In ancient times already, those particular physical properties of amber (Greek: “electron”) had been well known. Its characteristic, the existence of electric “**charges**”, however, is not a matter of Quantum Gravity. Thus, in nature, there do exist still additional phenomena beyond what Quantum Gravity is describing. Hence, its 8 types of “quanta” will have to show up still more, additional properties!

In fundamental physics, those “additional properties” are called “**internal** properties”. One of the first of those properties, “**isospin**”, still is originating from nuclear physics. In 1947, the verification of “**strangeness**” to exist in cosmic-ray particles had been the next one. Further discoveries followed.

Kaluza and Klein found a simple way (first of all) to relate electromagnetism to classical dynamics by multiplying dynamics with some kind of a 2-dimensional spinor, thus formally doubling it. Sum and difference of dynamic 4-momentum P and that electromagnetic 4-potential A thus generated, in addition, provided us with what we actually are calling a “**minimal coupling**” of electromagnetism to mechanics.

This procedure will correspond to a bottom-up method. In a top-down model, however, our old principle will work effectively which we successfully have applied already in order to construct Quantum Gravity: For subsystems to be normalizable, they should allow for a classification (via the division algebras of number theory) in terms of some octet scheme. Every dynamic octet component individually, hence, should enter in 8 “internal” variants each.

By appropriate combinations, this will provide 8 “internal” variants of Quantum Gravity:

$$\mathbf{U(4,4)}_{\text{QG}} \rightarrow \mathbf{U(4,4)}_1 \oplus \dots \oplus \mathbf{U(4,4)}_8 .$$

In literature, those 8 new, “internal” subsystems – as far as they are detected already – are called “**chiral**” subsystems. Only, the official literature still does not yet know Quantum Gravity $U(4,4)$; hence, by a typically “bottom-up” substructure, it first of all is reducing its chiral content to a world of orthogonal substructures (like $SO(3)$, etc., e.g.).

Now, it is obvious to try to collect all those above 8 independent variants of an 8x8-dimensional representation in some uniform representation in 64 dimensions. The result, then, would include the **transitions** of all those individual, chiral, partial systems into each other, as well:

$$U(4,4)_1 \oplus \dots \oplus U(4,4)_8 \subset U(32,32)_{\text{GUT}}.$$

This “internal” 8-fold multitude, hence, is propagated under the notion of a “**General Unified Theory**”, briefly “**GUT**” (which, officially, is leaving open the number of dimensions). On the other hand, we are understanding an elementary particle as a “representation” of this GUT. Let us, hence, split this GUT, now, multiplicatively according to its dynamic $SU(4,4)$ times its “internal” octet $U(8)$:

$$U(32,32) \supset SU(4,4)_{\text{QG}} \times U(8)_{\text{“internal”}}.$$

Then, the representation of the „internal“ singlet $SU(4,4) \times U(1)$, apparently, will be missing to which the graviton is belonging to. Beware, however, of confounding a “representation” of a group with that group itself: As a matter of fact, this above “internal” $U(8)$, of course, will have a singlet representation in addition to its 8-dimensional representation, as well! Officially, however, with that chiral GUT, people are used only to take its chiral factors into account. Hence, in order to include gravity explicitly, people unnecessarily still added another notion for that combination calling it a “**Theory of Everything**”, briefly “**ToE**”.

So far the general top-down pattern of “**New Physics**”. The corresponding bottom-up pattern of official literature is what they call their “**standard model**” of particle physics.

In that "standard" model, there are just $2 \times 3 = 6$ different types of "internal" charges. For, "**leptons**", which include the electron as a component of their "4th quark pair", are subject to some special treatment in that "standard" model. The "standard" model is talking of "quarks" where "New Physics" is talking of "quanta". For, Gell-Mann's "quark model" happened to arise in a period "before Enlightenment 2.0", i.e., in a period where the misinterpretation of Bell's no-go theorem still abounded by which the introduction of "hidden parameters" had been declared to an absolute "taboo".

Here, unproven dogmas of all kind still had been flourishing in fundamental theory. A real religious battle about the interpretation of physical methods raged through the gazettes. Finally, the ultra-conservatives became the winners. Their 2 most devastating theses not proven, which radically prevented effective progress in fundamental theory for decades, read:

1. An elementary particle must consist of **maximally 3 quarks**.
2. Contrary to all other interactions in fundamental physics, **Pauli's exclusion principle** is not realized by intermediate exchange particles but statistically, by an "**antisymmetry**".

Point 1 categorically excluded the existence of a **non-valence part** made of "quarks" (or quanta). This immediately imposed the alternative ansatz of "**3 flavour generations**" in the "standard" model. Their characteristic measuring values like "charm" or "strangeness", e.g., still are treated as "quantum numbers" – though those "quantum numbers" are no conserved quantities but are "broken".

In "New Physics", there are **no broken quantum numbers!** In complete consistence, those "**hadronic flavours**" turn out merely to be **many-quant constructs**, while the "**leptonic flavours**" prove to arise from special symmetry properties according to which a "lepto-nucleus" is bound into the lepton. In "New Physics", a **lepton** is an "antibaryon", i.e., some **bound state** composed of 3 valence quanta. Its **lepton number** $L=+1$ will arise from its "**lepto-nucleus**", i.e., from some special 2-quant subsystem.

Nevertheless, the notion of “8 components” may be transferred analogously to the above 8 “internal” variants of Quantum Gravity. The following 4 quantum numbers are part of it:

- **total number of quanta,**
- **electric charge,**
- **triality,**
- **lepton number.**

They are conserved absolutely. In the given order, the lower 3 are characterizing the **3 classical forces** of electromagnetism, the “strong” nuclear force, and the “weak” nuclear force. Their central two are showing up to be divided into thirds (“**quark confinement**”) and its fourth into halves. “**Triality**” is the property of the “strong” nuclear force that its “strong charges” (= triality) of its quanta within a particle like that we are measuring in experiment always will have to neutralize to zero.

For the “standard” model, the existence of that quark confinement is a property totally unresolved by theory. In “New Physics”, however, it is some inevitable consequence of its dimension $8=2 \times 2 \times 2$. This 3rd power of the number of quantum pairs implies the application of a permutation group in 3 dimensions, there, and with it, last but not least, the application of a $U(3)$.

Now, Gell-Mann had shown already that the irreducible octet representation of a $U(3)$ will arise if we extract a certain “pair trace” out of it. The components of that 3-dimensional pair trace, however, will have values of $1/3$, each. Half of it ($=1/6$) will have to be subtracted from the two isospin components $(+1/2, -1/2)$ [1]. This exactly will yield those “odd” values $(+1/3, -2/3)$.

The reason why those values will have to neutralize each other will be given later (keyword: oscillator forces).

All these facts automatically are following from “New Physics”. In the “standard” model, however, they are unknown. Hence, that “standard” invented another “balcony” to be annexed to the model: the “quantum number **colour**” ranging over “**red, green, blue**”! All 3 colours together are asked just to yield a neutral “white”. Brrrr! By that “colour”, representations which by nature are not anti-symmetrical can formally be represented in an antisymmetrical way.

The "standard" model is splitting off its leptonic "quarks" from their hadronic counterparts identifying them with those leptons. Here again, it is introducing 3 "generations" characterized by the leptonic flavours electron, muon, and tauon number. Without that (superfluous) quantum number "colour", there are 4 "generations" of fundamental particle pairs ("quarks" + leptons) with 3 flavours, each, giving 4 "generations" with $(4 \times 2) \times 3 = 8 \times 3 = 24$ fundamental particle spinors altogether in the "standard" model.

In "New Physics", those 3 "**flavours**" are existing as derived, non-fundamental entities only; their factor "3" will drop out of the above calculation, hence. The number of remaining quantum types – what a miracle! – again is just $4 \times 2 = 8$ "**internal**" **quantum numbers**! Hence, as expected, that factor 8 again is emerging in the physics of "internal interactions" ("**General Unified Theory**" = **GUT**), as we had derived it from the division logics of octonions, already.

There, it has given us the 8-dimensionality of Quantum Gravity. Here, it is characterizing another, additional 8-dimensionality independent of it, which refers to the "internal" properties. The step back to top-down logics is teaching us that nature's split, in the subatomic quantum level, is proceeding in iterative steps of 8, indeed. In the dynamic channel:

Quantum Gravity:	$U(4,4),$
chiral interaction:	$U(4,4)_1 + \dots + U(4,4)_8,$
GUT + leptons:	$U(4 \times 8, 4 \times 8) = U(32, 32),$
[ToE:	$U(4 \times (8+1), 4 \times (8+1))].$

The model of "**chiral interactions**" still had given us 8 versions of "Quantum Gravity" standing separately side by side. The GUT, then, is adding their transitions into each other. (*The "bilinearity" of generators, now, automatically yields the ToE singlet mentioned above, in addition, where the graviton is belonging to. The explicit introduction of some special "ToE", thus, is not really needed.*)

There is no experimental evidence for needing a 3rd power of our basic dimension 8. On the other hand, let me mention that the extension of Quantum Gravity to yield that GUT (or ToE) sketched above stood the test at its best, as far as explicit consequences and experimental comparisons are available up to now, already.

Let us point to the special role of “weak” interactions, in this context. Until the 1960’s, the beta-decay of particles had been considered as self-evident to be represented by “4-point forces” not well understood. With the later detection of the W- and Z-bosons, it turned out that beta-decay could be treated quite naturally by applying these bosons as intermediary states in the frame of Feynman’s logics.

Now, this novel decay logics still went producing a lot of “spontaneous” **symmetry breakings** involving plenty of measured quantities people had expected to represent conserved quantum numbers: typical evidence of a “theory” nobody really had understood!

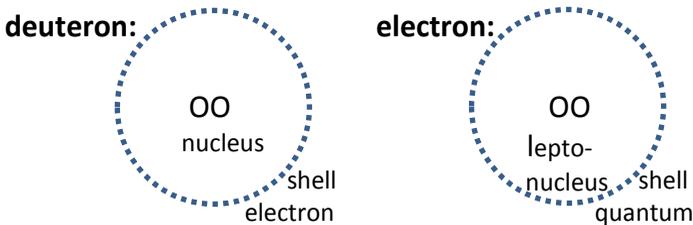
From the point of view of “New Physics”, which is describing all those interactions without violating any “quantum number”, the crux of the matter is that – in the framework of the “standard” model – those “weak” bosons W and Z (like the photon and the graviton) are not described by the model itself!

Even the leptons are treated as “**point particles**” without any internal structure, there. “New Physics”, however, is successfully describing them as composed structures made of a central “**lepto-nucleus**” about which, similarly as the electrons in an atom, there is “circling” some lonely valence quantum in a far distance which is coupled by “strong” interactions to it.

The lepto-nucleus itself, here, is some double-quant (with respect to its valence part). Its two individual quanta, however, are not coupled to each other by “strong” interactions (trinality) only, but by the so called “**leptonic force**”, in addition. I am still returning to those additional forces of “New Physics”, which are absent in the “standard” model, in the next chapter.

Here just that much: Like the “strong“ force, which is stronger than the electromagnetic force, the hierarchy of forces is propagating from the strong to the leptonic force, as well. It still must be stronger than triality by orders of magnitude! (The explicit reasoning will be given in the next chapter.)

This will yield an extremely small radius for the electron as a whole (“point particle“). The “strong“ coupling of its lonely valence quantum to the “lepto-nucleus“, then, is almost negligibly small in comparison to the enormous strength of the leptonic force binding the two quanta of the lepto-nucleus to each other.



According to “New Physics“, the “weak“ W-boson itself will contain both a lepto-nucleus and an anti-leptonucleus, as well. Hence, in its function as an exchange particle, the W-boson will not mediate the leptonic force as a monopole but exclusively as a dipole, i.e., in a highly weakened form!

“New Physics“ is demonstrating that the “weak“ interaction, thus, does neither violate any quantum number in its leptonic nor in its non-leptonic channels; it is able to describe all those different reaction modes in a clean way. Insofar, we also may consider “New Physics“ as a milestone in order to understand “**weak“ interactions**.”

Additional “internal“ quantum numbers of “New Physics“ beyond those 4 conventional ones mentioned above already will refer to the **shell model of nuclear physics** or to the **isospin mass-split** of particle multiplets [1]. Both of them are not treated in the “standard“ model.

As mentioned, the “standard“ model is based on a multitude of dogmas, which massively has barred and still is barring the way to its onward development. Its dogma “colour“, thus, is confounding “necessary“ with “sufficient“, e.g.

“New Physics”, now, is demonstrating that the proposition of a quantum number “colour” is absolutely superfluous [1]: **Pauli’s principle** can be satisfied completely by appropriate intermediary bosons in Feynman’s diagrams, as well.

Range Horizons

Klein-Gordon's part of the world formula of 2nd order provides the **Yukawa potential** of particle physics in the conventional way. In its massless case it transforms to a **Coulomb potential**. In this 2-body problem, the distance of a particle from its common centre of gravity is in a negative power, i.e., in its denominator.

The complete world formula of 2nd order, however, contains "**non-local**" distance terms of positive power, in addition. They still are adding an **oscillator potential** to the Yukawa potential.

In the GUT, the Yukawa potential always is coupled to an oscillator potential!

According to its negative distance power, that classical Yukawa force is maximal (infinite) in its centre; by increasing distance of it, it becomes smaller and smaller; asymptotically, it vanishes. An oscillator force will behave just oppositely: It is vanishing in its centre and increasing asymptotically without limitation.

For a bound system, this means that its (octet) charges of equal sign repel each other more and more by increasing distance until they finally will overcome all attractive forces which might be present in addition and break apart. For a bound system, hence, its individual charges should neutralize each other.

This, exactly, is the demand posed by the "**quark confinement**"! In a 3-quant baryon, thus, the "strong" triality charges of its valence part will compensate each other giving $+2/3 - 1/3 - 1/3 = 0$; in a 2-quant meson they yield $+2/3 - 2/3 = 0$ or $-1/3 + 1/3 = 0$, respectively. Mathematicians, then, are showing that this quark confinement just is summing up the electric charges (which are multiples of a third, as well) in order to give integer charges. And this is the fact we observe in experiment.

On the other hand, electric charges formally behave like the "strong" charges of triality. Why, then, can we observe non-vanishing electric charges in experiment at all??

Now, in “New Physics” all 8 chiral groups are equivalent to each other. But the individual “occupation numbers” of those 8 chiral components by quanta of their respective 64 types are different in the multiverse. (Those occupation numbers are *external* parameters of the representation fixed from *outside* our multiverse at its *creation*. Subsequent modifications from inside are not feasible!)

When considering our multiverse as some dynamic hyperboloid or, in its reaction channel, as some ellipsoid, respectively, made of its 64 types of quanta, we observe ourselves to be confronted with a rather badly “dented” structure with its principal axes differing in length. This will directly influence the 8 types of chiral coupling constants whose scales, hence, will have to follow rather different orders of magnitude.

For, every oscillator also is related to some range horizon. In a purely classical consideration – think of a coil spring – this range parameter will correspond to its reversal point from where the spring spins back. Technically, this horizon is proportional to the occupation number of this special type of potential by quanta on the related principal axis of the multiverse. With a differing occupation number, hence, the radius of the horizon of its related force will vary widely from chiral component to chiral component.

As mentioned, already, we cannot influence those “external” parameters any more from its interior, because they are conserved quantities. On the other hand, however, we observe that, in our multiverse, those occupation numbers might be equal in case of the “strong” and the electromagnetic force. The “strong” mediator particles, however, are *massive* (Yukawa force), while the photon is *massless* (Coulomb force). Hence, in spite of their equal occupation numbers, electromagnetism will show up a horizon of *cosmic order*, while that of the triality force only will be of *microscopic order*. Hence:

**“New Physics” will describe particles
and the cosmos by the same formula[s].**

But those differing orders of the individual horizons make us

observe our cosmos from its interior, an elementary particle, however, from outside!

Loosely speaking, we are calling everything which is much smaller than we ourselves are to be "microscopic", and everything which is much bigger to be "cosmic". (Comparable orders between both, then, are defined as "macroscopic".)

This will provide some entire spectrum of oscillator horizons for the 8 "internal" charges of New Physics. The electron example teaches us that we still have to specify the 3 classical charges – electric, "strong", and "weak" – with respect to the types electric (Q), triality-dependent (T), and leptonic (Lambda).

This in itself simple scheme is complicated by the presence of "massless" mediator particles, in addition (see above). Together with the former specification of "weak" interactions, experiment will yield the following differentiation of range horizons:

$$H_Q \gg H_T \gg H_\Lambda .$$

While the **electromagnetic horizon**, thus, will give rise to some cosmic order of magnitude, the **triality horizon** will provide the order of atomic nuclei; the **leptonic horizon**, then, will yield the radius of a lepto-nucleus. The combination of valence quanta of both horizons, Q and T, then, will describe ordinary chemistry (atomic nuclei surrounded by a cloud of electrons), while the two horizons on the right-hand side will describe "**weak**" interactions as redefined in the preceding chapter.

It would be still another challenge to check if the mass quotient electron/deuteron might be derived similarly. For, the isospin pair (proton-neutron) within the deuteron just is corresponding to the isospin pair of the leptonic quanta in the lepto-nucleus. (The discussion of neutrinos and their parities still will have to be postponed somewhat.)

It would still be another task to investigate **particle number N** and **lepton number L** (not to be confounded with the leptonic charge Λ !) in their roles as (presumably rather weak) *coupling constants*. Their influence probably will restrict itself to minor correction terms to the above 3 main actors. At least, experimental evidence, actually, would suggest it. The same applies to further 2 of those 8 “internal” charges we are attributing to the shell model or to the mass split by isospin mentioned already.

The horizons of the latter two “correction **charges A and M**” to the “strong” charge T could lie somewhere between those of Q and T. For, their theoretical values the “standard” model is providing (according to its “**quantum-chromo-dynamics**” QCD), in spite of all those mathematical tricks used there, in the experimental comparison, is reproducing rather rough data.

Finally, there still is left the “internal” charge #8, that “**exotic charge**”. As its name is telling us, already, its properties are somewhat “exotic” [1]. It is characterizing the force (predicted by “New Physics”) which has the smallest range. Its effective strength (inversely proportional to its horizon), thus, will be maximal. Hence, it cannot be balanced by any of the other forces any more. Its detailed discussion would lead us too far astray, here, however. –

But let me still add a few words to classical Yukawa and Coulomb potentials. Both of them are equally singular at their origins. Infinities, however, are the result of limiting processes within *continuous* numbers. Within a *finite* set of *discrete* numbers, such a limiting procedure cannot be constructed! Hence, in Quantum Gravity, there are **no singularities**.

In both cases, thus, there will be some (statistical) effect rounding up those potentials close to their origins. (Technically, it is realized by the non-commutativity of the 4 spacetime generators with each other.) Due to their differing ranges (microscopic vs. cosmic), this effect will hit considerably “earlier” in the short-range Yukawa case than in the long-range Coulomb case, however.

I used that fact in the rough sketches not to scale of preceding e-books (of 2016 and 2017), already, where both cases are compared in their effective non-classical forms. There, I did not point to that range difference in a sufficiently explicit way. Hence, the attentive reader might have been irritated a bit by my non-classical sketches of the Yukawa terms, as given there in their forms being rounded up instead of their classical, singular representations, which I had used on other occasions always. I apologize for it!

Interactions

The attentive reader should have noticed that the discussion on range horizons omitted gravity. The reason is that gravity, as an “internal” singlet force, is following rules differing from those the “internal” octet forces are subject to.

For the octet forces, opposite charges are attracting and equal ones are repelling each other. For the singlet gravity, the situation reverses. Exactly this has been *one* of the insurmountable obstacles prohibiting that gravity (spin 2) could be lumped together with the “internal” forces (spin 1). Formally, that absurd dogma of particle physics – that there should be 3 “quarks”, at most, which are “permitted” to join each other – presented an obstacle, already.

Contrary to repelling forces, attracting forces can form arbitrarily large conglomerates. That disastrous “dogma of 3”, for more than half a century, has prevented every trial, no matter how good its intention, to link gravity – and with it cosmology – to quantum models on an equal footing!

Implications of that dogma are reaching as far as to the *official* acceptance of the **Higgs mechanism** as a model for generating **mass** in particle physics. The maintenance of that 3-quark *dogma* has been considered as more important than seriously to search for an alternative source of mass – like that Quantum Gravity is offering that successfully. The origin of that mass “ban” can be traced back to the **Lagrange formalism** of classical physics of centuries long since gone.

From that continuous Lagrange formalism, the model of particle physics derives that the photon should be the source of electromagnetism in terms of a “**gauge boson**”, and *as such* it should be massless (gauge condition). When trying to transfer that gauge formalism from the massless photon to the “weak” W- and Z-bosons, people entangled in giant contradictions, because the W and Z are fitted with considerable mass values. Instead of adapting the model, people – again – just attached another “balcony” to their “standard” model.

This became the celebrated come-back of the Higgs mechanism. Like effectively all “balconies” of the “standard” model, this one again just served for a more or less successful “fit” of experimental data by trying locally to smooth the inconsistencies of previous balconies. Contrary to Quantum Gravity, however, the Higgs model did not contribute anything in favour of seriously “understanding” the physics behind it.

The mandatory conclusion remained undone, namely that there should be present some deeper level made of “quanta”. For, then, the entire house of cards called the “standard” model would have crashed down: People, then, should admit the existence of non-valence parts in the Interior of elementary particles, etc., etc. Briefly: People would have to invent Quantum Gravity another time. Progress is contradicting the conservation of traditions!

In Quantum Gravity, heavy mass is one of its standard (linear) quantum numbers. Therefore, an artificial “creation” of mass by some different procedure is not needed. An obscure

Higgs mechanism is suprtfluous!

Let us return to gravity, however. Contrary to the chiral forces, each of its individual quanta is contributing to its interaction – the non-valence quanta included, and not only that selected, small amount of quanta making up its valence part!

With an equal range, for gravity this requires some strength of force per quantum which should be a tiny share when compared to that of electromagnetism. (*An infinite range, here, will mean: the size of the quarter (of our universe accessible to us after the “big bang”, on our side of the event horizon .)*) Thus, we find:

$$G_{\text{grav.}} \ll g_{\text{chiral}} \cdot$$

For an exact calculation of the **gravitational constant** we still would need to know the conversion factor of cm (as its length unit) into the number of quanta making it up (see below). This, however, will be some *external* parameter fixed from outside our multiverse. Hence, we are obliged to rely on a measurement in order to fix it (**dependence on the experiment**).

The situation is different with the electromagnetic coupling constant (the "fine-structure constant") because it is composed of 2 factors: one of it is its probability amplitude the respective transition will proceed with (its "Clebsch-Gordon coefficient"), the other one is the inverse length of the principal axis of the ellipsoid of the "internal" 8 quantum numbers containing the measuring units chosen (possibly differently) on it.

With a normalization of its electromagnetic principal axis to be equal to 1, the value of the **fine-structure constant** will become predictable [1]; its theoretical deviation from experiment yields

$$\text{in a 1st approximation: } \frac{\alpha_{\text{theor.}}}{\alpha_{\text{exp.}}} \approx 0.08.$$

The fine-structure constant calculated by New Physics, thus, will deviate from its experimental value in its 1st-order approximation by less than 0.1 per cent! This calculation is based on its lepton structure containing a "strong" shell quant about its lepto-nucleus. In this approximation, the still finer dipole substructure of its lepto-nucleus is not yet taken into account; its influence remains reserved to the corrections to be made by higher approximations.

For a comparison: The "standard" model does not know any method in order to calculate absolute values of coupling constants!

The gravitational constant only appears to us to be extremely small because we are used to measure it in *cgs-units* (cm, g, sec) replacing its natural units "number of quanta". (The *experimental precision of lengths will yield a conversion factor of the order of at least 10^{24} quanta per cm.*)

Let us consider all quanta of a certain type to be lined up in equal distances one behind the other one. Then, according to the quantum type, this line will end at different horizon values depending on the type. When, now, compressing those differing lines to some common length, those differing horizon widths will transform to some lines differing in (reciprocal) density (i.e., potential).

In 3 dimensions, the Yukawa potential will transform to some narrow, central peak rapidly decreasing asymptotically. Its main part of quanta will concentrate in the immediate neighbourhood around that peak; further away of it, similar to the case of a Coulomb potential, we still are observing its asymptotic decrease, only.

Now, for the electric power, its reference value is the small number of electric charges in the valence part of a sample (electromagnetism as a member of an "internal" octet), that of gravity, however, the huge number of quanta both in the valence plus non-valence parts (gravity as a member of an "internal" singlet).

In order to become comparable with electromagnetism, let us in the case of gravity shift that huge number of quanta as some order of magnitude from the factor "mass" over to the factor "gravitation constant". Then, we definitely could obtain some corresponding, modified gravitational constant roughly of the order of magnitude being equal to the electromagnetic coupling constant. Last but not least, this would be a matter of experiment. (*In older articles I still had tried for a test to sum up the distance in the denominator of the force with the G-constant instead of using the particle masses.*)

By a theoretical point of view, this sounds well. For, it shows us that, with an appropriate choice of its scale, the gravitational strength might assume a considerable size, indeed. Thus – this is the topic "unifying all forces of nature" – it could well keep pace with those "internal" octet forces. –

With increasing mass, the whole system will be compressed to some kind of "**hard-core**" potential: All effects are concentrating directly on its centre; further out, (effectively) nothing will be felt any more (effect similar to that of a "delta function"). Last but not least, an extreme compression with hard-core repulsion would result in the **Pauli principle**.

The exchange particle then needed would be some vector boson like the photon, however as an "internal" singlet with spin 1, similar to the graviton representing an "internal" singlet with spin 2. By its extremely strong compression ("hard core"), it should be extremely massive, in addition. Hence, its impact, then, would reduce to a couple of immediately neighbouring quanta, only.

In order to become effective at all under those conditions, both interacting partners (particles) should show up an effectively identical micro-structure, i.e., both particles should be of exactly the same type in order to be able to overlap 1:1. In the experiment, Pauli's principle is acting among „identical“ particles, only, indeed, and strictly locally, in addition.

Let us denote that fictitious exchange boson an "omega-P", after Pauli. Then, we finally find:

An ω_p would satisfy the **Pauli principle**.

As a vector particle (spin 1), its force would result antisymmetrical, i.e., repulsive. Unfortunately, such a vector boson is unknown from experiment. That scarcely is surprising, however. For, even the graviton – the other "internal" singlet particle we are knowing – needed not less than 100 years until its experimental detection in 2015/2016! –

Now, with the Coulomb or Yukawa potential we are confronted with 2 kinds of unphysical singularities simultaneously: one in the potential at its limit "distance tending to zero" ("**infrared singularity**") and another one at its range horizon ("**ultraviolet singularity**").

Basically, we may state for all particles that, in the framework of New Physics, both types of **singularities** always will have to be of **recoverable** nature because of the principal finiteness of all its parameters. In order to circumvent those formal singularities in the unphysical model of classical continuum physics, we have to pass over to treating discrete series of quanta (cf. the end of the preceding chapter).

This allows us to ignore (“cut off”) everything beyond the “last” quantum in its outward direction, e.g. This will cancel the ultraviolet singularity – on principle, at least.

At the same time, due to the non-commensurability of the 4 spacetime components with each other, we have to apply statistical methods for a measurement. This needs applying the law of great numbers, according to which originally neighbouring measuring values will effectively come to overlap each other. Close to the centre of the force, that “overlap” of (a finite number of) distances means that those infrared singularities will dissolve into harmony, as well.

The electromagnetic case allows for avoiding both singularities by deriving its fine-structure constant directly out of its transition probability (its “Clebsch-Gordon coefficient”) in forward scattering. It is circumventing that problem; for, last but not least, it just is a matter of an unphysical detour by old continuum physics.

With gravity, however, this problem will hit another time. For – contrary to the electromagnetic case – there, the number of “gravitational charges” (i.e., of the number of quanta involved) is not known to us. Equally unknown to us is the exact symmetry content of the quanta inside a graviton. That, however, just will be a matter of time.

In order to calculate the fine-structure constant, we only needed that *particular* electron in the shell around its lepto-nucleus; there had not been any symmetry problem with respect to Young tableaux. Here, however, it (actually still) is impossible for us directly to calculate the corresponding transition probability (its “Clebsch-Gordon coefficient”) for the graviton, by the same procedure. –

Now, the multiplication of a single quantum ($N = +1/3$) with its antiquantum ($N = -1/3$) will give a 2-quant structure where all linear quantum numbers are neutralizing each other in pairs; the spin of the product, then, might be kept open as some mixture of spin 0 and 1.

Let us append this special 2-quant structure as some kind of “backpack” to some third quantum, and let us ensure by some appropriate superposition that the resulting total spin again is 1/2 pointing into the same direction as the original 3rd quantum did. Then, this 3-quant structure will be called a “**hadronic flavour**” in New Physics.

The most simple variant would be taking the “up” or “down” quanta the valence parts of nucleons are composed of, already. Due to their electric charges, the up-up variant would offer the stronger bond leading to a less heavy flavour than that of the down-down variant bound less stronger.

In nature, however, appropriate mixtures of both variants will be more realistic. Here, a symbolic pattern for demonstration:

$$\begin{array}{l}
 q^{(\text{up})} \rightarrow q^{(\text{up})} \left(q^{(\text{up})} \bar{q}^{(\text{up})} \right), \\
 q^{(\text{down})} \rightarrow q^{(\text{down})} \left(q^{(\text{up})} \bar{q}^{(\text{up})} \right).
 \end{array}$$

The 2 constructs on the right thus arising from the left-hand pair “up/up” could represent the pair (charm, strange), those from the left-hand pair “down/down” the pair (top, bottom).

This way, the simple substitution of a single valence quant by the above 3-quant structure will transform a neutron to a lambda resonance, e.g., or a proton to a lambda-c resonance. A pion would give rise to a kaon; etc. By substituting all 3 quanta of a delta-minus resonance correspondingly, we would obtain the 9-quant structure of the baryon resonance omega-minus. The hadronic **flavour**, as the sum resulting from all those “backpack” contributions, here, is **no** (conserved) **quantum number** – in accord with experiment!

We could show [1] that, even in “weak” interactions, all decay processes – no matter if of leptonic or of non-leptonic nature – are resulting without breaking any quantum number by this way of representation!

Weak interactions do not break *any* symmetry!

This fundamental result, however, is based on omitting that disastrous 3-quant law of the "standard" model!

As far as this will concern (ordinary) **parity**, let me point to the fact that it is no property of the Lorentz group $SO(1,3)$, as people like to circulate erroneously. Only in the frame of the conformal $SO(2,4)$, it allows for being represented by some rotation by 180° of some generator. In the Lorentz group it is just an arbitrary assumption! More exactly: There, it will altogether be defined 4 times separately, for each of the 3 quark generations and for the leptons independently of each other!

With respect to the 1-time definition in Quantum Gravity, this is hiding the risk that one and the same **parity** will be defined 4 times independently in an **inconsistent** way. And this proves to be true, indeed: In its transition to New Physics they will have to be redefined!

The traditional, classical definition of (ordinary) parity will fail by the balance between a real space reflection on the one hand and the unrealistic desire of a simultaneous parity neutrality of the non-valence part on the other hand.

In addition, the incommensurability of the parity operator with the Lorentz boost is disregarded in classical physics. People erroneously are postulating that an accelerated particle has the same parity it has at rest. On the other hand, by an acceleration, time will asymptotically transform to some state where time (parity plus) with space (parity minus) will mix in a 1:1 proportion!

By experiment, due to their missing mass, **neutrinos** always are moving at the speed of light. They are mixing their parities in a proportion of 1:1, indeed:

Not the **neutrinos** "are breaking" parity,
but their classical definition of parity does so!

The Arrow of Time

Suppose we get passed a bag of spinor components out of our dynamical group in 8×8 dimensions. How, then, would they organize themselves if being left on their own?

Now, a glance into the construction kit of chemistry having built our atmosphere made of oxygen and nitrogen demonstrates that those components, at least in their asymptotic equilibrium, last but not least, would come together in pairs in order to neutralize their bonds (molecular gases).

For our 64 types of Dirac spinor components this primarily means that they will couple to singlets in pairs whose components are neutralizing their "internal" properties completely. (Like any comparison, this one will "hobble" a bit, as well – but so what: The principle becomes clear!)

Only by secondary priority, then, pair constructions would add whose *weakest* bonds are *not* completely neutralized, i.e., still stay open ("simply ionized gases"). In New Physics, it will be just the *dynamic* $U(2,2)$ factor whose values are variable the easiest in experiment; the variation of "internal" quantum numbers will need much more effort – as far as, actually, it will not be technically impossible at all.

When leaving open the Dirac labels, with all "internal" labels neutralized, we are left with $4 \times 4 = 16$ components, altogether (in which the above singlet will – indirectly – be contained, already). Provided we had chosen one of these spinors as an "input" and the other one as an "output" in these 16 component types, then this construction just would have given the 16 generators of Quantum Gravity!

This way, however, with these two equal (input) spinors, we just are confronted with the formal bricks of dark matter (type B):

Dark matter (of type B), formally, is composed of 16 types of double-quanta.

For – like type A of dark matter – they are exactly satisfying the astronomical definition of **dark matter**:

1. **Their (2-quant) structure is gravitationally active.**
2. **Their double-quanta are not really localizable.**

Point 2 follows from the fact that, for measuring the spacetime position of a state, the law of great numbers will have to be applied; the number of 2 quanta, however, is not “great” enough in that statistical sense! (In a statistical approach, the 4 components of Einstein’s spacetime X are commensurable only macroscopically – not, however, microscopically. In the absence of correlation, those individual double-quanta are not even macroscopically commensurable, but roughly on a cosmic level, at most.)

Remark: Those double-quanta are **pure valence parts**; no non-valence structure is present, there:

(In type B, too) **dark matter will not consist of elementary particles (“Wimps”)!**

Now, those 2-quant bricks of dark matter are fitted with rather similar properties as those the bilinear generators are. The essential difference is that their generators are building a “**Lie algebra**”, i.e., some closed system, while the bricks of dark matter are subject to some sort of a spin-addition mechanism (“reduction” according to irreducible states), i.e., they are orienting themselves more according to the laws of an open system.

When adding up both types to a common operation, then both properties, that of a closed system (like thermodynamic reversibility, e.g.) and those of an open system (showing up its typical, statistical **irreversibility**), are interrelating with each other. According to which of both opposite properties are dominating, this section of nature will appear to us as reversible or irreversible, respectively.

This way, the laws of nature will appear to us **microscopically reversible**, but **macroscopically irreversible** in their temporal process.

This apparent contradiction will be easily resolved: In the microscopic range, the reversibility of the generators will prevail. Only with accumulating time periods, we increasingly are feeling the growing influence of cosmic expansion according to which the size of our universe is accreting step by step: **We hear the clock ticking!** (Evidence of the cosmic expansion from time slice to time slice as components of a *static* multiverse!)

This accretion from slice to slice can be formally justified by the world formula of our static multiverse as some process of third and fourth order incorporating more and more matter created by the internal conversion of orbital angular momentum into heavy mass on the slices in consideration.

Formally, this gross conversion also might be imagined to be divided into a series of small individual steps. Then we arrive at our above quantum pairs which, by the addition theorem of group theory, one by one are docking at the matter present already in terms of additionally created matter and spacetime. This incorporation by group-theoretical “**reduction**” processes, however, is irreversible: Hence, the “**arrow of time**” just will point into the direction of cosmic expansion; it cannot be reversed into the opposite direction!

The temporal flow of a process which, on the microscopic level, still is reversible, by accumulating time periods will become more and more irreversible. But then – we could argue immediately – our behaviour into those 3 directions of space should be irreversible, as well: we should not be able to walk the same way there and back according to the same procedures!

On principle, this is correct. The reason why we do not observe it immediately is buried in our measuring units. For, with the speed of light, $c=1$, we obtain the conversion

$$1 \text{ sec} = 3 \times 10^{10} \text{ cm.}$$

A second, hence, in space will correspond to a distance of the order earth/moon! Hence, due to its cosmic expansion, we are recognizing the **irreversibility of space** only with larger distances.

Let me mention that even the irreversibility of time does *not* start *abruptly*, at a certain time difference; it is building up in a slowly accreting process. Exactly this is the procedure with space, too.

The two types of arrows are assigning some path out of those 4 dimensions into some fifth dimension. In the vivid example two dimensions less – for our world as the surface of some inflated balloon – such an arrow will point into its radial direction, i.e., perpendicularly out of our world!

In our conformal $SO(2,4)$, as a “rotation” within its (5,4)-level, the arrow of time and, as a triplet of “rotations” within the three levels (x,4), the arrow of space will point perpendicularly out of their 4-dimensional **Lorentz world**, which is acting on the directions 1,2,3,5 only, into the direction 4 characterizing CMS-spacetime Q.

An “**x-arrow**”, thus, is a “boost”, i.e., a “rotation” (x,4) perpendicularly out of the classical world of the 4 dimensions $x = 1,2,3,5$ of Einstein’s relativity theories into some 5-dimensional **deSitter world** 1,2,3,4,5! The “arrow” we are observing in experiment is a **projection** of the 5-dimensional arrow (x,4) into our 4-dimensional world (x).

Einstein’s General Relativity could not recognize it at all, because, by his differential geometry in those only 4 dimensions of his spacetime X, the boss dogmatically had excluded the access to deSitter’s world of 5 dimensions by stubbornly insisting on his “background independence” within those only four dimensions.

Remember, however, that those “arrows” are reversing at the event horizon and at the big bang: In the interior of a black hole or within the range *before* the big bang, from our perspective, these arrows are pointing into the opposite directions. Only inside that region where both facts are meeting each other, “ordinary” conditions will re-establish themselves.

Principles

As mentioned in the beginning of the preceding chapter, already, New Physics does not start from the knowledge on an all-embracing world but is pragmatically limiting itself to some relatively small amount of 14 principles whose logical consequences we might hope with some chance of success still to be able to specify within some foreseeable future by experiment.

Thus, we do not demand that the events happening around us somehow are based on **abstract symmetries**, which we cannot substantiate. Our focus rather is of **deductive** nature. Our 8 starting **principles** ("axioms" + implications), thus, are:

- 1) We cannot count up to infinity. All our models, hence, will require **finiteness** – provided we intend to "understand" them, in addition.
- 2) Therefore, our procedure strictly will have not to be continuous: the **world** around us, basically, is **atomistic**.
- 3) "Great numbers" following from it will impose **statistical methods** on us, in addition.
- 4) *Mathematics*, then, is telling us that there will be **dimensions** (implying **field theories**) being some power of 8.
- 5) According to the actual state of experimental art, there is no evidence that those **8**2 dimensions** (the 8 of Quantum Gravity times those 8 "internal" ones) will have to be overridden.
- 6) By *mathematics*, the existence of a dimension greater than 1 necessarily requires that data might be **incommensurable**, as well (**quantum theories**).
- 7) Non-**reproducible** results are not subject to physics; there are **conservation laws**.
- 8) We name those 8x8 reproducible basic components "quanta".

The following axioms and implications, here, turned out to be of a special significance:

- 9) For the 64 types of quanta, a “representation” will imply the existence of certain **occupation numbers** of their components.
- 10) Primarily, 2 types of representations will exist: a unitary **U(64)** in the **reaction channel** and a finite-dimensional pseudo-unitary **U(32,32)** in the **dynamic channel**.
- 11) Both channels will form individual series of “universes” which as components, up to their differing metrics, will sum up to give the identical “multiverse” (which is a common, finite-dimensional representation).
- 12) The inverse occupation numbers of their quantum type is a measure for the **coupling strength** of the respective force type within our “multiverse”.

In the transition from the reaction channel to the dynamic channel, there will arise density variations in the arrangement of states in parameter space (i.e., in the multiverse).

- 13) In the dynamic channel, the density of states is interpreted as its “**potential**”, its gradient as a “**force**”.

From the unrestricted conservation of all quanta we find:

**All coupling constants are invariable
across the entire multiverse.**

I did not yet explicitly address the fact that the 64 occupation numbers will lead to some highly complex product in the interior of our multiverse. Its reduction by group theory will yield a huge number of autonomous subrepresentations. All of them, of course, will have to stay compatible with the embedding multiverse. Below that threshold, however, according to Young, they will develop a variety of *differing symmetry types*:

- 14) A particle having some fixed valence structure will show up quite different manifestations of its **non-valence part** in our universe (i.e., of spacetime, energy-momentum, etc.).

The investigation and classification of those non-valence types belongs to the actually still big future tasks in the framework of New Physics. However, it cannot be executed *within any acceptable period of time* in terms of some 1-man project – even more so if that man soon will exceed the age limit of 80 years. Remember the giant effort made by 10.000's of physicists now working for half a century on those "strings" and "branes", having started in the 1970's, already – without obtaining any result of physical relevance, by the way, purely for the garbage!

But let us return to the **measuring units**. There do not only exist 8 coupling constants for the 8 chiral components – there still is a hierarchy of "measuring units" within the 8 dimensions of Quantum Gravity, as well. Provided we disregard the disharmony between the vertical direction compared with the 2 horizontal directions on the surface of the earth, the 3 space directions 1,2,3 of the conformal group are looking as if they are locally exchangeable. Actually, the 3 measuring units (cm) are assumed to be identical.

The time direction 5, however, clearly is different from them by its relativistic measuring factor c of the speed of light. Even more massively, that situation will get worse with direction 6 of energy-momentum and 4 of CMS-spacetime, where group contractions are touching, already. Both directions, however, still are admitting some reasonable management within this frame.

Casually speaking, it will become "narrow" with the experimental modification of those additional parameters like particle number, while the number of quanta, as a constant of our multi-verse, will stay absolutely conserved. (*Mathematicians should be careful, however: Particle number and energy are assigned cross-wise in both channels!*)

When assuming as a criterion for a measuring unit how easy or difficult it is to alter a quantum number in an experiment, then we find that the course of an electron can be influenced more easily by means of a magnet than that some object can be accelerated purely by mechanics. In daily life, thus, on the sector of "internal" quantum numbers we are working with measuring units different from those resulting from the occupation numbers of quantum types.

The configuration of the 64 quantum types used for **constructing particles** partially is different from that we are deriving the force types from. The exact *criteria* of their experimental reconfiguration, actually, (still) are “not understood” (but cf. the end of the next chapter); however, we (approximately) know their *result* [1]. Anyway, they are arising from each other by some unitary rotation of the 8 chiral dimensions of their “internal” quantum numbers, i.e., by some (linear)

redagonalisation of quanta.

Immediately after Gell-Mann had invented his quark model, people already had stumbled upon the fact that a meson made of 2 “quarks” carrying spin $1/2$, each, could yield a maximal spin 1 only; that unfortunate “**3-quark dogma**” prevented the docking of additional quark pairs. This way, the spectrum of elementary particles with their higher spin values we are coming across in nature was not reproducible.

As an escape, hence, people originally jammed additional Pauli matrices between those 2-dimensional Weyl spinors: their label, formally, added another spin 1 to the spin given by the spinor pair. (*Ironically, in that moment, they had not really been conscious of the fact that, by group theory, those 4 Pauli matrices had been representing just those 1+3 combinations of two additional spin= $1/2$ quanta making up a spin 0 and 1, respectively!*)

The same, then, had been achieved in 4 dimensions by introducing those 4 “gamma matrices” used in Dirac’s equation. As that additional spin generated by those matrices was integer, people named it “**orbital angular momentum**”.

Then they found that the identical result could be obtained even “more elegantly” by applying *continuous* derivatives from functional analysis instead of applying *discrete* matrices from group theory. From this time on, their more abstract, glassy-eyed, new terminology was: those spinors are subject to some “**non-local**” coupling.

Thus, instead of simply multiplying additional “quark” pairs, people preferred to apply cumbersome, abstract continuum models, which, last but not least, amounted to gloomy conspiracy theories à la Higgs, hence ignoring the proper issue.

The above **non-valence part** of a state is intervening even deeper into those many-quant structures. Here, all “internal” quantum numbers will have to saturate each other by definition, already. In order not to generate new valence parts, this “internal” saturation will have to take place pairwise between 2 Dirac spinors already, with their Dirac labels staying open. Like in dark matter type B, this will yield $4 \times 4 = 16$ variants – “per chiral quantum pair”, however, i.e., without *summing up* all labels of our “internal U(8)”.

The rest is a product made of “internally” saturated pair quanta – more precisely: of a superposition of such products – taking into account, however, that they have to subject themselves to the total symmetry characterizing the particle. Their Dirac labels, then, will show up spin pairs carrying spin 0 and/or 1, each.

By applying the 4 generators of spacetime, the structure of the U(32,32) state, then, will be essentially conserved – only its Dirac components will add or subtract the number 1 to or from their previous values, respectively. Those tiny changes will be negligible in the frame of a **statistical approximation**, however, provided it is proceeding according to the **law of great numbers**.

In the frame of this approximation, some superposition of new states is generated whose individual components should statistically be contained in the original state, as well. The minimal change, then, will be their mutual weighting factors. By construction (law of great numbers), their deviations should be negligible, however. In this approximation, the result, then, will effectively be the old state with numerical factors corresponding to the static values of the 4 spacetime components.

Corresponding results, then, will apply to all the other generators of our conformal SU(2,2), as well. Technically, thus, our effort will reduce to constructing appropriate initial states, only. As everything will remain finite, some **numerical error-and-trial procedure** on the Computer offers.

This offering shift of the problem over to the computer also would remove that somewhat fiddly handling with Young symmetries, which easily can be programmed on a computer, as well . –

Genesis

Similarly as in a pool game, let us assume the scattering or decay process of precursor multiverses to be responsible for the birthing act of our multiverse. At its creation, individual quanta the billiard balls are composed of still are buzzing around in confusion. As a result of some primary arrangement (cf. above) we expect an "atmosphere" consisting of those 16 types of dark matter (of type B). But first of all, let me mention that, in analogy to the red box below the above point 13, all quanta will be individually conserved, i.e.,

in a multiverse, **dark matter** (of type B)
is a **conserved quantity**.

For, neither can new matter of this "dark" species be created any more, nor can a stock existing already disappear – except into a black hole; but then its missing amount would have to be looked up there. The creation process of dark matter (of type B) will stop when for the first 8 "internal" types of quanta there are no more dynamic spinor components available any more in order still to construct additional Dirac *pairs* of the respective "internal" type. (Every "internal" type is comprised of 4 Dirac components.)

Afterwards, the subsequent creation of "internal" *singlets* does not succeed any more. But additional pairs of quanta *saturated* "internally" on a linear base still might be created out of those remaining $64-4 = 60$ types of quanta – as long until those remaining pairing capacities needed for it are running out, too.

Finally, only more sophisticated residual structures composed of the remaining quanta still will survive. Meteorologists would consider them as some variety of "condensation germs". For, in comparison with chemistry, those saturated pairs not containing "internal" singlets, in the $U(8)$ -space of "internal" quantum numbers are acting like water molecules we are used to observe in the atmosphere: Like some sort of individual "dipoles", they are predestined weakly to dock to those more complex "condensation germs".

Last but not least, we obtain some cloud of dark matter, with **elementary particles** condensing out like raindrops, each of which consisting of a condensation germ as its **valence part** and a great number of pair quanta all of which together are making up its **non-valence part**. (*The non-valence part of an elementary particle, hence, still is composed of maximally 60 of the original 64 types of quanta, only. This means some subsequent*

projection from 64 onto 60 dimensions.

(*By calculating the fine-structure constant, this had been respected already.*)

As a consequence, now, at its thermodynamic equilibrium state, which depends on the valence parts and on the component of the multiverse selected, a certain motion and binding pattern will arise. On a statistical average, the heavy-mass values of elementary particles based on those still 60 types of quanta, thus, will deliver their **rest masses**. Deviating “**virtual**” masses, on both sides of the event horizon will tend towards this rest system.

Now, by definition, the rarest of the “internal” quantum numbers are those of the “exotic” type. After cancelling 4 of its 8 dynamic dimensions, we are left with the other 4 components. In order to have the *classical* guarantee never to “turn back” those 4 cancelled components, that particle must be a massless fermion and the cancelled 4 components must belong to its antiparticle.

Hence, necessarily

there must be some exotic type of neutrino

In analogy to the lepto-nucleus of weak interactions, its valence quanta will have to harbour some “**exo-nucleus**”. Its triality values, however, are different from those of the lepto-nucleus; an **exo-neutrino** is constructed in a way differing from the 3 “ordinary” neutrinos. But I do not want to expand that topic at this place, here.

Those missing 4 of the 64 original types of quanta are splitting off the type B of dark matter from "visible" matter, i.e., they will become irrelevant with respect to their chiral structure. Hence, the relevant occupation numbers of all types of quanta will decrease by those numbers which are absorbed in the dark matter of type B already; half of the 8 exotic types, thus, are switched to zero!

In order that the "internal" dark-matter singlets (type B) stay stable, the original 64 occupation numbers should not diverge too much from each other but be of some "comparable" order. By this assumption, after summing up the dark matter of type A, in addition, we find:

Share of **dark matter** >
share of **ordinary matter**.

Our expectation, then, will be that these reduced occupation numbers after this subtraction process will show up considerable differences. By the point #12 of our principles, these **diminished occupation numbers** will have to be applied for calculating coupling strengths; only they will yield our correct oscillator horizons!

Nevertheless, those dark-matter bricks of type B also will contribute a certain balance to the non-valence parts of ordinary matter to some minor extent. (In chemistry, compare the inclusion of noble gases in crystals, e.g.)

Corresponding remarks will apply to the pair bricks of non-valence parts with respect to valence parts. Within those additive superposition components, only non-valence and valence parts both together as a unit are "**irreducible**" in a mathematical sense!

As far as particles may be considered as "stable" at all (cf. above), we conclude from the number 64 of original quantum types:

There are exactly **64 stable states**.

16 of them are making up dark matter of type B. The rest is 48. Subtract those $4 \times 4 = 16$ massless states from them:

electron-neutrino	photon
one exo-neutrino	graviton

Each of these 4 particle types carries $4=2 \times 2$ components. One of those doublings has its origin in the energy sign and the other one in the "**helicities**" (spin projection onto the running direction). Neutrinos are coupling their helicity change to a particle-antiparticle transition.

The remaining $48-16 = 32$ states still to be identified might form 4 Dirac spinors + their antispinors. We already know half of them, indeed: these are the pairs electron-positron and proton-antiproton. Due to balancing all quantum types, the 2 Dirac pairs left, then, should contain an open leptonic and an open exotic charge, respectively:

electron	one leptonic spinor
proton	one exotic spinor

The 2 open charge types on the right-hand side would make the related particles extremely heavy. Thus, we hardly may expect to detect them experimentally any time soon. Hence, all particle states outside these two blue boxes should be unstable and, last but not least, decay into these 48 particle or antiparticle states marked above.

Especially, this also applies to the neutrinos observed already. But not in the sense of that "**neutrino oscillation**" [1] observed in experiment already, which is working into both directions, but in the catalytic sense of a thermodynamic scattering process changing the symmetry of how the lepto-nucleus is bound to ordinary matter. This is something more for the specialist, however.

The above ansatz of 16 massive leptonic- and exotic-spinor states is tentative. Some or all of them could be replaced by additional massless fermions (“neutrinos”) or even by adequate massive and/or massless mesons; this problem still needs some deeper research.

Especially, those 4 exotic types of quanta left over by the dark-matter construction, which are unable to build up additional dark matter, will somehow have to saturate their exotic charges, too. A part of them can do so by ducking in exo-nuclei. The rest, however, must be compensated elsewhere.

The easiest way would be to combine them with leptonic quanta. Such a combination of n exotic with m leptonic charges, weighted by (plus/minus) their coupling constants, could yield some new, adequate, “emergent” **quantum number “U”**. For $U=0$ such combinations could penetrate all range horizons.

This special combination U will fix some rigid ratio of n to m giving rise to some novel super-structure in New Physics not yet considered before. With m being much greater than n , both numbers are not of comparable size. When taking it as a component of some much bigger representation, we automatically will be confronted with some novel “**hypersymmetry**”. As the other components are not present in nature, this hyper-“symmetry” will be badly “broken”, i.e., it is defective. Nevertheless, it will give rise to some additional classification scheme.

Corresponding triple constructs could be built up by still mixing in triality components. Its third weighting factor, then, even will result far greater than those n and m . By still adding lepto- and/or exo-nuclei, we obtain “**monster**” **representations** with participating numbers of quanta exceeding all imaginations, comparable only with those numbers of atoms managed in solid-state physics.

It seems obvious to expect such extremely rare, super-dense candidates to populate the centres of exotic star types, ready to trigger their gravitational collapse when appropriate density shocks are hitting, there.

The problem indicated might be solved by re-diagonalizing those quanta *depending on their occupation numbers* (!) in a way that there are no quanta left still to be saturated afterwards, i.e., in a way that all charges left open are mutually saturating according to the examples of a leptonucleus and an exonucleus, already.

As a perspective, this problem of saturating the exotic charges left over from the creation of dark matter (type B) could stimulate ideas in order to understand that “re-diagonalization” mentioned in the preceding chapter in a “reversed” way.

Conclusion

Einstein neglected to decompose “his” world into its irreducible components. Theorists of cosmology, hence, failed by their lack of understanding group theory. Particle theorists, on the other hand, failed by their arrogance not to confess and remove their (“quick and dirty”) dogmas once passed and spread much too hastily.

Cosmologists and particle physicists are getting high on the success of their experimentalists at observatories and laboratories. At the same time, however, indifferent elites are starving out the theoretical base justifying their own existence as “scientists”. Like in high-level politics, that unhealthy conflict between power and lack of understanding only can end up in the disaster of a dictatorship.

Scientists still capable to contribute valuable progress in order really to understand nature are muzzled by extraneous formalities preventing their active access to the journals, while those big names of established authorities and sponsors are pretending to have all the truth of the world in their palms. A scientist brooding over his problems all on his own, i.e., the motor of all *long-term* progress, cf. Einstein, lags behind, is discredited, mobbed.

Authorities are conjuring up some Quantum Gravity “to come”, which in its basic guidelines does exist long since. Nobody is willing to accept that Bell’s no-go theorem is leading to nowhere when applied incorrectly! ... that all those fine wave theories merely are representing purely classical tinkering on continuum physics outdated by Planck already. Theory simply missed the change towards the 21st century.

No, it is not *canonical* quantization to set up the base of understanding the world we are living in. That old model just is bobbing up and down at the surface of some vector formalism not really understood in Einstein’s 4 dimensions. But space and time are no passive objects (vector components) which are subject to something. No, they are *actors* (operators, matrices in at least 4x4 dimensions) acting on their own account, driving change – cf. Dark Energy or those 2 kinds of Dark Matter, e.g.

By Quantum Gravity it is evident that even the most primitive technical requirements are not given in nature in order to apply Emmy Noether's theorem: Neither space and momentum nor time and energy are canonically conjugates of each other! Like the Lagrangian formalism, Noether's theorem should have been stored in a museum of prehistory long since, as well! All those beautiful "symmetries" are not found in nature.

My e-book series significantly is reflecting the progressive state of knowledge in Quantum Gravity and New Physics. By the turn of 2013/14 ("New Physics" [2]), the quantization of Einstein's *bent* spacetime still had been dominant – beside some general introduction into this "New Physics". In 2014/15 ("Flow of time" [3]) my focus had shifted more towards the background logics of the arrow of time: What is motion within a static world? Why does time run at all?

Quantum Gravity and New Physics are concluding the circle reaching from the smallest to the largest structures in nature. What remains is the 2-channel principle of thermodynamics: The open system of the dynamic channel is obtained by incorporating more and more "quantum pairs" into the closed system of the reaction channel.

But how do you intend to explore the nature of mass without understanding the coexistence nor the mere existence of these *two types of channels*, without understanding why there is an event horizon separating 2 *equivalent* pieces of our world, why a black hole does *not* contain any singularity? The event horizon as a formal barrier between our immediate environment and another partial world of tachionic particles moving faster than light, where spacetime is becoming energy-momentum and v.v. Briefly: Without having understood the 8-dimensionality of our environment, nothing really will work reliably!

Forget about that Higgs mechanism just trying to override the existence of some huge *non-valence part* in the interior of every elementary particle – a taboo for both "standard" models, but an actual hotspot in New Physics not yet worked out *in detail*.

The structure of non-valence parts in particles is not yet thought over to its end; its explicit construction still is waiting for its detailed specification. It is one of the big, open numerical challenges to New Physics. Its *starting point* could be the totally symmetric case.

Last but not least, it will depend on the external occupation numbers of the individual $8 \times 8 = 64$ types of quanta attributed to our multiverse. A huge number of explicit solutions are waiting. Some of them will be reserved for those mass-zero mesons like the photon or the graviton, not to forget others reserved to be responsible for the neutrinos. Its major part, however, will be reserved for quite ordinary particles and resonances carrying mass.

The theory of fundamental physics is withering away under the dictate of lobbyists in the ivory-tower of one of the last strongholds of the stubborn Middle Ages before Enlightenment 2.0. Imploringly they are clutching at straws, at the curious waste of continuum physics out of date, raping mathematics. They still continue ignoring the signs of the times according to which that classic infinitesimal calculus of past centuries long since has exceeded its zenith.

Undeniably but anyway not taken seriously, novel mathematics is paving its way into physics. Actually, Einstein's and Schrödinger's all-too-familiar, exhausted continuum methods are not asked for any more; those "discrete" activities by Planck, Young, deSitter, and Heisenberg are it, instead – not, however, in yesterday's ridiculous chain of absurd string-brane structures of pure, roundabout esotericism far from physics.

A new age needs new methods. He who does not realize it is beyond help. My textbook ("ToE; ..." [1a]) of 2016 is compiling the essential traits of this kind of mathematics. And my guideline ("Where Einstein had failed" [1b]), in 2017, is relentlessly putting its finger on the latent wound of the official "standard" models, especially on those wrong applications of Bell's no-go theorem. The present e-book, finally, is summarizing the logical principles leading to New Physics once more, pointing to its options of immediate progress.

The crux is that the laws of physics, actually, are not transparently *derived* according to scientific criteria any more, but passed in camera “*as a law*” and enforced ex officio as the alleged “mainstream” according to juridical ways inside lonely ivory towers of crafty institutions. Our task will be systematically to weed out dogmatism of such untenable methods based on metaphysics.

Why don't we follow Rousseau, the great philosopher of Enlightenment: **“Let us make use of our intellect!”**

In ancient times documented natural sciences once begun in terms of Greek philosophies. Later on, the early Islam, when ruling over the Moorish Spain and over the Mogul dynasties of India, took up these ideas. From there, they re-entered Europe where they started flourishing by the age of Enlightenment during the Renaissance epoch.

A spiritual counter development arose during the Roman Empire, when its rulers just lived for the sake of *one* god: corruption! It reached its acme by the inquisition on behalf of the popes and by the subjection of South America. Actual lobbycracies are pointing into the same mafia direction: Enlightenment good bye!

At least on the theoretical side of fundamental physics, this era of a liberal community of independent spirits ended by the 1930s. By the exodus of science towards Northern America the way of thinking has been capitalizing as well. The new motto became: maximal success by minimal expenditure. Nothing went properly being thought through any more; superficiality prevailed.

Irresponsibly hasty specifications began shaping literature more and more. Chances are not given any more to the person who has to demonstrate something but, as an end to itself, to those having the most powerful lobby – i.e., to the institutions and bureaucracies yet highly rewarded, but not especially involved in the actual subject itself.

Publications as mere counting objects for the “ranking” of institutions, combined with ivory-towered assumptions insufficiently reflected (like the dogmatic overemphasis of a free will, e.g.), are ruling official literature.

Non-reproducibility is the hallmark of scientific indoctrination, however! Just a reminder – we cannot repeat it often enough: The main criteria for understanding the world around us are:

- **reproducibility,**
- **finiteness,**
- **normalizable statistics.**

Every violation is doomed to failure!

During the last 100 years, the *theory* of fundamental physics has managed it to create a climate of aversion to call a spade a spade. “Irreducibility” in field theories is a good example. Einstein’s differential geometry in 4 dimensions totally suppressed the fact that Dirac’s 4 dimensions are of complex nature. When rewriting them in a conformal way, we get 6 fundamental dimensions.

Einstein had overlooked 2 of those 6 dimensions which are giving CMS-spacetime and energy-momentum, respectively. Only these additional 2 dimensions are demonstrating where cosmic expansion is expanding to at all. Only they are explaining the nature of Dark Energy and Dark Matter.

Instead, conspiracy theories are propagated which are contradicting logics and even mathematics. No surprise, hence, that heavy mass, which is connecting those 2 additional dimensions with each other, thus, developed to an enigmatic feature in classical physics.

Parities, then, are marking the 2 types of horizons given by charge conjugation and time reversal, respectively, which, in the dynamic channel, are characterizing those $2 \times 2 = 4$ sheets of our world. By their missing 2nd time-like dimension, Lagrange models are revealing not to be an adequate means of representation, and by their missing $(6+6=)$ 12th dimension, string-brane models with their just 11 dimensions cannot succeed, either – not to mention their half-baked management of the “internal” parameters, in addition.

If anybody still should have doubts on New Physics, its successful derivation of the fine-structure constant should be cause enough for concern; for, (together with the mass quotient electron/proton) it usually serves as one of the rhetoric criteria in favour of an ultimate theory.

The Author

Born in 1939 in Berlin/Germany. Sports, gossip, small talk, and the brainwashing by discos and game-apps always had been a horror to me. Thus, there had been sufficient time left for veritable challenges.

During my school time already, I had followed first problems on the field of comparative linguistics, which, during my subsequent study of physics (*theory of elementary particles*), focused on problems about a common ancestor language of the Indo-European and the Chinese languages. (*Examples and the sound-shift rules are published as an e-book in 2015.*)



Up to new horizons!

The challenge of fundamental physics consisted in the Faustian demand “to find out what is keeping our world together in its interior“, briefly: in the unification of Einstein’s *General Relativity* with Planck’s world of quanta (“*Quantum Gravity*“).

It is obvious that a simple diploma thesis could *not* cover all that. Nor did I accomplish this sophisticated target during my long-term activity as a scientific assistant after that graduation. In those times, however, I had come rather close to it, already.

After the “golden” 1960s with their enthusiastic consolidation of the quark model, the “Standard” Model with its inconsistencies and string models had been ringing in the creeping descent of the theory section of fundamental physics still lasting until nowadays. I myself had been personally condemned to experience that depressing fate in the situation of a university assistant.

Still as a student, I had got furious about that wobbly house of cards theoretical physics seemed to be founded upon, the way it had been presented in lectures and seminars. Especially with quantum theory, it was shocking how badly even professors appeared to have got behind its physical base when the students were kept diverted from the real problems of *physics* by long-winded *mathematical* formalisms.

After the expiration of my last contract at university, I went to industry. In the branch of software development (*main frame*), I acquired knowledge in project management. That software, however, had been boring me to death. When approaching to my state of retirement, I seized the opportunity gradually to return to my old ideas. My break-through succeeded.

My visits at conferences on particle physics attested me again: In my field of interest, the state still was the same as at the end of my time as an assistant many decades ago, I had not missed anything – only, at that turn of the millennium, string-brane fans were occupying and blocking (*almost*) all resources of particle physics. *Novel* insights: negative. During the boom at the experimental side of fundamental physics and astronomy, theory had been rotating at full speed, too – since half a century, however, just by idling about in a non-ending loop.

C. Birkholz.

References

In official literature we often read much rhetoric about **Quantum Gravity** and **New Physics**. In reality, however, they do not exist, there – not even in terms of an ansatz. “Loop Quantum Gravity” just is borrowing its name; in fact, it has no relation to some real “Quantum Gravity”: It still is based on Schrödinger’s age-old dead end of a canonical quantization.

Actually, the only texts which seriously are addressing Quantum Gravity, GUT, ToE, and the New Physics resulting from them, without just beating about the bush, are chronologically collected in the internet under www.q-grav.com, open for everybody. As e-books they are at disposal with the customary distributors.

The present article of 2018 is slightly more current than the “textbook” and the “guidelines” mentioned there, both of 2016:

[1a] “ToE; New Physics explaining our world by Quantum Gravity. World’s first textbook on QG” (2016). e-book. ISBN 978-3-7396-3009-0.

[1b] “Where Einstein had failed. A compendium of New Physics (2016). e-book. ISBN 978-3-7396-9183-1.

As suggested by their titles, both e-books of 2018 are presenting the logics of previous e-books released by the same publisher and refining that of the textbook (2017). Their English titles are:

[2] “New Physics, *Dawn of Cognition*” (2013),

[3] “Flow of Time, *Quantum Gravity giving New Physics*” (2014).

(Interim report: Sales figures of these **e-books** within the first 4 years from the end of 2013 to 2017, in German and in English: more than 64.000 copies.)

Impressum

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This is the English translation of a German e-book dated 2018 by the publisher BookRix, Munch/Germany.

ISBN 978-3-7438-4841-2.

Its German original "Quantengravitation. *Logik der Neuen Physik*" carries the same date.

ISBN 978-3-7438-4840-5.