

Claus Birkholz

Flow of Time

Quantum Gravity giving New Physics

Fundamental Physics Report

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Preface

My original intention had been to face the striking success of my “New Physics – Dawn of Cognition” by publishing just a second, extended edition. Then, however, I felt that priorities had shifted that drastically meanwhile that a more specific title seemed to be more adequate.

Nevertheless, the main body of this book will effectively be identical with the old one. The philosophical input situation, however, changed dramatically, still becoming even deeper intelligible. Again, it is the English translation of a research report in German language on the common foundations of particle physics and cosmology, together with their consistent unification to a “Quantum Gravity“ and to a „Grand Unification Theory” (GUT).

This edition, again, in parts, is an extract – here and there: word for word – out of a more technical report (‘Die “Weltformel” (2013)/‘The “World Formula”’) of the same author (www.q-grav.com - Summary View). But it is an extended update edition.

In characteristic parts, where that report would have asked too much of the rapid reader, this extract is paying more tribute to the requirements of a popular-science presentation. All the same, the author’s endeavour had been not to drop the technical context completely – at least, it will survive in terms of commentary headwords and special boxes.

The main report, ‘The “World Formula”’, is based on the author’s lectures given at diverse universities, starting in 2011 in the frame of the annual DPG (Deutsche Physikalische Gesellschaft) spring conferences in their sections T (particle physics), GR (gravity and relativity), MP (the mathematical foundations of physics) and AGPhil (working group on the philosophy of physics). Its numerous manuscripts (predominantly written in English) are found in the internet as well, see www.q-grav.com - Lecture Notes. Their “Abstracts” are published, in addition, under Verhandl. DPG (VI), starting with volume 46 (2011), see www.dpg-physik.de.

At their appointed dates, these lectures represented the

actualized research states on a unified field theory as originally registered in terms of the author's preliminary German print-book 'Weltbild nach Vereinheitlichung aller Kräfte der Natur im 3. Jahrtausend' (2010), registered under the ISBN 978-3-00-030847-6. By such punctually anticipated representations I checked that the statements made are not lively fantasy "beyond" whatsoever but fully in accord with (present-day) experiment.

The Old Physics at Its End

This is a story deeply splitting the community of physicists into opponent camps. With his “World Formula”, Einstein once had coined a notion which now stands for failed trials to include electromagnetism into his 1915 concept of General Relativity, which is the geometrization of gravity.

Meanwhile, the number of forces has increased by still adding nuclear forces. It turned out that the dynamics of all those “internal” forces in addition to gravity can be roughly described by Schrödinger’s wave mechanics, which is a particular aspect of quantum theory.

The (“chiral”) interactions of those “internal” nuclear forces seem to follow comparable (“gauge”) structures, too – although, in terms of the “Standard Model”, those (gauge) structures are not well understood until to-day, as far as their abstract origins are concerned.

And quantum theory – the other component of modern physics – is based on Planck’s discovery in 1900 that nature does not behave in a continuous way but is showing up in discrete steps. This, however, is a stringent consequence of physical statements in order to be verifiable by measurements.

For, due to its limited span of life, a living organism like a human cannot count up to infinity. Hence, infinities are unphysical, i.e., not measurable; everything must stay finite in physics. Even an elementary particle cannot be accelerated beyond all bounds, its energy must remain delimited.

As a non-rational, “continuous” number only can be reproduced by an infinite series of rational numbers (decimal digits, e.g.), non-rational numbers are not denumerable, either. Rational numbers, however, are countable. Hence, fundamental physics will have to deal with finite sets of rational numbers only, and not with their limiting values, either.

In consideration of its continuous treatment of space and time, classical physics – including Einstein’s General Relativity – in this

sense is “unphysical”, too. Thus, it necessarily will have to be “discretised”, or “quantized”, which is the modern way of formulating it.

Only, since one century, gravity, i.e., Einstein’s General Relativity, stubbornly refused to “cooperate” with Planck’s quantum theory – and, v.v.: those “internal” forces denied any cooperation with General Relativity, likewise.

The action of General Relativity is best visualized by the well-known, familiar model of a flat rubber membrane stretching itself horizontally. An object deposited on its surface, by its weight and by the elasticity of the membrane will give rise to some downward depression, there. By this depression, a small marble, then, kicked (in a non-centric way) towards that object will be deviated from its straight run such as if that object and the marble are attracting each other.

The reason for this strange behaviour is traced back to geometry, i.e., to that depression in the membrane. The formerly flat plane, now, is not any more flat but bent downwards in the region where the object is located. Mathematicians are attributing such a surface curvature to some “non-linear” condition, as they call it. (For, “linear” equations are exclusively describing straight lines and flat planes.)

Special Relativity is a subset of General Relativity, acting in flat space-time only. Physically, it is neglecting the acceleration created by mass attraction. This acceleration, however, just is the crucial result of a (here: gravitational) force. Thus, Special Relativity is dropping forces.

On the other hand, the current theories of elementary particles – i.e., the “quantum field theories” – are exclusively working with Special Relativity only. And no successful trial is officially known proving that they are tolerating their extension to General Relativity, while, equally, the (official) theory of gravity does not show up to tolerate wave mechanics, i.e., the superposition principle of waves. This is another indication of Einstein’s General Relativity apparently not to be consistent with Planck’s quantization concept. Schrödinger’s wave mechanics is a derivation of.

Briefly, nobody yet is (officially) acknowledged to have combined Planck's quantum theory with Einstein's General Relativity in a consistent way.

By interpreting a linear superposition as a contradiction to a non-linear surface, small-minded contemporaries even are trying to persuade us that a unification of Einstein with Planck should be principally impossible. (However, they are comparing "apples with pears".)

This (false) conclusion is symptomatic. For, we just realized that Special Relativity is cancelling forces. And particle physicists, instead of letting themselves be guided by General-Relativistic ideas, are continuously inventing a wealth of substituting strategies in order to describe interaction forces by circumventing General Relativity.

V.v., a much more promising access would be to extend General Relativity in order to include the "internal" forces, in addition. This, however, is Einstein's old idea of a "World Formula" which, then, should be excavated – although, due to its well documented failures in the past, this access had to bear a heavy loss of reputation since.

After the detection of nuclear forces, Einstein's notion of a "World Formula" even had become somewhat ambiguous. On the one hand, it would have to include the consistent combination of Planck's quantum theory with Einstein's General Relativity. This, actually, is attributed to a "Quantum Gravity" still to be constructed.

On the other hand, it would have to include the unification of all "internal" forces with each other and with gravity to a "Grand Unification (Theory)" (GUT) of all forces of nature. (The string models are calling it a "Theory of Everything (ToE)".)

Our so called "Standard Models", however, (that of particles and that of cosmology) are far from covering any of those targets.

"String/brane" models are digging even deeper into that dead end of physics because they have taken over crucial parts of those bad features of the aged quantum field theories – let me just mention the "variation principle" (Leibnitz, Bernouilli, 400 years ago) with its "path integrals" and "Lagrangians", e.g.

The New Physics

Theoretical physics is the mapping of (parts of) nature into mathematics. Current “string theories” do not care about nature; hence, string theories cannot be considered any more to belong to the category of “natural” sciences. Even to their protagonists it is unclear what at all they are mapping into mathematics.

String models do not try to reproduce nature, but they are hoping, the other way round, that, in nature, there are existing structures – still to be uncovered – which are corresponding to their models. This cross-over method “beyond the Standard Model” of not asking theory to reproduce nature but of nature to follow theory, still might keep them busy for another couple of hundreds of years more to come.

Hence, let us follow another line of argumentation. As we cannot count up to infinity, a measurement can reproduce a result at most up to the accuracy of some rational number. The total of all our measuring results, then, must be some finite set of rational numbers. This demands physical models of nature basically to be of an atomistic structure, i.e., “quantized”, in order to stay measurable; and measurability is the key property of physics. Let us designate their “atoms”, here, as “quanta”. By the huge number of quanta available in our universe, most of their structure only can be covered by statistical methods.

In mathematics, an atomistic structure is dealt with by combinatorics, and statistics is dealt with by the theory of probability. The combination of combinatorics with probability is “group theory”. A typical example of group theory is the property of a “spin” – that “intrinsic” angular momentum where nothing is rotating.

For the majority of physicists, group theory has remained a complete mystery. Even Einstein did not care about it; his General Relativity does not take it into account, spin is foreign to General Relativity. Schrödinger scornfully renamed it “group pestilence”, and Pauli jumped onto that trend.

On the other hand, we shall observe that this underestimated discipline of mathematics widely swept under the carpet so long just is representing the “missing link” between Planck and Einstein; still during the course of the actual century, it might take over the leading position in fundamental physics.

Creation and Destruction Revisited

The first ingredient of a “group theory” is combinatorics. Combinatorics alone, without adding a concept of probability, is giving rise to discrete symmetries, which, in physics, found their application to crystal lattices, e.g.

Let us number (equal types of) atoms in a crystal. When subjecting them to some “transformation” (a rotation, a reflection, or whatsoever) after which every (such) atom of this crystal is moved from its original position to the former position of one of the other atoms (or even to its own former position) without leaving any position empty or doubling it, the crystal under consideration does not change its form – although particular atoms (or even all of them) do change their positions (in a 1:1 way).

A discrete transposition of an atom from a former position r' to a final position r'' , as effected by some transformation A , can be expressed as well by first deleting it at its former position r' , followed by recreating it at its final position r'' :

$$A_{r''r'} \equiv a_{r''}^+ a_{r'}^- .$$

Those secondary operators “ a ” with the upper plus and minus signs are called “creation operator” and “destruction operator”, respectively. (The transposition matrix A collecting all their pair combinations like the one shown above, then, is defining its “adjoint representation”.) Special linear combinations of these elements of the matrix A which the mathematicians are calling “permutations”, in physics are better known as “generators”: In physics, usually,

A permutation is a “generator”.

Let me stress, however: These permutations, usually, are no real options but pure “thought experiments” in order to visualize the (crystal-like) ordering structures we find in nature!

Now, actual fundamental physics does not yet officially realize

that modern physics is more than warming up some classical principles of centuries gone by which merely are extending some classical formalism of functional analysis once learnt at school. Not just a couple of additional parameters has to be introduced. No, those principles have to be adjusted instead of fitting just some additional ad-hoc parameters as the “Standard Models” are practising it!

The traditional formalism of the “Standard Models” is it to integrate a generator G over some pathway. This pathway could happen to end at another lattice position allowed for the transposed atom. Usually, however, it might end up at any position between such allowed positions. Hitting an “allowed” position will lead to some respective “eigenvalue” condition.

Such an intermediate “position”, however, does not indicate the end of a “pathway” in the sense of classical physics but a mixture of “neighbouring” permutations inside the crystal; and the larger that mixing parameter, the larger the “neighbourhood” effectively involved. Here, the probability aspect of “quantum” physics is entering in terms of apparently “intermediate” positions “smeared out” over neighbouring states pretending some statistical “interpolation”.

Why are there Dimensions, Why Forces?

We have seen that physics demands some concept of probability on an atomistic model, and we designated those “atoms” as “quanta”. When introducing parameters in terms of labels, we are defining “classes” (i.e., components, dimensions) of those quanta. But how many classes (dimensions) might be there?

Now, for normalization reasons, probability needs a division operator. Then, however, number theory is teaching us that the highest dimension of a field of numbers tolerating a division operator is 8. (For comparison remember that the complex plane is a 2-dimensional field $x = a+ib$ of r -numbers a and b .) The mathematicians named those 8-dimensional numbers “octonions”.

For the physicist, this means that he has to split the running label n counting our quanta ($n = 1, \dots, N$) into a pair of labels: $n - (r;x)$ – with its first part r denoting the class (r from 1 to 8) and another part x designating its remaining rest of individuality. And this procedure may be repeated:

$$n - r;x - r,s;y - r,s,t;z - \dots$$

The labels x,y,z, \dots designating the remaining rest of individuality, which is not subject to measurements, usually will be dropped. Hence, from statistics – together with number theory – we derive that nature should manifest itself in terms (of powers) of 8 dimensions. And experiment shows that powers higher than 2, actually (!), are not needed. For the actual state of the art, thus, the dimension of our world is fixed to be $8 \times 8 = 64$.

Now, the first factor 8 will be identified to reproduce Quantum Gravity, the second factor 8 the “internal” forces, and both together the Grand Unification Theory (GUT)! But let us proceed step by step.

For non-mathematicians, octonion arithmetic looks rather strange. The actual state of the art with respect to fundamental physics, however, does not need its sophisticated multiplication rules. We only need that octonions occur in 8 dimensions.

Compare it with the chemical elements phosphor and oxygen: When put together, they immediately will catch fire. When safely bottled, however, each of them in its own bottle, then they can be stored peacefully side by side and nothing will happen.

Consider our actual access to fundamental physics as treating octonions in a bottle, with their glass walls, i.e., with our actual mathematics, shielding us from their aggressive multiplication rules. But we do observe that there are 8 different types of “bottles”, and we take this multiplicity into account. If you like, consider it as some first approximation to a physics to be developed in a future lying far ahead.

To cut it short: Dimensions are the result of probability to be normalizable – especially the 4-dimensionality of space-time – while forces will show up as the necessary result of permutations, i.e., as effects of statistics (probability) on specific types of permutations. The following chapters are giving details.

Quantum Gravity

The above first factor 8, an octet of eight dimensions, in quantum field theories had been identified to provide Dirac's four "covariant" plus his four "contravariant" dimensions. For a preview: Our 4-dimensionality of space and time will derive from that. Thus, the 4-dimensionality of space-time (and of energy-momentum) is an output feature of Quantum Gravity, based on probability. For all other models – Einstein's General Relativity included – it still is an external input feature of unknown origin!

When setting both 4-tuples on a common base (as opposite variances of some common substructure), then we already obtain a consistent Quantum Gravity, the fully quantized version of Einstein's General Relativity, on a fully quantized bent space-time.

Emerging in a mathematically closed form (i.e., not just as some approximation but in an exact form), in Einstein's terminology, it proves to be fully "background-independent" – i.e., all physics is staying inside the above "membrane", unable to leave its bent surface. Thus, this Quantum Gravity has taken the great hurdle no model before, after Einstein, has been able to jump over. ("Loop Quantum Gravity" is not fully quantized!)

Its separation of the two types ("co-" and "contravariant") of dimensions in its $4+4 = 8$ -dimensional version demonstrates that, contrary to the situation in the current models of quantum field theory, no quant is getting lost (as it is standard with the "commutators" of "2nd quantization" in the "Standard Model") and no quant is falling from heaven (giving "vacuum polarization"). Thus, in Quantum Gravity, a vacuum remains empty, indeed!

In Quantum Gravity, the four non-linear space-time components are simple quotients of generating operators with the generator of heavy mass as their common divisor:

$$x_{\mu} = \frac{Q_{\mu}}{M_0}$$

Quantum Gravity is the only (field-theoretic) model having dug out this almost trivial relation physicists even before Einstein and Planck already had been well familiar with. (That $Q = MX$ is the additive CMS-space-time, where CMS stands for “Centre of Mass System”.)

Remark for mathematicians:
 This quotient, of course, will have to be evaluated for X_μ in the implicit form

$$M_0 X_\mu M_0 = \frac{1}{2} [M_0, Q_\mu]_+.$$

Modern models – like that of “Loop Quantum Theory” and other models – which are poor trials of approximating just partial structure components of a veritable Quantum Gravity, not even are scraping at its surface. After considerable computer time in grand style, they are making up a fuss about having found some approximate, qualitative evidence that a Big Bang might not be singular. – So what: Quantum Gravity is reproducing this result without any effort, exactly, quantitatively, and in a mathematically closed form.

When considering this heavy mass as a constant, then space-time together with energy-momentum is reproducing Heisenberg’s uncertainty relation. The special mathematics behind that combination (i.e., the “commutator” of space-time with energy-momentum) is defining the “canonical” quantization of good old quantum mechanics – originally once some relic of the ancient variation calculus.

However, when considering heavy mass as an operator as it is, there will result additional terms proportional to some (squared) length. This length reveals itself to be the radius of the Big Bang region. (In Quantum Gravity, the “Big Bang” is extended, it is no point singularity any more.) And these additional terms just are reproducing the behaviour of Dark Energy. Thus, by inserting the experimental Dark Energy data, we are measuring the Big Bang radius of our universe.

In Quantum Gravity, an elementary particle is following the same

equations as our universe as a whole. The difference is its point of observation: a particle is observed from outside, our universe from inside. A particle, hence, is appearing “small” to us, its reactions are fast, at most too fast in order to be registered in all details by experiment.

On the other extreme, our universe is appearing “huge” to us, its variations, usually, are that slow that they hardly are observable, either. The connection of both realms by Quantum Gravity, hence, is offering us the opportunity to study particle reactions in slow motion and the evolution of our universe in time-lapse.

Quantum Gravity does not only reproduce Dark Energy, but also cosmic inflation. And Hubble’s law is derived as some internal detail of Einstein’s cosmological constant artificially split off from it. The latter is shown to correspond to the (inverse) “propagator” of particle physics, where the partition between (squared) heavy mass and Einstein’s constant is a matter of definition because, for experimental verification, at the time being, only their sum is measured.

The Physics of Actions

Classical physics – Einstein’s classical version of General Relativity included – is the physics of numbers. Quantum physics, however, is the physics of actions. What is the difference?

For real or complex numbers, their ordering within a sum or within a product is irrelevant: $a+b = b+a$ and $axb = bxa$. Mathematicians say: they are “commuting” with each other, they are “commensurable”. For actions, the situation is different: they might either commute or not. For an example, let me define two special actions:

- A) Ask a pedestrian the way,**
- B) This pedestrian is overrun by a car.**

In the case BA (mathematicians are reading that from right to left), I could succeed in obtaining the answer because that individual is overrun only subsequently: B is after A. In the inverse case AB, however, that individual is overrun (B) before I had asked my question (A). Then, my chance for getting an answer all the same, will be rather delimited.

The compound reaction AB, thus, will not necessarily be identical with BA. Their degree of conformity is measured by their difference $AB-BA$, which is the “(minus-)commutator” of A with B. For commuting actions ($AB=BA$), this commutator is vanishing.

In mathematics, an “action” is represented by an “operator” or, what is the same, by a “transformation”. But let me state a warning: Not every abstract “transformation” formulated by mathematicians also will be a physically executable “action” as well!

On the contrary: The overwhelming multitude of all “actions” defined by mathematicians are not physically executable actions from a state X to a state Y, but just are serving as a sample for a physical comparison(!) of a state X with a state Y. Time increase is an example where two distinguishable states – a starting state and an

end state – are compared with each other, without a physically executable procedure (except just waiting) existing which might “perform” such a transformation there and back.

The mathematical background is the following: Contrary to the situation in classical physics, the permutations, i.e., the small, finite number of “generators”, are representing the fundament of physics – and not their integrated transformations containing those additional, continuous path parameters not even observed by experiment!

The problem in classical physics is: To which of our 8 “dimensions” shall we assign its r -number pathway parameters? If just admitting the 2 dimensions of a complex plane – as it is custom in classical physics – we always have the choice between the r -numbers on the real axis and those on the imaginary axis of its complex plane.

In the “Standard Model”, people had the alternative either to fix their decision for the real or for the imaginary axis, and that for every parameter separately. Thus, classical physics decided to assign different types of axes for the 3 space parameters on the one hand, and for the time parameter on the other hand. This had been leading Einstein to the Lorentz transformations of Special Relativity.

All that, however, is the result of interpreting artificial “pathway” parameters which are not even all “observable” in experiment, because their generators are not commensurable! Quantum Gravity is free of such pre-settings. In Quantum Gravity, there are both opposing types of systems potentially present simultaneously, which are acting on the identical physical base of “generators” (admitting a complex Lie algebra). These two systems are, e.g.:

- a (“unitary”) **reaction channel**, opposed to
- a (“pseudo-unitary”) **dynamic channel**.

The reaction channel, which is conserving probability, simply is ignored in conventional physics. This will drop fundamental properties of physics! This is one of the reasons why the “Standard Model” has to work with coupling constants (and form factors)

whose values cannot be calculated from theory but are accessible only by experiment. (For, in the pseudo-unitary dynamic channel, there is no “positive-definite norm” in order to conserve probability.)

In Quantum Gravity, the parallel use of both channels is no problem. When dropping the variation principle that characteristic for the “Standard Model”, a view of operators similar to Heisenberg’s is easily managing that job for both systems.

For a better understanding, let me give an example in classical argumentation. Say, the parameters s and t of a state are lying on a circle:

$$s^2 + t^2 = C = \text{const.}$$

The same equation can be rewritten in a hyperbolic form as

$$s^2 - t'^2 = C, \text{ with } t' \equiv it,$$

When measuring s in “cm” and t' in “sec”, some appropriate normalization might give “1 sec = i cm” where “ i ” is the imaginary unit. Direct measurements, however, are counting r -numbers only – the “ i ” is theory (like any equation). In order to formally support the explicit disappearance of such i -values, “metric” tensors had been introduced into theory contracting the “ i ” of a “ket” vector with that of a “bra” vector to a (squared) common factor “ -1 ”.

Now, we should expect that the equation of a hyperbola will cover value ranges (s,t) different from those of a circle. This assumes that the hyperbola will run to infinity, indeed. Infinities, however, are unphysical. On the other hand, there are numerous examples in particle physics giving “finite-dimensional” pseudo-unitary representations of the non-compact Lorentz group of Special Relativity, indeed.

Mutual non-commutativity is the driving force of a perpetual “redagonalization” between two systems to and fro. The 400 years old variation calculus is an unnecessary, drastic limitation for a modern approach to physics. The (“unitary”) reaction channel is defining its physical base – while its (“pseudo-unitary”) dynamic

channel is acting as some overlay structure. However, I do not want to waste too much time for details.

Let me recapitulate a remark *for readers with mathematical interests*: “Action” and “generator” are in the relation of an exponential function vs. (part of its) logarithm:

$$A = \exp [i\zeta G] \Leftrightarrow \zeta G = \frac{1}{i} \lg A .$$

In the (unitary) reaction channel, the action A can be rewritten as a sum of two trigonometric functions:

$$\exp [i\zeta G] = \cos (\zeta G) + i \sin (\zeta G) .$$

And a trigonometric function is periodic.

In the (pseudo-unitary) dynamic channel, a non-compact action by $G \rightarrow -iG$, however, is rewritten as a sum of two hyperbolic functions:

$$\exp [\zeta G] = \cosh (\zeta G) + \sinh (\zeta G) .$$

They are not periodic.

Now, in the reaction channel, the running parameter, usually, will be the *bounded* eigenvalue of A; in the dynamic channel, however, the *unbounded* parameter ζ is preferred, instead.

Traditionally, Dirac’s creation and destruction operators are not applied consistently. Originally, the destruction operator on the bra-hand side of an internal product once served as a technical tool for counting corresponding creation operators on the ket-hand side, only; equal counts on both sides were to contribute to the product, differing counts did not.

Destruction operators, thus, served for decomposing a composed structure on the bra-hand side into „*contravariant*“ factors, and creation operators did that job for the ket side into „*covariant*“ factors. Within each side, the order of factors, then, had been arbitrary (symmetry types found their expressions exclusively in index combinations) – the multiplication rules of group theory (some generalized „*spin-addition theorem*“) had to be observed. The subsequent admission of creation operators on the bra side and of destruction operators on the ket side, then, gave rise to a certain

insecurity with those rules, however.

For a quick and dirty "escape strategy", non-mathematicians went creating their own, badly "simplified" "mathematics". That „commutator“ logic ("2nd quantization", "normal ordering"), however, provided an arbitrary, highly inconsistent result ending up with representing the source of the actual chaos and non-comprehension in fundamental physics.

For guaranteeing the conservation of probability, the mathematicians are teaching us, a transformation should be "unitary", in addition. Hence, the reaction channel is describing some "closed system" conserving probability, while the dynamic channel is describing some "open system" where probability is not guaranteed.

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It is the interplay between a "naked" generator on the one hand and the integrated "action" with its arbitrariness and multivalentness on the other hand which is preventing even experienced, callous physicists of reputation from really "understanding" the rules of quantum mechanics.

It is that simple, however: The generators are containing all "fundamental" physics. We are measuring final results ("eigenvalues"), and not intermediate "pathways"! Those integration pathways included in the "actions", however, are representing additional trimmings of mathematics, i.e., arbitrary settings which have not been subjects ("eigenvalues") of experimental verification. Full stop!

The dilemma of current physics is that people are mixing up both aspects. Issues of pure mathematics (statistics) are misinterpreted as physics. All is cooked up to a thermodynamic, tough pulp. Mathematical formalisms having nothing to do with physics, finally, are taken for physics, ending up with the "Standard Model" or even with the string models. Beware of restarting that game!

(The reader should not be troubled by "imaginary eigenvalues": r-numbered ones just are the result of "Hermitean" operators – and "Hermitecity" is a matter of definition.)

Now, What Really Is Space and Time?

There are subsets of the generators of Quantum Gravity which are identical in both channels – in the reaction and in the dynamic channel. These are their common generators which the “Standard Model” would call “compact” if it would know them as operators. A still smaller subset of them, up to some r -number factors, even is leaving the state unchanged which they are acting on.

These r -numbers are their “measuring values”, and their generators are called “diagonal”. (This denotation offers if such a generator is written down as some matrix acting on a state vector.) Another word for these “measuring values” is “quantum numbers”.

Technically, such a (linear) “diagonal generator” just is counting the number of certain types of quanta the physical (product) state is consisting of, and the different (linear) quantum numbers of one and the same state are distinguishing themselves by the types of quanta they are adding up with a positive sign and those to be added up with a negative sign.

Hence, up to some arbitrary unit factor like “1 cm times 1 gram” or similar constructs arising from some arbitrary normalization, these “quantum numbers” should be multiples of some integer numbers. (In the case of a “spin” value, that normalization, usually, is arbitrarily separating another factor $1/2$ off that value, and in the case of a particle number or of a charge, people often like to split off a factor $1/3$, instead.)

As a result, the statement is: Up to (arbitrarily chosen) normalization factors and up to relative signs, there are 4 “diagonal” linear quantum numbers:

- 1) **particle number**,
- 2) **energy**,
- 3) **CMS-space** (3-component),
- 4) **spin** (3-component)

They are counting the 4 types of quanta a physical state is consisting of in the framework of 4-dimensional Quantum Gravity.

For the special *reader interested in mathematics*, these 4 generators (in Dirac's terminology, with Pauli's matrices σ_μ) are given by

- 1) $L_0 \equiv \frac{1}{2}(a^+ \sigma_0 a^- - b^- \sigma_0 b^+),$
- 2) $P'_0 \equiv \frac{1}{2}(a^+ \sigma_0 a^- + b^- \sigma_0 b^+),$
- 3) $Q'_3 \equiv \frac{1}{2}(a^+ \sigma_3 a^- + b^- \sigma_3 b^+),$
- 4) $L_3 \equiv \frac{1}{2}(a^+ \sigma_3 a^- - b^- \sigma_3 b^+).$

While we have the cgs system of units in traditional physics, in Quantum Gravity all measuring units are reduced to multiples of the number 1, instead, which are representing four “counts” of its $4+4 = 8$ types of quanta.

In its C(enter of)M(ass)S(ystem) frame, space Q' is an additive quantity like energy and momentum. Its non-additivity in the X -frame is due to the division of Q' by heavy mass, there, as given two chapters back already. Dirac himself once had managed the pseudo-unitarity of his dynamic channel by exchanging the creation and destruction aspect in 2 of his 4 components:

$$\begin{aligned} a_{2+i}^+ &\rightarrow -ib_i^-, \\ a_{2+i}^- &\rightarrow -ib_i^+. \end{aligned}$$

And, in order to generate physical transformations, Dirac himself used only $2 \times 3 = 6$ of the 16 (“gamma”-)matrices of his “Dirac algebra”. By this artificial self-limitation – let me anticipate some later results – he only succeeded in generating the Special-Relativistic (“covering group” of) Lorentz transformations in his “ $SL(2,c)$ ” form containing just “spin” and the “Lorentz boosters”. This, however, merely is representing a small section out of our total “ $U(2,2)$ ” version of (the covering group of) General Relativity:

$$SL(2,c)_{\text{Lorentz}} \subset U(2,2)_{\text{QG}}.$$

The full “ $U(2,2)$ ” of Quantum Gravity in its 4-dimensional version, then, still is adding the remainder of dynamics like heavy mass, e.g.,

3-momentum, and

CMS-time:

$$Q'_0 \equiv \frac{1}{2}(a^+ \sigma_0 b^+ + b^- \sigma_0 a^-).$$

Now, according to group theory, the a 's and b 's still are keeping their original creation and destruction characters, i.e., the b 's with the upper plus still are destruction operators, and the b 's with the upper minus still are creation operators. Their range of application, thus, still is that of a finite-dimensional pseudo-unitary group.

In Dirac's formalism, however, the creation/destruction aspects of the b 's are inverted! As a result, the above CMS-time operator does not conserve the total sum of all quanta any more, but its first term is increasing that sum by two units with every application, and the other term is decreasing it by two units.

Altogether, a physical state consisting of n quanta by a single application of the (CMS-)time generator will be transformed to a superposition of states containing $(n+2)$ and $(n-2)$ quanta, respectively, by the next application to a superposition of $(n+4)$, n , and $(n-4)$ quanta, etc. The summation up to an exponential function, in its "Taylor expansion", finally, will yield a state containing an infinite number of quanta – more than there are in the entire universe! Infinities, however, are unphysical. The "Standard Model", hence, is unphysical, too.

The poor excuse of the Dirac fans runs: "Mathematics requires that a unitary representation of a non-compact operator (here: time) must be infinite-dimensional." Well, but then it does not describe physics any more! Nevertheless, when inspecting the physical content of the above (CMS-)time operator and comparing it with that of our diagonal (CMS-)space operator treated before, we observe that the non-diagonal time does not reproduce the state it is applied to but is fanning it out, becoming an ever wider superposition structure.

(In the reaction channel, a non-diagonal generator could be diagonalized because the cosine will periodically pass through zero. This option, however, cannot be copied to the hyperbolic cosh and

sinh; for, the cosh never will vanish!)

Thus, by the above expansion, the application of the

Law of Great Numbers

will be indispensable where, to some extent, $(n+2)$ will approximately become equivalent to n .

As, in daily life, time looks diagonal, indeed, this means that the physically quantized state in question, even generally must consist (!) of some sufficiently “great” number of quanta. This is indirectly leading us to the general experimental evidence of a

*Sublevel of “quanta”
existing far below the level of quarks!*

Beside the few quanta representing its valence part, hence, an elementary particle necessarily still will have to harbour a “great” number of quanta making up its

non-valence-structure.

Contrary to the case in a traditional quantum field theory, a consideration of time as some masked version of a reaction channel generator would not give rise to a treatment of time essentially different from that of space. (This is the working mode of “Loop Quantum Gravity”).

Only the acknowledgement that time – beside its trivial role as a parametrizer (of some part) of the space-time manifold in the reaction channel – still is playing a second, more important role in the open, dynamic channel will justify its special meaning in physics, which is worrying even philosophers as well.

This special treatment essentially is that mystery why in the macroscopic world the time arrow always is pointing into the same (forward) direction and never backwards. Thermodynamic entropy arguments are not helpful either as long as changes in entropy cannot be founded solidly. Those arguments still missing, however,

will be prepared up to the chapter “The Flow of Time, the Time Arrow”. Let us continue there.

Here just that: Time is playing a double role, 1) as a generator made of a “rising” and a “lowering” operator, in the reaction channel, 2) as a tensor subjected to the rules of “Young’s tensor multiplication” (= the extended “spin-addition theorem”) in the dynamic channel.

Heavy mass is a non-compact generator, too. Hence, the same argumentation as for time will hold. By dividing CMS-space by heavy mass we obtain space in its “ordinary” X-form. Hence, contrary to Q-space, all 4 components of X-space will show up a similar, non-linear behaviour as time.

This non-valence part comprising some large number of quanta also is solving the old problem why a single “particle” behind a grid yields an interference pattern. And the “mystery” of Schrödinger’s “wave mechanics” for a single particle resolves as a simple application of mechanical statistics on its individual quanta.

For the “compact” operators of the reaction channel, as far as they are “diagonal”, there still is existing another way of interpretation, namely that of an elementary composition of their properties. Thus, the energy operator is collecting its total energy by summing up elementary “energy quanta”, and the 3-component of (CMS-)space is summing up its “total space” out of myriads of little “pieces of space”, etc.

It is this simplicity of physical argumentation – not of calculation! – which is distinguishing good physics from painstaking alibi compilations of pure diligence and mathematical skills like the “Standard Models” or the string/brane models.

The “World Formula”

When adding the probability aspect to our “generators” (“permutations”), people are used to integrate them up to “actions” (in the sense of functional analysis). This will supplement additional “integration pathways” in terms of continuous “angles” or “displacements”, etc. In traditional physics, up to numerical factors, those “generators” – the other way round – are defined as the logarithms of (some characterizing set of) basic actions.

For non-mathematicians, all this might sound rather abstract. But be sure: for mathematicians, this is mere routine. The advantage of such a procedure of preferring a generator treatment to sophisticated “actions” is that the “multiplication” of actions (their subsequent execution) is reduced to the more simple addition and subtraction of a handful of transparent standard operators, i.e., of those “generators”. Those continuous “angles”, etc., are unphysical, of course! I mentioned this already.

In its 4-dimensional subform, Quantum Gravity is based on the following set of $4 \times 4 = 16$ “dynamic” generators:

L_0	: particle number,
L_i	: spin (3 components),
M_0	: heavy mass,
M_i	: Lorentz booster (3 components),
P_0	: energy,
P_i	: momentum (3 components),
Q_0	: CMS-time,
Q_i	: CMS-space (3 components).

CMS-space-time Q' is additive (i.e., “linear”). After division by heavy mass, the resulting, ordinary, bent Einstein space-time X is not additive any more (it is “non-linear”, then). This situation reminds us of the additive energy-momentum, which – after being divided by heavy mass – is converting to the non-additive velocity.

In order to realize why this Einsteinian space-time is not flat but

bent, indeed, we again have to make another excursion to group theory:

The above 16 generators are defining a group of actions which the mathematicians are classifying as a $U(2,2)$, where the “U” stands for “unitary” (or “pseudo-unitary”) – whatever this might mean for the moment. And the numbers behind are designating the dimension of that group – in our case, here, $2+2=4$.

The reason why this dimension is split into two entries is that two of them are behaving like a time component and the other two like space components. Due to that fact, the group is renamed to be a “pseudo”-unitary one. (Mathematically, just a couple of “metric”-signs are switching over from positive to negative values.)

Now, particle number allows to be separated off; the remaining 15 generators still are defining a (sub)group, in this case an $SU(2,2)$, where the “S” stands for “special”. Up to “topological” properties, this “special-unitary” subform $SU(2,2)$, however, can be shown to have the same properties which another type of groups, an $SO(2,4)$, is sharing.

“O” stands for “orthogonal”, i.e., an $SO(2,4)$ is representing an ordinary group of rotations in 2 temporal plus 4 spatial directions, giving a total of 6 dimensions. (A “rotation” in a plane spanned by 1 time plus 1 space component is a “Lorentz-boost” generating the Lorentz transformation of Special Relativity.) An $SO(2,4)$, by the way, also is known under the name of a “conformal” group.

For the variation principle it is lethal that the conformal group $SO(2,4)$ is equipped with 2 time directions: For, the existence of exactly 1 time direction is its working condition; with a second time, its entire concept (of a “canonical conjugation”) will collapse. With respect to good old Quantum Mechanics a la Schrödinger and the “Standard Model”, which both are based on the variation principle, this is delivering the death-blow – just one of a long series of death-blows; for, the “Standard Model”, by its creation history, is an over and over inconsistent construction in itself.

Be aware of not mixing up the orthogonal 4-dimensionality of space-time as some $SO(1,3)$ -substructure of the conformal $SO(2,4)$ with the unitary 4-dimensionality of our $SU(2,2)$! The equality of

both dimension numbers is by chance only. Nevertheless, the unitary 4-dimensionality happens to give rise to the orthogonal 4-dimensionality of space-time, too, as demonstrated above.

Our main goal, however, has been to write down the “World Formula” Einstein never had managed to find because he did not care about group theory. Our second goal has been to show why the resulting space-time is not flat but bent. The tablet for doing so is almost prepared. We just still need the notion of a “Casimir operator”.

“Creation” and “destruction” operators had been introduced by re-interpreting transpositions A (cf. some chapters back). Among the products of those transpositions A , there are some of them the mathematicians are calling “invariant” ones. The reader does not need their explicit forms – but only that, except one of them, all are non-linear.

For the *reader interested in mathematics*:

Casimir operator: $A_a^b A_b^c \dots A_y^z A_z^a$

summed over all pairwise equal labels.

For a basic “unitary” or “pseudo-unitary” group, Casimirs have the additional property that the number of independent group “invariants” to be constructed like that out of generators is equal to the dimension of that [pseudo-]unitary group.

Of all those invariants, the set with the lowest numbers of factors is used to define their Casimir operators. They are numbered by their number of factors. Those numbers are varying from 1 up to the (unitary) dimension number. The 1st-order Casimir, thus, is the linear one; for our dynamic $U(2,2)$, it is proportional to the generator of particle number.

In a “special” unitary or pseudo-unitary group, this 1st-order Casimir is dropped. The remaining Casimirs are equal to those of the original, non-special group.

Unitary and pseudo-unitary groups are characterized by the values of their Casimir operators. The components of such a group

can be characterized as well by series of the Casimirs of appropriate subgroups. Different values of Casimirs are leading to different representations or, at least, to different components. Hence, physics itself is characterized by the values of the Casimirs needed. They are our (primary) constants of nature.

Thus, Einstein's "World Formula" must read

$$\text{Casimir} = \text{const.}$$

valid for all Casimirs needed. In Quantum Gravity (and in its GUT-extension), this formula is replacing the Lagrange formalism of the "Standard Model". The advantage is that those Casimirs, in the reaction channel, do allow the calculation of all coupling constants (and form factors) as functions of "Clebsch-Gordon-coefficients", which in Lagrange models are to be inserted as external inputs.

Thus, the predictive power of Quantum Gravity (and its GUT-extension) is much stronger than that of the "Standard Model" – and even mathematically consistent! While the "Standard Model" is constructed as some "bottom-up"-type model describing – in unconnected portions – only what is immediately programmed in, Quantum Gravity (together with its GUT-extension) is a "top-down"-type model with the claim of consistently explaining all physics (on its 8x8-dimensional level).

As Quantum Gravity, in its 4-dimensional version, is the application of an $SU(2,2)$, there are exactly 3 non-linear Casimirs. After resolving them with respect to their spatial components, we obtain exactly 3 macroscopically independent equations of motion, i.e., 3-location as a function of time (and of additional parameters). This is the well-known 3-dimensionality of motion.

And, a non-linear Casimir set equal to a constant (i.e., our "World Formula"!) is representing a non-linear condition. Hence, the 4-dimensional hypersurface of space-time extracted from such a Casimir within its 15 dimensions of parameter space is a bent one: space-time automatically is resulting in a bent form.

Einstein's geodesic condition in order to trace a pathway through General Relativity is not needed: Usually, the 2nd-order Casimir will

be applied to determine a bent hyperspace of space-time (depending on heavy mass, etc.), and the other two Casimirs (of 3rd and 4th order) are applied to fix the pathway in it. Einstein's "background independence" – i.e., his physical restriction that physics is prevented from leaving this bent hypersurface – is nothing else than the "irreducibility" condition of group theory.

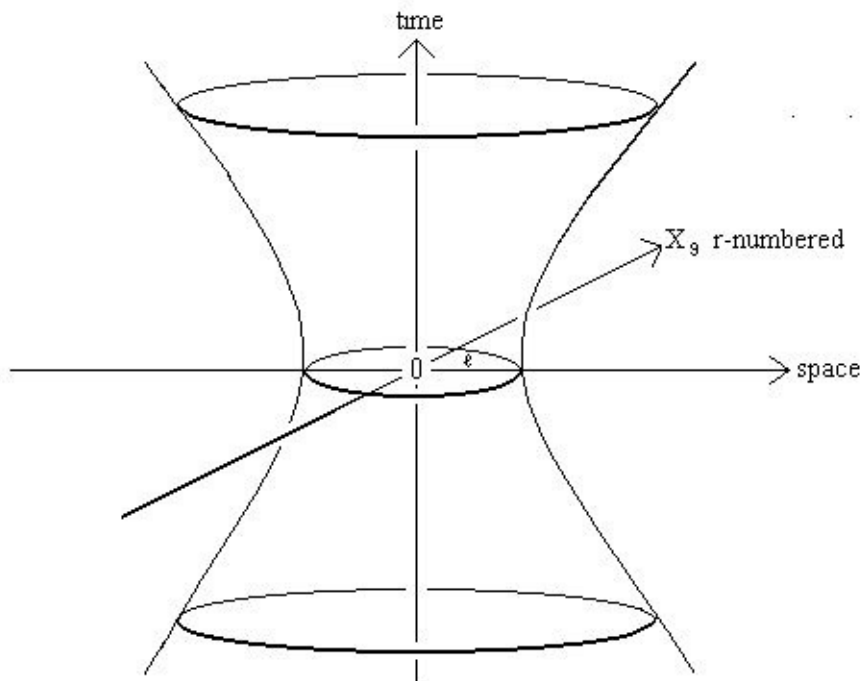
Irreducibility is splitting the total parameter space into slices of bent universes which are not further decomposable any more. Without that irreducibility, our constants of nature would not be "constant".

Now, the priority of a ("unitary") reaction channel is based on the fact that probability conservation is an undoubted requirement for every description of nature: Nothing is getting lost, and nothing is falling from heaven. As a mathematical fact, a strictly "unitary" group is conserving probability. The coexistence of a "pseudo"-unitary, i.e., of a not strictly "unitary" dynamic channel, then, necessarily must be some subordinate, secondary property. In order to coexist with that primary reaction channel, the dynamical channel has to share its base with (at least: parts of) the reaction channel.

By finiteness, then, the ("pseudo-unitary") dynamic group will have to be represented in a finite-dimensional version, too.

The Cosmic Hyperboloid

When applying our “World Formula” to the 2nd-order Casimir of the dynamic channel, we obtain the following sketch:



Its axis perpendicular to the drawing plain, here, is the abbreviation for the collection of all parameters exceeding pure space-time. As a square root value, it might as well be imaginary. That special case not shown, here, is the region expected to describe the interior of Black Holes. (See the corresponding chapter.) In the (partial) representation shown here, space is expanding with time – and not only with respect to positive times but also towards negative times!

Its waist radius, here, is the Dark Energy parameter mentioned already. A particle at rest, at the time equal to zero, according to this sketch, by increasing time, obviously, will be accelerated outwards in order to stay at the expanding surface of its hyperboloid, until, asymptotically, this extension of space will

converge to the velocity of light – but not faster, as people try to make us believe!

Exactly this is the message of Dark Energy, which, thus, is described quantitatively by Quantum Gravity. Due to its origin from a commutator of generators, Dark Energy might be considered as a “quantum effect of cosmic size”.

In Einstein’s non-quantized General Relativity, this waist radius is shrinking to zero. Then, the entire hyperboloid is degenerating to a double-cone with a point-like, “singular” Big Bang at time $t=0$, and the Dark Energy effect is disappearing. Within that drawing plain, then, all particles are moving by the velocity of light; hence, they should be massless. This way we are accustomed to by the “Standard Model”. For correction, some non-transparent “Higgs” mechanism had been invented, there, which, in Quantum Gravity, is superfluous. (The “Higgs” found, here is an ordinary particle.)

In conventional models, the negative-time cone part, usually, is dropped. In clear contradiction to the conservation rules of physics, people even seriously do offer their opinion that all space-time only is “created” at that singular Big Bang position, and that “nothing had existed before”: Dogmatic ad-hoc statements are given in order to mask the absence of knowledge.

Now, by quantum gravity, the lower half of the above hyperboloid is the region of (predominantly) negative energy states, and time is running backwards, there. As, in Quantum Gravity, a particle and our universe have to be treated on the same footing, we formally could interpret our universe as a bound boson state u^*u of a “universal quant u ” in its positive-time section with a “universal antiquant u^* ” in its negative-time section.

The construction of differently designed “universes” is assigned to the mathematicians and to the philosophers.

Another feature, however, still is of importance. The hyperboloid representing a 2nd-order Casimir is a sum of squared generators, some terms adding up with a positive sign, others (according to their pseudo-unitary “metric”) with a negative sign. When not resolving it with respect to the space-time parameters as done in the above sketch, but with respect to energy-momentum, then we extract the

“Klein-Gordon” equation of motion of particle physics out of it.

By the “World Formula”, it is set equal to some inhomogeneous term consisting of the remaining squared generators of the 2nd-order Casimir. For cosmology, Einstein once had named this inhomogeneous term his “cosmological constant” – however without, then, knowing its composing content. Here, we are writing down its composition explicitly (from its 2nd-order Casimir), in all details – either for our GUT or, with fewer components, with respect to Quantum Gravity.

Particle physicists are used to adding their analogue of the cosmological constant to their heavy-mass term, thus obtaining some effective (squared) particle mass. Now, depending on the value of their (squared) inertial mass, i.e., of (squared) energy-momentum, this mass value is varying together with it. For mass values not equal to the value the asymptotically free particle would assume in a flat space-time, particle physicists – exclusively working with Special Relativity – are speaking of a “virtual state” of this particle.

In cosmology, due to the mutual gravitational interaction of all matter, space-time and energy-momentum are continuously converted into each other. (Remember that visualization by the rubber membrane, where a change of the potential energy or weight of that object is stretching or compressing the area content of the membrane).

Hence, in the formulation of particle physicists, who are caring for Special Relativity only, cosmology almost ever is describing just “virtual” states – however, close to their real range – in most of its cases of application, at least.

Thus, the reason why a particle will become “virtual” in particle physics, very clearly is traced back to an effect we are familiar with from General Relativity. As long as particle physicists do not care about the working pattern of General Relativity, the effect of a state to become “virtual” will remain an unsolved mystery for them, darkening their principle understanding of fundamental physics.

By mathematics, the same “irreducible representation” of group theory in which there is allocated some “real” state, simultaneously is harbouring a great scale of “virtual” particle states, in addition; all

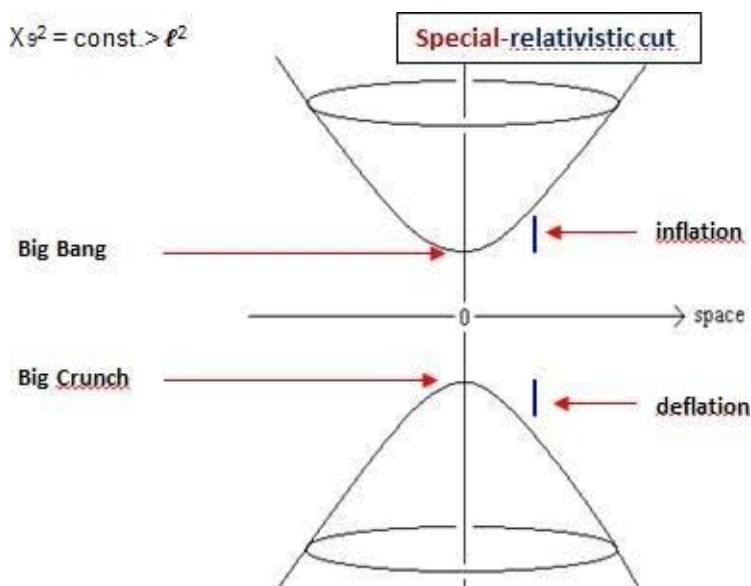
those states can be “transformed” into each other. Those “virtual” states, thus, are to be considered as inevitable, collateral “tail” features of that “real” state.

Cosmic Inflation

When restricting ourselves to Special Relativity, the parameter perpendicular to the drawing sketch of the cosmic hyperboloid in the preceding chapter will become constant. In case of a vanishing constant, the respective conic section of that hyperboloid is the plane drawn there.

For an increasing (r-number) parameter, the horizontal gap at vanishing time between the two branches of the hyperbola drawn there will be shrinking more and more, until this “hyperbola” will degenerate to a cross attached to the origin of space-time, but in a plane parallel to the drawing plane at a distance of the Dark Energy parameter. This is the classical Big Bang “point”.

If that parameter is increasing still further, this cross will open again, and our Special-Relativistic conic section will assume the following configuration, now with a vertical gap in time direction:



With a still increasing parameter, this time-gap between a “Big Bang” and a “Big Crunch” position will get wider and wider, too.

In the traditional “Standard Models”, both “Bigs” are coinciding. (This corresponds to the “cross” configuration just mentioned.) The existence of its lower branch, however, tacitly is ignored – thus

leading to all those adventurous interpretations trying to disguise to the public one's personal ignorance of the matter by pithy statements.

And, contrary to Einstein's classical model, where the Big Bang is some singular point because he did not know the composition of his cosmological "constant", our full hyperboloid allows to circumvent that distinguished "point" quite easily: In Quantum Gravity, there are no singularities any more.

But more interesting is the fact that a tangent at this "Big Bang" position is exactly horizontal – meaning that a slight increase in time will produce some enormous increase in space direction around that point – an expansion faster than light! (Formally, it even will be infinite.)

This behaviour of a locally unlimited blow up of our universe immediately "after its creation" is well known in cosmology: it is the "cosmic inflation" no model yet has been able to explain. And that – formal – increase faster than light triggered huge head-ache among cosmologists.

The lame excuse they finally reached an agreement upon reads: Not the physical "objects" in space-time are accelerated that fast, there, but "space itself" is expanding faster than light, sweeping all objects along with it. This, however, just shifted the unphysical behaviour from the objects to an equally mysterious "space" they are lying in. (Remember that the ether-like models attributing properties to space had been abandoned since Einstein!)

Einstein had reduced space-time to a property of matter: Without matter, there is no space-time, i.e., empty space – a number of "zero" quanta – cannot expand: Zero times something remains zero! In Quantum Gravity, however, space and time are not com measurable. Thus, in its reaction channel, usually, (one component of CMS-) space will be kept diagonal, while its dynamic channel admits an approximate diagonalization of time, instead.

Due to this non-com measurability, hence, and contrary to the never-validated opinion of current cosmology, cosmic inflation does not describe an acceleration of matter – say – from that specific Big Bang point fixed to the special conic section elected, to some

different point far away within that identical Special-Relativistic conic section. Instead, it is describing the view by somebody else observing both points at a time from some different conic section closer to the drawing plane.

Then, both points are not correlated by causality directly – such a transport of matter faster than light would drastically violate all concepts of physics. And an expansion of “space” not depending on matter would reinstall into physics the existence of some mysterious additional stuff like ether or whatsoever.

Provided both points can independently be traced back to some common third, earlier point on a different conic section, which is slicing our full cosmic hyperboloid, then causality simply would refer to the distance of that third point with respect to both our points running apart. And velocities faster than light are not needed. For, causality is not restricted to points connected by Special (or even General) Relativity only.

In the case of cosmic inflation, their relation back to that common third point only should be in reach by Quantum Gravity. Then, this third point would belong to some time sufficiently earlier than our special Big Bang point within our conic section of departure.

In New Physics, thus, cosmic inflation explains as some quite natural effect which does not give rise to any complication. And space remains that fictitious construction deriving from a mere count of quanta.

To the experimentalists, cosmic inflation is serving for making plausible the (approximate) isotropy of the microwave radiation background of our universe attributed to be some relic of a Big Bang. Observe, however, that there is no single Big Bang “point” but an entire line of such Big Bangs varying with the parameter denoting the distance of our conic section from the drawing plane in the preceding chapter.

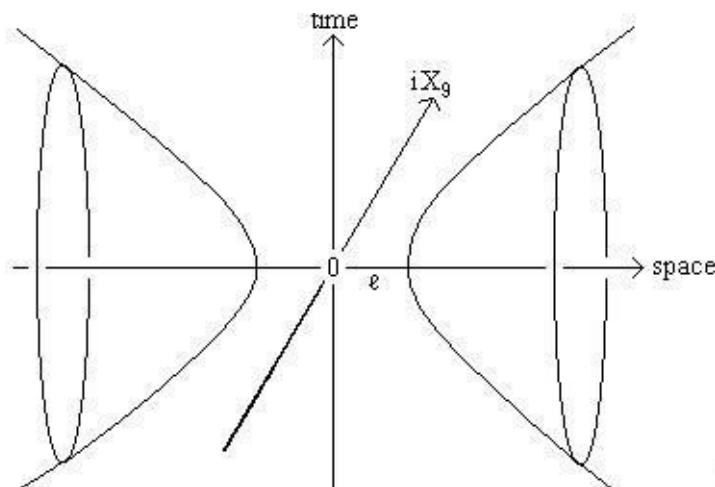
Let me stress again: “The” Big Bang is no singular point! The photons of that microwave background must have had their individual origins from reactions which took place somewhere in that “virtual” neighbourhood within our early universe, but not too far from its “real” range.

And: Our universe has not been starting there. By theory, as mentioned, it is no problem at all to circumvent those “Big Bangs” in order to proceed to negative absolute times of our universe: We just have to recall that physics does not strictly follow the conic section of Special Relativity discussed here but it will follow General Relativity in its Quantum Gravity and GUT extension as discussed in the preceding chapter.

And observe, in addition, that the mathematical “origin” of our universe (i.e., all parameters vanishing) is no point on the bent hypersurface of our cosmic hyperboloid: it is not accessible to physics. But: So what!

Particle Pair Creation and Black Holes

That special case of imaginary values on the axis perpendicular to the drawing plane not shown in the figure two chapters back is expected to be the region describing the interior of a Black Hole. Its common drawing plane with the sketch below, then, obviously should represent its event horizon.



Here, the roles of space and time are exchanged in a way: time is delimited, while space, formally, seems to be unbounded. In the (partial) representation shown here, time is expanding with space, asymptotically converging to it. This transition real - imaginary on that axis, formally, is reflecting a switch like the one we would obtain by going from a pseudo-unitary $U(n,m)$ to a $U(m,n)$.

Observe that, here again, two separate branches are emerging – in this case not with a gap in time, like in cosmic inflation, but with a gap in space. As, in Quantum Gravity and in its GUT-extension, a particle is described by the same equations a universe is, the above sketch will remind us of a pair creation process in particle physics (with space “running” inside out) or of a pair destruction (with space “running” outside in).

This, however, is a rather narrow view of things, deduced from the creation of a fermion pair by some meson. More generally, we shall have to admit that universes will react with each other the

same way as particles do. Only the numbers of participating quanta are differing by an unprecedented order of magnitude.

But this will be a matter of embedding our basic generators derived for the $8 \times 8 = 64$ dimensions of our GUT into some higher structure – similarly as our 8-dimensional Quantum Gravity is embedded as an “internal” singlet in the $8 \times 8 = 64$ -dimensional GUT.

New structures will emerge, there, in addition to Quantum Gravity and GUT. But those “Monsters” cannot be subject of this discourse, here. Just keep in mind: The structures discussed here still will survive there, too – as substructures. And universes will be segregating off from each other the same way as particles are doing it from each other within our own universe. When switching on those additional structures, there, universes will interact with each other similarly as our particles, here, when switching on their individual forces.

Hence, like in particle physics, the boundary of a universe will neither be expected to be strictly impenetrable: in principal, substructures of any magnitude are exchangeable – from a mere transfer of momentum and “radiation” up to complete fission products – thus even enabling inter-universal traffic. All that is a matter of embedment.

Creation and destruction of a universe, thus, are expected not necessarily to be a matter of “Big Bangs” and “Big Crunches” only. Like in particle physics, universes simply will have to be multiplied, and the product will have to be reduced to a direct sum of irreducible components, which, then, are becoming our individual universes.

In particle physics, new states thus created, usually, will result as “virtual”. The same will hold with universes – and the Big Bang domains, above, will be sketching just one such way. Collisions of thermodynamic provenance, then, will gradually lead towards some equilibrium of “stable” universes.

From particle physics we may copy, in addition, that a “free” particle – as we observe it from outside, travelling through our universe as an “adult” structure long after its “birth” – is well delimited in its spatial extension, too, when we are going to measure its “size” by whatever reaction channel procedure.

Then, its size is converging to some finite value destined by the finite number of quanta available in that closed system – provided its external interactions are considered to be switched off. (Otherwise, it would be an open system with space not diagonal.)

For cosmology, this might be taken as an indirect hint from experiment that our universe – as a “free” universe – should stay finite as well, not extending to infinity with increasing time: Our universe – like each of its “particles” – should be some finite representation of Quantum Gravity and of the GUT, too!

The “vacuum polarization” of the conventional “Standard Model” might formally be copied as well, i.e., by states with opposite quantum numbers. They could arise from the two branches of a “Black (Mini-)Hole” – or from opposite regions of our (r-numbered) cosmic hyperboloid (in the microcosmos). However, due to the conservation of the number of quanta, they could not truly arise from the vacuum! They need some trigger to deliver those quanta. But we are treating Dark Matter only later.

Contrary to the Black-Hole case, however, in the r-numbered cosmic hyperboloid both (extended) domains of predominantly opposite quantum numbers are touching and penetrating each other about their relatively narrow central region. Astronomers are observing that collision of states of opposite quantum numbers, there, in terms of (the microwave background of) some violent “explosion”.

People once had named that collision area “the Big Bang”, and according to Einstein, this area should be some point singularity. We learnt meanwhile that this area is extended and that our universe will not necessarily be “created” there.

Note added in proof: One particle carries just one charge. But due to $+1+(+1-1)=+1$, a total charge of +1 does not exclude the presence of oppositely charged particles (+1-1) in our universe!

Thus, there might take place that violent “explosion” of oppositely charged particles in the centre of our universe. Its analogue on the particle level would be the collision of oppositely charged quanta predominantly uniting the non-valence parts of the particles involved.

If describing some pair of particles, our cosmic hyperboloid is separating the two opponents at least by double the waist radius – only extended ranges could touch or overlap each other. In case of a Black Hole (representing some pair of particles), the domains of oppositely lying quantum numbers are not touching each other at all: a gap in space is keeping them at distance.

For particle physics, this means that this type of pair creation and destruction, in any case should be a non-local process – no matter what are the triggering boson(-like) states.

Those “Mini Black Holes” pushed to giving rise to a press campaign of fear in 2010 when the LHC at Geneva had been reinstalled, hence, are turning out to be quite ordinary elementary particles. The alternative, then, if particle-internal dynamics is giving rise to an r -number hyperboloid or to an imaginary Black Hole depends on the external collision parameters.

(The subsequent accretion of one of the branches of a Black Hole – or simply of one of the participants of a pair creation – to some larger agglomeration, then, will be another story.)

Spin vs. Angular Momentum

The half-integral spin value of an $SU(2,2)$ is a covering property of the related conformal $SO(2,4)$ containing purely integer spin values. Both types of a “spin” are properties of their respective linear generators.

Quantum Gravity is applying a system of “natural units”.

For the *reader interested in mathematics*, they are

$$\begin{aligned} P_\mu &\equiv \frac{1}{\ell} P'_\mu \\ Q_\mu &\equiv \ell \vartheta Q'_\mu \\ D &\equiv \vartheta M_0 \end{aligned}$$

where $\vartheta \ll 1/(\ell^2 \vartheta) \ll 1 \ll \ell$.

Let us, now, consider the 3rd-and 4th-order Casimirs of the $SU(2,2)$. When grouping their terms according to magnitude – as resulting from their natural measuring units to be used in Quantum Gravity – we find that, up to additive (“group-contraction”) terms of experimentally negligible size and multiplying mass factors, both Casimirs just are reproducing the Casimirs of the Lorentz group of Special Relativity where their Special-Relativistic generators of spin and boost are replaced by their total-angular momentum and by their total-boost analogues.

This means: The 3rd-and 4th-order Casimirs of Quantum Gravity are giving rise to the (approximate) conservation of total angular momentum (spin plus orbit) and of the total boost. By experiment, this fact is well-known long since – at least for angular momentum, less for the boost. By theory, however, it never has strictly been derived but just conjectured.

The interesting fact is that these two conservation conditions are not satisfied exactly in Quantum Gravity but only approximately. Their deviations, however, are tiny – but they do exist. As soon as experimental devices will become sensitive enough, this should become a matter of experimental precision verification!

In view of the 2nd-order Casimir, which does not contain orbital terms, this means a clear distinction for theory between angular momentum on the one hand and spin on the other hand. In the past, both notions often have been used as synonyms of each other. This is not tenable any more.

Especially in the boost case. Astronomers, used to discard all spin argumentation, now are asked carefully to distinguish between an orbital boost originating from a variation of location and/or of momentum – from a boost originating from spin. This, possibly but not necessarily, could concern the measurement of certain star distances by the red-shift method, e.g. This should be carefully scrutinized!

And for particle theory, a p-wave (“orbital”) excitation is different from just adding up a higher “spin” value.

What Is a Vacuum Good for?

This is a technical chapter reasoning why the “2nd quantization” of traditional quantum field theories is based on a false application of mathematics, which is systematically destroying the conservation of probability. For the unprofessional reader this chapter, thus, will be rather boring; he better should skip over large parts of this technical argumentation, which is of importance more for the theoretician familiar with mathematics.

In the beginning, creation and destruction operators had been introduced in the context of a combinatorial transposition. And transpositions, there, had been combined to permutations (in mathematics), which, then, had been identified as generators (in physics). All that may sound somewhat mysterious and artificial.

A more direct access is by simple school mathematics.

Only for the special <i>reader interested in mathematics</i> :	
Consider the two singular matrices	
$\mathbf{a}^+ \equiv \begin{pmatrix} 0 & 0 \\ 1 & 0 \end{pmatrix} \equiv -i\mathbf{b}^-$,	$\mathbf{a}^- \equiv \begin{pmatrix} 0 & 1 \\ 0 & 0 \end{pmatrix} \equiv -i\mathbf{b}^+$.
Their products	
$\mathbf{a}^-\mathbf{a}^+ = \begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} = -\mathbf{b}^+\mathbf{b}^-$, $\mathbf{a}^+\mathbf{a}^- = \begin{pmatrix} 0 & 0 \\ 0 & 1 \end{pmatrix} = -\mathbf{b}^-\mathbf{b}^+$	
are “projection” operators. When defining the 4 types of “vacua”,	
$ 0\rangle_{\mathbf{a}} \equiv \begin{pmatrix} 1 \\ 0 \end{pmatrix}$,	$ 0\rangle_{\mathbf{b}} \equiv i \begin{pmatrix} 0 \\ 1 \end{pmatrix}$,
${}_{\mathbf{a}}\langle 0 \equiv (1 \ 0)$,	${}_{\mathbf{b}}\langle 0 \equiv i(0 \ 1)$,
their “vacuum expectation values” will yield	
${}_{\mathbf{a}}\langle 0 \mathbf{a}^-\mathbf{a}^+ 0\rangle_{\mathbf{a}} = 1$,	${}_{\mathbf{b}}\langle 0 \mathbf{b}^-\mathbf{b}^+ 0\rangle_{\mathbf{b}} = 1$,
${}_{\mathbf{a}}\langle 0 \mathbf{a}^+\mathbf{a}^- 0\rangle_{\mathbf{a}} = 0$,	${}_{\mathbf{b}}\langle 0 \mathbf{b}^+\mathbf{b}^- 0\rangle_{\mathbf{b}} = 0$.

In the original foundations of group theory (100 years ago), co- and contravariant representations still had been strictly separated from each other. Tensor labels, there, had been either all co- or all contravariant.

In order to define an internal product in the sense of the vector

calculus, one of its two sides had to be chosen co- and the other one contravariant. For a purely covariant representation (i.e., a covariant “tensor”), hence, some 1:1 contravariant representation (i.e., a contravariant “tensor”) had to be constructed, in addition. (A “tensor of order n ” is a superposition of n -fold products of vectors, each vector with its own label designating its components.)

This became the hour when the mathematical formalism of creation and destruction operators had been invented: Every factor (“destruction operator”) on the bra-side of the internal product had to convert some respective factor (“creation operator”) on the ket-side into some non-vanishing r -number. Every factor on the bra-side which could not hit its corresponding factor on the ket-side had to cancel the entire internal product (of the respective term) – and v.v. Contributions arise from a pure “reshuffling” of factors, only.

(This is the technique how mathematicians, last but not least, are calculating their “Clebsch-Gordon coefficients”, i.e., their “transition amplitudes” of a ket-state to a bra-state – or v.v.)

Within one and the same side, the individual factors (“creation” operators on the one, “destruction” operators on the other side), formally, have to be expanded to a “direct” product:

$$S \otimes T \otimes U \otimes \dots$$

(where the S , T , U , ... are the individual vector components the tensor is constructed of).

And this still remained so when people later on were beginning to construct tensors collecting both types of variances on one and the same side of an internal product.

Now, the error of “2nd quantization” is that it does not clearly distinguish a “direct” multiplication from an ordinary multiplication – it is inconsistently mixing up features of both concepts. This became crucial when “2nd quantization” demanded the direct product of a destruction operator with a creation operator to be contracted to a “Kronecker-delta”, i.e., to some number, like in

$$a^- \otimes a^+ \rightarrow (a^- a^+) \rightarrow \delta .$$

The destruction operator, here, is applied to the creation operator behind, like in the case of an ordinary product of operators. The inconsistency, thus, shows up very transparently: The “2nd quantization” of current quantum field theories does not conserve the number of direct factors: 2 in the beginning, none in the end. This is a severe violation of (conserving the 1st-order Casimir of the reaction channel in) the tensor calculus!

As an excuse for this violation of mathematical structure, people are offering a “concept” running like this: The vector components a tensor is constructed of, here, are operators – and operators are allowed to do everything evil!

Their result, then, is the “Standard Model” – mathematically inconsistent from its first stroke. Of course, those quanta thus arbitrarily swept under the carpet will be needed elsewhere in the model – being revitalized again, there, in terms of their “vacuum polarization”, e.g.

In a consistent theory, those quanta needed for “vacuum polarization” would have been handled over directly from where they had been cancelled, instead. Then, the sink of quantum pairs would be related to their later source. In the “Standard Model”, however, their cancelation by 2nd quantization is totally independent of their resurrection, later on, in “vacuum polarization”. And particle physicists do not recognize that the “sea” of quantum pairs under their carpet just is what cosmologists are measuring as “Dark Matter”.

The introduction of one inconsistency, thus, is immediately giving rise to inventing another one in order to partly compensate the error made by the first one, and the second one to inventing a third one, etc. This is the “Standard Model”. People are extremely creative in inventing always new excuses – instead of curing the roots of all evil.

New Physics is correcting those mistakes. It does not really need a concept describing some physical vacuum. In New Physics, a vacuum just is empty; it has no properties, all quantum numbers are absent/vanishing.

In Quantum Gravity, an 8-dimensional basic “spinor” (i.e., vector

with half-integral spin) is splitting into two 4-dimensional parts, and, with the exception of their parity behaviour beyond pure space-reflections, no transitions between both halves are experimentally observed. In a region of our universe where the basic spinors are diagonal with respect to their signs of particle number, the definition of a vacuum as a projection onto one of its two halves of parameter space serves as the technical means for granting special favours to exactly that half. For the opposite half the opposite definition will hold.

From the definition of (CMS-)time and heavy mass, we have to deduce that for negative absolute times, i.e., before “the Big Bang”, not particles with positive masses but states with negative masses should dominate. For our total universe, hence, an overall balance of spinors and antispinors will be expected because, according to the pair creation and destruction history discussed already, we should expect an overall neutral universe – provided there has not taken place an exchange with other universes. We happen to live in the half governed by positive masses, “after the Big Bang(s)”.

Now, the reaction channel had been characterized with respect to energy and to the 3-components of spin and CMS-location. Instead of energy and CMS-location, we could have chosen 2 alternative generators as well. Examples of commuting triplets of generators (the 3-component of M is the Lorentz booster) are:

P'_0	Q'_3	L_3
M_0	M_3	L_3
P'_3	Q'_0	L_3

The generators of the first line all are “compact”, i.e., they are characterizing physical states according to their reaction channels. In the two alternative triplets, the first 2 generators, each, are “non-compact”, thus belonging to the dynamic channel.

After proceeding from the first line, where energy and (one component of) CMS-space are commuting, to the second line, (heavy) mass and (a component of) the Lorentz booster are commensurable, instead. This is the (pink) system of current

quantum field theories, which are working with the Lorentz group of Special Relativity. Heavy mass is an external constant, for them. Quantum field theories, hence, are unable to explain what a virtual state is, the mass of which is deviating from that value. And the “Standard Model” merely is an application of those poor quantum field theories.

In the third line, finally, CMS-time is made accessible, together with its commensurable (3-component of) momentum. Observe that none of these 3 lines is commensurable with either of the other two.

Why Space-Time Must Be Non-Linear

We are distinguishing “ordinary” space-time X from its additive CMS-version $Q=MX$. In the reaction channel of Quantum Gravity – beside particle number – energy and the 3-components of spin and space are representing a complete set of additive, commensurable (i.e., commuting) generators. Each of them might be measured in its own, individual measuring unit.

Spin, as one of them, usually, is measured in units of Planck’s constant. In history, spin had been the first generator to be quantized, and, in the subsequent decades, people observed that its measuring unit does not make any cognitive sense: In all relations derived later on, it proved to be equivalent to the number 1. Thus it is providing a relation among the physical units (cm, gram, sec) by which Planck’s number once had been multiplied together. As a result, theoreticians simply set

$$\hbar = 1.$$

Similarly, they found that the relation of space to time, without restriction of generality, could be simplified by setting the velocity of light to

$$c = 1.$$

By these two equalities, the measuring units of the $2 \times 3 = 6$ generators “spin” and “Lorentz booster” of Special Relativity are fixed to unity. But we still need the units for 1) energy-momentum, 2) space-time, 3) heavy mass. As the triple of generators – energy, heavy mass, and CMS-time – are generating just a 2-dimensional group (an $SU(1,1)$), only 2 of their 3 measuring units are independent of each other. My choice is shown in the blue box in the last but one chapter.

According to the mathematically “closed” reaction channel, the 3-component of CMS-space is diagonal. A switch over to the case

where heavy mass is commuting with (the 3-component of) the Lorentz booster will shift us to the “open” dynamic channel.

The open channel, however, needs the law of great numbers in order to work properly. From the third alternative of the previous chapter, where CMS-time and (the 3-component of) momentum are commuting with each other, we, finally, learn that all 4 components of CMS-space-time are handling “great numbers”.

Now, by evolution, mankind has developed in a way that our optic sense is recording positions and velocities. Velocity, however, is a secondary construction which is either dividing location by time or momentum by (heavy) mass. In both cases, velocity is a quotient of two “great” numbers. And a quotient, of course, is non-linear.

The observation of an “object” is combining the observation of its position with the observation of its velocity. Both observations – that of position and that of velocity – would not be compatible if velocity is measured in a non-linear way and position in a linear (CMS) way. In order to obtain a compatible view of our neighbourhood when velocity is some non-linear quotient, position (i.e., space) – and with it: time – necessarily will have to be a quotient (“ray representaton”), too, and one related to the identical denominator!

The non-linearity of Einstein’s space-time X we observe instead of its linear CMS-version Q is the necessary consequence in order that an “object” of daily life will remain something compact in our eyes of an ancient hunter and gatherer. Otherwise, the “points” of neighbouring coordinates which are grouping an “object” together would not be identical when observed by its position and when observed by its velocity – they would run apart!

The Grand Unification

By first principles, nature had revealed itself to show up in $8 \times 8 = 64$ dimensions. This will immediately be identified to be the Grand Unification of all forces of nature. The reaction channel of its first octet factor, i.e., of pure Quantum Gravity, is propagating to the entire system giving a “unitary” group $U(64)$ strictly conserving probability, and to a “pseudo-unitary” dynamic overlay structure expanding to a $U(32,32)$.

Dirac’s split into a pair of “co-“ and “contravariant” substructures according to the sign of particle number is giving rise to a corresponding reaction channel in terms of a pair of groups $U(32)$, and his subsequent split according to the energy sign of the basic constituents (quanta), then, is giving rise to the dynamic overlay channel in terms of a $U(16,16)$ pair of half the original dimensions, each.

This partition of the 64 primary dimensions into four 16-dimensional substructures (8 “internal” dimensions with 2 spin directions, each) is secondary, i.e., belonging to the open system of the dynamic channel; the “true”, closed-system physics is playing in the reaction channel: dynamics is secondary. Current field theories – the “Standard Models” – are busy only with those secondary entities. The reason will become clear later.

Independently, the total of $8 \times 8 = 64$ dimensions, may be split either multiplicatively to 8 times 8 dimensions, or additively to an 8-fold sum $8+8+8+8+8+8+8+8$ of 8 dimensions, each. The second octet of the multiplicative split is the octet of “internal” interactions, and the individual eight octets of the additive split are representing eight “chiral” versions of Quantum Gravity.

The “chiral” split is intimately related to the gauge models of quantum field theories. However, it is dropping their hard restriction that gauge particle masses will have strictly to vanish. This restriction, there, had been laboriously to be adapted to the physical reality by that formidably non-transparent “Higgs” formalism, which New Physics does not need at all.

Now, in the total group of 64 dimensions, there are more generators ($64 \times 64 = 4096$) than in the sum of all eight chiral subgroups added up ($8 \times (8 \times 8) = 512$). The 64-generators not simultaneously belonging to the 8 chiral subgroups are those generators transforming one of the chiral subgroups into another one, i.e., one type of the “internal” forces into another type. And (Quantum) Gravity is contained in those “internal” forces as some linear combination: Hence, the total 64-dimensional group is representing the Grand Unification of all forces of nature.

The “Internal” Forces of Nature

After (multiplicatively) having split the dynamic octet of Quantum Gravity off the Grand Unification, we are left with the remaining, second octet factor, which is representing the “internal” interactions of nature. The 8 components of its basic 8-dimensional “spinor” are represented by some label running from 1 to 8, or, equivalently, by 3 labels, each running from 1 to 2 only (because the 3rd power of 2 is equal to 8).

For physical applications, these 3 labels, all of them present simultaneously, are characterizing

- **the electromagnetic force,**
- **the strong force, and**
- **the weak force,**

although, partly in some non-conventional form. But remember: the Grand Unification is not the “Standard Model”!

Formally, these 3 types of labels all have the same mathematical structure. This is permitting the application of permutations on the three labels or, more generally, of unitary transformations in terms of a $U(3)$. “Irreducibility” of the result, then, is demanding to tear the (mathematical) “trace” ($= 1/3$) out of the 3×3 -matrices of their generators.

This means, we have to subtract $1/3$ of the unity operator from the remaining generators, especially from the (double amount of the) charge values. A pair $(+1/2, -1/2)$ of quantum numbers, thus, will convert to a pair $(+1/3, -2/3)$. For unifying reasons, this value of $1/6$, then, is subtracted from (half the) particle number, too, giving particle number itself as some multiple of $1/3$.

This will yield some set of “internal” generators. Now, up to its metric, the chiral analogue of particle number in Quantum Gravity is “charge” in the GUT. A priori, however, we do not know, in which (linear) combinations nature is offering those charges to us. (This, at

most, will be derivable from some superior structure our universe would have to be embedded into.)

When trying to stay in accord with the current experimental situation, we find the following (linear) charge combinations:

N	: particle number,
Q	: electric charge,
T	: triality,
L	: lepton number.

T is the main (charge) component of the “strong” interaction. According to what has been explained above, N , Q , and T are multiples of $1/3$. In the remaining linear charge combinations, some of these terms of $1/3$ are mutually cancelling each other.

The reader might be confused why there are 8 charges instead of the 4 conventional ones of the “Standard Model”:

Λ	: leptonic charge,
E	: exotic charge,
A	: strong charge (2nd component),
M	: strong charge (3rd component).

The reason is simple: The “Standard Model” is ignoring a couple of nuclear quantum numbers well-known from nuclear physics: A and M , together with Q , are leading to the specific mass differences within an iso-multiplet of particles and atomic nuclei, which the “Standard Model”, in vain, thinks to be able of attributing to (polynomials of) Q alone (out of Feynman diagrams).

And A , especially, is the force keeping the nucleons within an atomic nucleus at distance from each other in order not to be obliged to resolve a 2-nucleon deuteron into some 6-quark structure, e.g. (The old “Standard Model” is allergic against a particle to be made of more than 3 quarks!) And Λ is more basic than the conventional “weak” force transmitted by the Z - and W -mesons. Only E is new, here – therefore its name.

Altogether, we find the following relations between Dirac’s

“creation operators” of type “a” and the 8 above quantum numbers:

	N	Q	T	L	Λ	E	A	M
a_{i211}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$-\frac{1}{3}$	0	0	0	0	0
a_{i111}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0	0	0	0	0
a_{i222}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{2}{3}$	0	0	0	$+\frac{1}{2}$	$+\frac{1}{2}$
a_{i122}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$+\frac{2}{3}$	0	0	0	$+\frac{1}{2}$	$-\frac{1}{2}$
a_{i212}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$-\frac{1}{3}$	$-\frac{1}{2}$	$-\frac{1}{2}$	0	0	0
a_{i112}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{2}$	$+\frac{1}{2}$	0	0	0
a_{i221}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{2}{3}$	$+\frac{1}{2}$	0	$+\frac{1}{2}$	$-\frac{1}{2}$	0
a_{i121}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{2}$	0

(The colours in the table have nothing to do with the quantum number “colour” of the “Standard Model“!)

Horizons and the “Quark Confinement”

Now, a product of n generators can act on maximally n different quanta simultaneously; then, it yields an n -particle force. Conventional particle models, usually, are restricting themselves to 2-particle forces like the Yukawa force and its massless Coulomb derivate. In its 4-dimensional $U(2,2)$ version, Quantum Gravity is limited to describe 4-particle forces at most, given by its 4th-order Casimir.

Its 2nd-order Casimir only can produce 2-particle forces. Thus, spin is providing a 2-particle force only, while (“orbital”) angular momentum is able to describe 3-and 4-particle interactions in addition to 2-particle interactions. And the full 64-dimensional version of the Grand Unification even can describe up to 64-particle interactions.

However, let us stay with the 2-particle interactions of a 2nd-order Casimir. Its energy-momentum and mass terms, together, yield the “Klein-Gordon equation” of motion of particle physics. (Its non-relativistic limit is the Schrödinger equation.) Still in ordinary quantum mechanics, it is providing the Yukawa force, which, in the case of a vanishing mass term, is collapsing to its Coulomb subversion. By considering its space-time generators, in addition, an oscillator-type interaction will have to be added, with the mass term as its inverse range.

Oscillator forces and Yukawa/Coulomb forces always are emerging in pairs with each other. An oscillator might be visualized by a spring: By stretching and releasing its one end, its elongation will oscillate some time between two extreme positions to and fro: their “range”. In more than 2 dimensions, the word “range” often is replaced by the word “horizon (width)”. Oscillator forces also give rise to the nuclear shell model.

When, finally, still considering the term representing the Lorentz Casimir contained in the 2nd-order Casimir of Quantum Gravity or of its GUT-extension, we obtain Hubble’s law as a subordinate part of the total Casimir.

But let us stay with the oscillator. In the GUT-extension, its strength is proportional to the “charge” giving rise to this force. A particle or a quant cannot penetrate its “horizon”, i.e., its return position: it is “bound”. One way, however, still is open in order to “escape” from this oscillator prison: Provided it finds some partner(s) such that their total charge will vanish, then there will be no point of attachment left any more for that oscillator force still to pull that compound structure back to its centre.

Exactly this is happening in particle physics: A single quark or quant carrying a non-vanishing “strong” (triality) charge is rigorously kept tight in its oscillator prison – until it is managing to find some appropriate antiquark or antiquant to build a meson, or some pair of suitable quarks or quanta to make up some baryon. Then, its triality charge will become neutralized to zero and the particle can escape.

This is the ill-reputed “quark confinement”. In conventional models (including the “Standard Model”), this quark confinement still is an unsolved mystery. Neither did anybody have any idea where an oscillator force could come from, nor could anybody imagine a reason why triality charge is coming along in multiples of $1/3$. Well, in the framework of Quantum Gravity and in its GUT-extension, both problems are solved (above).

For triality, the horizon is of the order of a nucleon radius, i.e., it is allocated in the microscopic range. For other forces of nature its size is different. For electromagnetism and gravity, it will be of the order of the (maximal) extension of our (finite) universe, i.e., of cosmic range. The masses of their (lightest) carriers, the photon and the graviton, hence, will be (almost) zero.

Still other forces will have macroscopic horizons or even subnuclear ones.

The System of Leptons

One of the new charge types defined by the Grand Unification is “leptonic number” Λ . A research, at most, will be starting with the question “What would be if ...?”. Now, what would be if the horizon of Λ would be considerably (not greater but) smaller than that of triality force T – and if the horizon of the “exotic” charge E still is smaller?

According to the (above, colourful) table of the “internal” forces, there are – up to spin – only two types of (equal-variant) quanta in the GUT which are carrying a non-vanishing value of Λ (the “blue” ones); and their two values are exactly opposite to each other. A mutual compound of both quanta, thus, will result in a neutral Λ .

Let me call such a 2-quant compound an “antilepto-nucleus”. (The “lepto-nucleus” itself, made of Dirac’s b ’s, is carrying the opposite charges.) It can penetrate the “leptonic” horizon. The next greater horizon it will meet, then, is that of triality T .

With respect to T , the lepto-nucleus carries a “charge”, $T=+2/3$, and its electric charge is $-1/3$. In order to penetrate this T -horizon, our lepto-nucleus still needs another quant in order to neutralize its triality value as well.

Now, there are exactly two such (b -) candidates with $T=-2/3$ and lepton number $L=0$ (the “green” ones). Their electric charges are $Q=-2/3$ and $+1/3$, respectively. When bound to the lepto-nucleus, this 3-quant complex will carry the total electric charge of either -1 or zero, and it is able to penetrate the triality horizon, in addition.

By breaking through that “quark confinement” restriction, it will become observable as some real (pair of) particle(s). The value of its quantum number L will result as $L=+1$: Thus, this complex will represent a lepton – in one case a lepton with a negative electric charge, in the other case an electrically neutral lepton. They are members of the same GUT-multiplet as antibaryons are: Leptons, hence, are (special) antibaryons (with a non-vanishing lepton number L), and antileptons are baryons.

However, why, then, are there existing a muon and a tauon multiplet in addition to the electron multiplet? The answer, again, is trivial. The reason is the same as that responsible for the existence of more than just one representative of (ordinary) baryons – namely of the N^* 's and the Deltas in addition to the nucleons: the multiplet is big enough to contain all of them.

In the (“ordinary”) baryon case, all three quanta are bound by the same force, i.e., by triality. In the lepton case, however, two of the three quanta are bound by the leptonic force, which, due to its much narrower horizon by orders of magnitude, is to be expected to bind two states of opposite Lambda-charges much stronger than triality T .

Thus, we are confronted with a situation well known already from ordinary atomic physics: electrons loosely bound by the electromagnetic force are constituting a wide “shell” around some more pointlike nucleus, which is bound together unequally tighter by the “strong” nuclear force T .

We are meeting the analogous case with 2 force types of rather different binding strengths inside a lepton: Some shell consisting of an ordinary quant “loosely” bound by T to an almost pointlike lepto-nucleus bound together by Lambda.

Now, the two „leptonic“ quanta in the lepto-nucleus are carrying opposite Lambda-charges. Hence, they are strongly attracting each other. A trial to couple two “leptonic” quanta of equal Lambda-charge with each other, due to their strongly repulsive forces, will be illusory. (Compare it with the marriage of 2 protons with each other to some kind of a double-charged deuteron without the putty of additional neutrons.)

In nuclear physics just a couple of those combinations of nucleons with each other which are imaginable by theory also are physically observable as particle multiplets in nature, indeed – namely that narrow “catwalk” where neutron number = proton number, with a small excess of “gluing” neutrons with higher numbers. Likewise, just a couple of those corresponding Lambda-combinations are observable, too.

This explains that poor yield of lepton multiplets actually present

in current particle tables in comparison with the parallel abundance of ordinary baryon multiplets. Thus, those 3 lepton multiplets found already have artificially been fed up as “generations”.

By uncovering “neutrino oscillations” about the turn of the millennium (i.e., the conversion of different neutrino flavours into each other, to and fro), that “solar neutrino conundrum” shook the idea of the original ansatz that (lepton) flavours might represent quantum numbers. “Flavours” are no “quantum numbers” to be strictly conserved but non-linear substructures of questionable stability.

Dark Matter

By the spin-addition theorem of quantum mechanics, the product of two spin states, usually, will produce a sum of states interfering with each other. These individual terms will differ in their spin contents.

By the same mechanism, the product of two particle states will expand to a series of “irreducible” “intermediate” states. That means: a product state, usually, will not be “irreducible” any more but will be decomposing into a series of interfering states differing in their properties.

As a result of this “irreducibility” concept – which is nothing else than the quantized version of Einstein’s “background independence” – our universe on the one side and the particles within that universe on the other side cannot both be irreducible simultaneously!

In other words: If our universe is irreducible, then it does not “consist” of particles; single particles only can result as locally confined superposition nodes of different states of our one universe which are interfering in order to locally pretend the existence of such a particle state as some constructive interference effect whose wave content, further out, will be smearing out past recognition.

By similar arguments, the old view of a measuring process to split our universe into two parallel universes coexisting side by side neither is tenable: An irreducible universe cannot split into parts; the customary “parallel world” scenarios are mere science fiction in conflict with mathematics!

And the inconsistent Copenhagen interpretation of a measuring process likewise will have to be corrected in order to include the measuring device, which will have physically to “rotate” its input state (in a unitary way) towards one of its few output channels, instead of multiplying two abstract, singular actions: first a “projection”, then a “renormalization”.

That “projection” would be giving some partial state – in contradiction to the fact that there do not exist “partial” electrons in nature. And that subsequent “renormalization” in order to

supplement that “partial” electron to an “entire” electron is unphysical as well. –

With this prologue in mind, let us return to our problem: Due to irreducibility constraints, our irreducible universe cannot “consist” of particles. And if there are particles, they cannot multiply to one irreducible universe. There, necessarily, must exist some mediating “putty” gluing all particle structures together in a way that the resulting (in our GUT:) atomistic “universe” made of quanta will become irreducible.

This “putty” in parts is gravity, which is connecting all matter (within its range). But gravity does not suffice quantitatively. Therefore, its major (officially: not identified) contribution had been named “(Cold) Dark Matter” in cosmology.

Now, our GUT claims to contain all information extractable from nature (on its 64-dimensional level). And its constituting “atoms” are the “quanta” showing up (geometrically founded) forces. Dark Matter, hence, has to be made of those quanta as well. (Contrary to Gell-Mann’s “quarks”, our “quanta” are no “particles”: They do neither depend on momentum nor on space-time! The other way round is true: momentum and space-time are emergent functions of some great number of quanta.)

The simplest combinations of those quanta saturating all “internal” forces are the four pair types (with the a’s and b’s according to Dirac):

$$a^+_i b^+_i, a^+_i a^-_i, b^-_i b^+_i, b^-_i a^-_i$$

to be summed in pairs over all three “internal” labels with just the spin labels “i” being allowed to be left open unsaturated. As i is running from 1 to 2, there are $2 \times 2 = 4$ such i-label combinations in each of the four pairs. Altogether, these are $4 \times 4 = 16$ different entities. When read as (linear combinations of) group generators, they are just generating Quantum Gravity (in its 4-dimensional variant).

Let us try an ansatz. Provided, in our universe, the majority of all

quanta succeeded in saturating up like that, then the problem appears what happened to the remaining quanta left over. When comparing those saturated pairs, above, with a cloud of water vapour (humidity) in the air, the “sediment” of unpaired quanta might serve as some crumbly base of condensation germs triggering the “water molecules” to loosely binding up to those condensation germs.

As a result, complete elementary particles will be “raining” out of that “cloud of Dark Matter gas”, with the tiny condensation germs corresponding to their “valence” parts and the great bulk of “water molecules”, i.e., those Dark Matter constituents, giving rise to their “non-valence” parts.

Now, every quant of type a^+ and b^+ is carrying the unit $+1/2$ of energy as a quantum number, and every quant a^- and b^- the unit $-1/2$. Hence, the 4 pair quanta, above, are carrying the units $+1, 0, 0, -1$, respectively. Two of those 4 types are carrying non-vanishing energy values. When neglecting the tiny contribution of the valence part of a particle, then its energy – which, in its rest frame, is its mass – will be summing up as the resultant of the quanta making up the non-valence part of a particle. For an additional, dubious “Higgs” mechanism which the “Standard Model” is requiring, there is no necessity.

Astronomers defined Dark Matter by

- the existence of some gravitational activity
- combined with non-localizability of its source.

The first point is satisfied by the non-vanishing energy values out of the above “cloud”, which are subject to gravity. The second point follows from the fact that Einstein’s four components of bent space-time are “non-compact” operators of the “dynamic channel”. In order to reproduce some well-defined (“diagonal”) measuring value, a non-compact operator needs some “huge company” of quanta organized in some mathematically appropriate way.

This is the typical “emergence” case (i.e., a case occurring as secondary, afterwards, not being present originally): Like in

thermodynamics, where notions like temperature, pressure, or entropy are not yet properties of a single gas molecule treated by statistical mechanics, the “non-compact” properties of Quantum Gravity and GUT are “emergent” properties which only are “emerging” by the “cooperation” of very many quanta (i.e., by applying the law of great numbers), but they do not make sense in an application to a single quant or to a pair of quanta.

The non-valence part of a particle is big enough for showing up emergent properties – while the bricks of a single pair of quanta are by far not numerous enough. Hence, the exact location in space and time of a cloud of single pair quanta which do not “cooperate” with each other is impossible: Such a localization trial would yield some superposition of results smeared out over too large sets of different values; an individual, sharp value is not extractable.

Our GUT, thus, is reproducing and explaining the experimental situation of Dark Matter.

Be aware of not confounding a “quark”, which designates an entire particle – valence plus non-valence part – with a “quant”, which is just one of its “atomic” bricks – without any non-valence part.

Conventional fundamental physics (in its particle range) is based on fundamental “particles”. String models are taking over much ballast of the aged “Standard Model of particles”; but they still add some “double-point mechanics” (“strings”). Our New Physics is installing an entire new level of single, atomic point quanta far below the level of particles.

The reason why the “Standard Model” needs the Higgs mechanism is that it does not care about the existence of a non-valence part in an elementary particle. While New Physics is in the habit of casting these non-valences into definite Young structures, the “SM” tries to swallow all properties, which easily are following from such a non-valence part, into mystic “balcony mathematics” of physically rather non-transparent provenance. Instead of fundamentally renovating the model, one “balcony” after the other is appended.

The challenge for mathematicians, now, is explicitly to offer some classes of non-valence reference constructions which physicists could

put on the computer in order to carry out realistic physical calculations with them. For, “in physics, everything must stay finite”. Hence, the handling of all that “Young”-type mathematics of group theory might be easily left to the computer.

The Flow of Time, the Time Arrow

Let us consider some partial range to be cut out of our universe as a “closed system old” – and some shell range around it in addition. Both systems together are admitting their reduction according to the rules of group theory to a superposition (“direct sum”) of a number of resulting “compound systems new”.

Let us pick out one of those “partial systems new”. With a sufficiently small shell, it still will look similar to the “system old”. Particle physicists, hence, would try to express the relation “new” to “old” by some transformation:

$$|\psi\rangle_{\text{new}} = A|\psi\rangle_{\text{old}} .$$

For the fans of **mathematics**:

$$A \equiv \exp[i \sum_k \alpha_k G_k] .$$

In Quantum Gravity, α would be a parameter and G one of the 16 $U(2,2)$ generators – however, not as an operator, here, („open“ system!) but as some ordinary tensor like Dark Matter. (The exponential function, clearly, will be applied as some approximation, only, because its Taylor expansion is going up to infinity making it unphysical.)

This transformation also includes CMS-time and heavy mass as components, whose quotient is X-time; its sign is the “arrow of time”. The existence of many “compound systems” will lead us to the time arrow showing up the maximal change in X-time. (The Copenhagen interpretation will cut off all competing channels, anyhow; and cosmology does not know any quantum-theoretical alternative channels, either.)

When, in a thought experiment, considering all locations, sizes, and filling degrees (with quanta) of such (uncertainty) shells realizable in our universe, then we shall obtain the arrow of time as the maximal resultant of the two opposing effects of shell size vs.

the unitary transition probability (“new” to the “fit new”).

The existence of non-vanishing transition amplitudes $t - t'$ will lead to the result – paradoxical for a static space-time: Time will start running in short jumps; there is some self-created

steady flow of time.

Now, from experiment we conclude that, in a certain period of the past reaching up till to-day, the partial amount of Dark Matter within the „surrounding“ range of our universe should have been much greater than that of „ordinary“ matter. This, however, might not stay so for ever.

Thus, the actual „flow of time“, essentially, will be based on feeding up Dark Matter into our “system old”, blowing space-time up with it – cf. our cosmic hyperboloid, but cf. the old „Steady State“ model as well! At some era, this effect might stop, however – when a certain state of whatsoever equilibrium will have been achieved. A stationary time, then, will found some completely different type of physics. Or, the arrow of time even will be reversing. Contrary to conventional thermodynamics, which still is assigning a special role to time over space, the finiteness of our total universe in Quantum Gravity with respect to all parameters will suggest such a situation as realistic!

The apparent problem, thus, is a closed universe containing open subranges in the sense of conventional thermodynamics. On that base, Quantum Gravity will explain why, actually, it is physical standard to work in the dynamic channel of an “open” system.

Dark Matter, as identified by New Physics, in our world is omnipresent. Its sparse distribution, however, will admit just extremely rare reactions with “ordinary” matter. But these reactions do exist. The flip of all 4 of Dirac’s components into each other, and not just of spin alone, are part of it.

From an unequal distribution of Dark Matter, the challenge arrises for cosmologists to consider a rescaling of their time scales: time is running with varying “velocities” (widths of jump).

Pauli's Exclusion Principle

Group theory had been developed at the turn of the centuries 18XX to 19XX. Its greatest success had been the invention of its “Young tableaux”. At that time, only a few physicists took that new mathematics seriously. Einstein and the great majority of his contemporaries did not belong to them.

Hence, they had not been familiar with Young's “mixed symmetries”. Thus, their results only were a completely symmetric “Bose-Einstein statistics” for “boson” states (particles with integer spins) together with a completely antisymmetric “Fermi-Dirac statistics” for “fermion” states (particles with half-integer spins). The latter one is giving rise to Pauli's exclusion principle.

Neither did people take into account that there also could exist “mixed-symmetric” statistics – as needed for Gell-Mann's quarks – nor that Pauli's principle also could follow from different considerations – as it does, indeed, in the electron shells of atomic physics, e.g. This fragmentary input of knowledge, then, had been frozen in and considered as the last cry in the “Standard Model (of particles)”.

Up to my knowledge, no particle physicist ever has arrived at the idea that Pauli's exclusion principle could be a result of the action of some intermediate particle as it is customary to conjecture for all other forces of nature. The “SM” still nowadays, 100 years after the enthronement of those just 2 types of statistics, does not call the statistical origin of Pauli's principle in question: too many names of reputed physicists are connected with it.

But let us consider the gravitation law. Its force at rest is proportional to the gravitation constant G , for which experiment yields an extremely small value (in the frame of our conventional measuring units). However, it is no problem to boost that G up to some “ordinary” value about unity: We just need to multiply it with some appropriate factor such that the product, designating the revised gravitation constant, will become of the order 1.

In order not to violate the gravitation law, we, then, have to

multiply the radius r in its denominator by the root of the same factor:

$$(\lambda^2 \mathbf{G}) \frac{m_1 m_2}{(\lambda r)^2} = \mathbf{G} \frac{m_1 m_2}{r^2}.$$

After this extension, however, we have to measure the distance r not in units “cm” any more but in units of “cm” divided by that factor. According to the smallness of G , this will result in a length scale at about the order of a Planck length (10 to the power of minus 32).

While the “internal” interactions are acting on the valence part of a particle, gravity is acting on its non-valence part (the contribution of its valence part is negligible). Gravity is the singlet component with respect to “internal” interactions.

But is gravity the only singlet force with respect to “internal” interactions? According to the “Standard Model”, we first should bother about asymptotically massless (“gauge”) particles with spin=1 when looking for competitors of the graviton (spin=2).

Such a particle should be measured in the same system of measuring units (cm) we had applied to the graviton. Like the graviton, it would have some coupling constant of the order of the gravitation constant. As a “vector particle” – field theory is telling us – it would overlap the symmetric force of the graviton with some antisymmetric term. Furthermore, equal charges N would not be attractive, like in the case of the graviton, but repulsive.

However, such a particle is likewise unknown to experiment as the graviton itself. The graviton, however, will show up itself indirectly, by its symmetrical action of gravity, e.g. For an antisymmetrical vector part, there is no evidence in actual experiments. By this result, the topic of a “vector-graviton” as an additional “gauge particle”, usually, would have died for particle physicists.

But what, if such a “vector-graviton” had some mass small enough? Then, the long-range Coulomb force of such a particle would collapse to the short-range Yukawa force. Then, its existence would not necessarily contradict the experimental data any more.

Simultaneously, such a force would shrink from some form softly decreasing towards outside to some kind of “hard-core force” effectively concentrating itself in its centre. In fact, it would become effectively active only in the immediate vicinity to its centre. There, it would show up a strongly repulsive character.

Such an effect, however, is experimentally well-known, indeed: This is Pauli’s exclusion principle, which is prohibiting equal fermion states to coincide in all quantum numbers.

In current theory, this Pauli principle, according to the standard methods, is not traced back to the action of intermediary particles executing some force, but people, by history, are turning an abstract somersault by attributing the action of Pauli’s principle, in a mathematically abstract form, to a plus-commutator of the participating fermions (“Fermi-Dirac statistics”).

It is declared to a taboo to correct eccentric ideas of the past. Thus, former misinterpretations are assembling to some impenetrable jungle of predefined, premature trails. Beside the variation calculus, this is another fundamental conjecture of the “SM” which is not proved. In addition, it served as the base for introducing “2nd quantization”, which is making everything even worse.

On the other hand, that aged “Standard Model” with all its fictitious consequences of sophisticated internal contradictions has developed such a self-dynamics meanwhile that it is an absolute taboo even to touch its stronghold in order to correct its most curious ideas of the past leading far astray.

In the end, it does not even need an earthquake in order to make that house of cards crashing down. Former misinterpretations are bundling to an impenetrable jungle of predefined and premature commitments. This blind Babylonian confinement in terms of the “Standard Model of Elementary Particles” is making illusory every trial of renovating an incrustated physics. Its protagonists are defending it by teeth and claws. –

Still to clarify is: Why does Pauli’s principle act on “equal” particles only? When leaving neutrinos aside, one of the specialities of “unequal” particles is that their rest masses are differing. This

means: “Unequal“ particles have differing internal structure.

“Unequal“ particles, thus, cannot interfere even “approximately completely“. The “hard-core“ repulsion of differing types of fermions cannot become fully effective because their interaction ranges (with respect to this “vector-graviton“) only are of the order of a few Planck lengths, while, by their non-valence parts, the particles proper are spatially much more extended. Their repulsion, hence, is becoming observable to the experimentalist only if they are overlapping completely.

Thus, our “vector-graviton“ does succeed in explaining Pauli’s principle as an effect of some quite “ordinary” force, indeed. In this aspect, the old trial of explaining it by means of plus-commutators falling from heaven is looking somewhat helpless.

This, however, also means some rethinking process in our view of fundamental physics. This “New Physics“ is strictly colliding with the conventional, antiquated methods of the “Standard Model“. Even the community of physicists, since decades already, is suspecting that their “Standard“ is representing just one type of a model to parametrize nature by means of mathematics, i.e., that their aged “Standard Model” had long since been thrusting its limits.

By attaching one “balcony” after the other without giving up misleading structures included before, it is trying to survive and not to hobble too far after later experiments. Every “balcony“, finally, is leading into a thicker jungle of “truths“ and misinterpreted fictions and errors, which, then, quickly will start spreading their own way of life, with no chance ever again to be disentangled any more. This is the “Standard Model”, topped only by the “string models”.

Old-Timer “Standard Model”

Beyond lepton flavours, there still are “hadron flavours” showing up in experiment. These, however, are of totally different origin. According to current observation, hadron flavours are conserved in “strong” and electromagnetic interactions only, but not in “weak” interactions. Reversely, this also might serve for distinguishing interaction types against each other.

But what, really, are hadron flavours – when opposed to lepton flavours? First of all, their terminology is differing:

- An electron, muon, or tauon number designates a total multiplet of leptons, each, while
- the hadron flavours “charm” and “strangeness” are designating the identical flavour, however separated according to electric charge. And this holds for the flavour pair “top” and “bottom” as well.

The notion “hadrons” is comprising all particles exclusively composed of those “quarks” defined as such by the “Standard Model”. For our GUT we should redefine: “Hadrons are particles whose valence parts are exclusively composed of quanta with $L=0$.”

We all are familiar with the principal traits of that ancient “Standard Model (of particles)” with its three “generations” of up- and down-quarks, which all 6 are claimed to appear in 3 “colours”, each:

quarks		leptons		special bosons
up	down	e^-	ν_e	$g \ \gamma \ g_1 \ g_2 \ g_3 \dots$ $W^+ \ Z \ W^-$ $H_1 \ H_2 \ H_3 \dots$
charm	strange	μ^-	ν_μ	
top	bottom	τ^-	ν_τ	

If still considering their 2 spin components, each, and their corresponding antiparticles, we obtain $6 \times 3 \times 2 \times 2 = 72$ distinguishable states. These, alone for the quarks, are more states than our Grand

Unification has entries for all 64 fundamental states representing its periodic table for the total of basic states in nature.

But this still continues. In the “Standard Model”, for every quark there is both: a creation operator and a destruction operator, giving 144 entries, meanwhile. In our GUT extension of quantum gravity, all space-time structures are emergent functions of our 64 quanta – in the “Standard Model”, however, for every individual one of its 144 quark states, all these structures still are independent, additional space-time properties.

Provided we unpretentiously are considering the number 4 of its space-time dimensions as a multiplier, then we arrive at a number of 532 entries.

But all these only are the quarks. In addition, there still are analogous entries for the 6 leptons, for the graviton, for the photon, for the 8 gluons, for the 3 “weak” bosons, and for the Higgs particles, about whose existence and number people still are discussing with open end.

The content of the “Standard Model”, usually, is represented small and simple by dropping details and quoting just the 12 entries marked in red, above. The fact that it is summing up to a thousand (!) states properly to be distinguished as “fundamental”, however, is carefully hidden – an inflation of states! All smaller numbers are window dressing.

When compared with those giant numbers of the “Standard Model” – what, then, are our shabby 64 entries for a complete quantum gravity including its GUT extension! And how much more than the “Standard Model” does it deliver, in addition! Totally apart from the fact that our “New Physics” is clearing away all singularities including those additional inconsistencies the “Standard Model” does not get tired to pile up again and again.

In the particle tables of the “Standard Model”, the wildly proliferating multitude of special bosons – starting with the photon and ending up with the Higgs boson(s) – does not even allow any more to be stored in an ordered way. The existence of a couple of those particles even might be based on free invention, just in order to make disposable the desired minimal number of parameters needed

for the variation calculus.

Flavours

Lepton flavours had been identified to be structure differences in the detailed way a lepto-nucleus is bound within a particle. More generally, a flavoured particle had been defined as the copy of some well-known different particle carrying some additional, non-linear property whose occurrences can be counted. As a flavour is no quantum number, it is not absolutely conserved.

The “Standard Model” does neither explain the origin nor the number of its “generations” nor what they really are. For the leptons, the “SM” is sticking to its doctrine that they are constituting “point-like” particles without internal structure. The knowledge why, beside the electron, there still exist a muon and a tauon, consequently, must remain a dark mystery, there.

One of my main points of critics with respect to the “Standard Model” – beside its singularities and its additional inconsistencies – however, is its doctrine that a baryon is permitted to be composed of 3 quarks only and a (“hadronic”) meson of one quark/antiquark pair only. The non-hadronic mesons do not fit into the concept of the particle table of the “Standard Model”, anyhow – the unordered chaos on the right-hand side of the table in the preceding chapter is demonstrating it.

The reason: Otherwise, particles with unorthodox electric charges would emerge; by experiment, however, “there is no evidence for them”. People, hence, without any necessity, are prescribing a think ban to the theoreticians for all times to come! (Thereby, it is not even clear if such “resonances” have not yet been detected, indeed, but have been “discussed away” for the only reason that they are not fitting into the “scheme”.)

But why ranging that far. With just 2 spin= $1/2$ states (“quarks” as full particles in the “Standard Model”, “quanta” as valence structures in Quantum Gravity), no higher total spin than 1 can be packed together, and with just 3 such states no spin higher than $3/2$. The experimental tables, however, are full with particles carrying higher spins – still nowadays.

Then, people told to themselves, some "orbital angular momentum" should be added. By doing so, not the "spin" but the total angular momentum (spin+orbit) will become experimentally reproducible as the new "spin" – however, we know already that this is another story.

By Gell-Mann's quark model, such an "orbital angular momentum", strictly spoken, had not been covered. It is some auxiliary crutch wildly mixing up spin, orbital, and total angular momenta. By the misleading notion of an "angular momentum" for "spin" – though nothing is rotating – and by not properly distinguishing between the (topologically double-connected) rotation group $SO(3)$ and its (single-connected) covering group $SU(2)$, people were cooking everything in the same pot: "goulash physics"! Thus, it will be no miracle that an understanding of the real physics behind it is fainting away.

Immediately after Gell-Mann's introduction of his quark model, people still had argued more distinctly: An "orbital angular momentum" had been defined as the "internally" saturated compound of a co- with a contravariant quark. We, meanwhile, are identifying it to constitute a brick of Dark Matter or, slightly changed, of the non-valence part of a particle as well. (They, however, did not take it as a quantum pair, then, but still as a quark/antiquark pair.)

By multiplying this pair to some 2-quant meson or to some 3-quant baryon, however, we are automatically left with some 4-quant meson and some 5-quant baryon, respectively! If doing so another time (as a "d-wave"), this is proliferating, as the start of a "Regge-trajectory", in terms of a 6-quant meson and a 7-quant baryon, respectively. Etc.

In the light of the "Standard Model", these many-quant constructs had been inopportune. The "SM" went on prohibiting such constructions without any reasonable argument, purely by doctrine, as a nasty trick to prevent theoreticians from violating that think ban by the penalty of losing their reputation. Greetings from the Middle Ages!

Now, we do know by experiment that an "excitation" of a particle

is triggered much less expensively in the space-time octet of Quantum Gravity (spin, momentum, ...) than an analogous excitation in the "internal" octet of our GUT (charges, force types, ...). Spin excitations, hence, will be shooting up much faster than excitations of isospin, e.g. (confer the "Regge poles"). It is just this stricter rigidity of "internal" quantum numbers with respect to the space-time quantum numbers which is distinguishing these two GUT-octets from each other.

Let us, hence, forget those doctrines of the "Standard Model" and stick to experimental evidence. Our initial problem had been: What are hadron flavours? From the situation with the leptons, we stated already that "flavours are no quantum numbers but non-linear structures", especially, that simple ones that they can occur several times within the same particle valence.

The simplest way of constructing such a hadron flavour would be just to multiply some quant-antiquant pair to the quant we want to flavour which neither does change the additive quantum numbers nor the spin value of the "naked", unflavoured quant. Then, three "generations" with respect to hadron flavour could read

1.	$a^+ \cdot_{222}$	$a^+ \cdot_{122}$
2.	$a^+ \cdot_{222} (a^+ \cdot_{222} b^+ \cdot_{222})$	$a^+ \cdot_{122} (a^+ \cdot_{222} b^+ \cdot_{222})$
3.	$a^+ \cdot_{222} (a^+ \cdot_{122} b^+ \cdot_{122})$	$a^+ \cdot_{122} (a^+ \cdot_{122} b^+ \cdot_{122})$

e.g. (The labels given by dots are designating the respective spin combinations necessary for doing so.) Mixtures, at least among the 2nd and 3rd generation, cannot be excluded a priori. Additional types of generations are offering. Result: The (hadronically) simple-flavoured valence of a single quant is a 3-quant structure.

The (valence parts of) our customary nucleons (p,n) and of the least heavy delta-resonances (with charges ++,+,0,-), are 3-quant structures made of three a^+ -quanta, each (with the nucleons being of mixed symmetry and the deltas totally symmetrical).

After substituting a single down-quant (of Dirac's type "a") by its

3-quant $a(ab)$ flavour version of the second generation, above, the sigma-resonance (of electric charges $(+,0,-)$) will result as a 5-quant resonance. (In its $++$ version, there is no down-quant.)

Δ^{++}	$(+2/3,+2/3,+2/3)$	$aaa \rightarrow$	$-$	$-$
Δ^+,p	$(+2/3,+2/3,-1/3)$	$aaa \rightarrow$	$a a a(ab)$	Σ^+
Δ^0,n	$(+2/3,-1/3,-1/3)$	$aaa \rightarrow$	$a a a(ab)$	Σ^0
Δ^-	$(-1/3,-1/3,-1/3)$	$aaa \rightarrow$	$a a a(ab)$	Σ^-

When flavouring some a -Quant of type „up“ instead of the “down”, then we obtain the “charm” sigma-c $(++,+,0)$ instead of the ordinary, “strange” sigma $(+,0,-)$.

Δ^{++}	$(+2/3,+2/3,+2/3)$	$aaa \rightarrow$	$a(ab) a a$	Σ_c^{++}
Δ^+,p	$(+2/3,+2/3,-1/3)$	$aaa \rightarrow$	$a(ab) a a$	Σ_c^+
Δ^0,n	$(+2/3,-1/3,-1/3)$	$aaa \rightarrow$	$a(ab) a a$	Σ_c^0
Δ^-	$(-1/3,-1/3,-1/3)$	$aaa \rightarrow$	$-$	$-$

Additional substitutions yield the xi-resonances $(0,-)$ as 7-quant structures, and the “omega-minus” as a 9-quant structure.

Δ^0,n	$(+2/3,-1/3,-1/3)$	$aaa \rightarrow$	$a a(ab) a(ab)$	Ξ^0
Δ^-	$(-1/3,-1/3,-1/3)$	$aaa \rightarrow$	$a a(ab) a(ab)$	Ξ^-
Δ^-	$(-1/3,-1/3,-1/3)$	$aaa \rightarrow$	$a(ab) a(ab) a(ab)$	Ω^-

Correspondingly, K -and D -mesons will be 4-quant structures. Flavoured hadron valences, thus, are many-quant systems.

“Lepton flavours” – as structure differences of how the lepton-nucleus is tied up – and “hadron flavours” – substituting 1-quant by 3-quant structures – hence, are completely independent properties. Their treatment by the “Standard Model” in terms of common “generations” looks rather artificial, lacking any physical base. Only, the aged “Standard Model” does not know it better.

Parity

Parity is some mirror property in 3-dimensional location space. The typical example is a distance vector: After reflecting it in all its 3 dimensions, it will point into its opposite direction. This means, its components are multiplied by the number -1 ; this is its "parity".

Parity is a multiplicative property: As a product of location with momentum, an (orbital) angular momentum is fitted with the parity $(-1) \times (-1) = +1$. Hence, people are denoting it as a "pseudo-vector" or "axial-vector". The "1" may be dropped, its sign is sufficient: a parity, thus, is "positive" or "negative".

With respect to their space coordinates, 1-dimensional entities, correspondingly, are titled "scalars" and "pseudo-scalars", respectively. A colour "pink", e.g., will have the "parity plus" because it is "invariant" with respect to spatial reflections.

Mathematically, however, there still is a topological problem: "Location" is defined by some vector in 3-dimensional location space, i.e., its three dimensions are "orthogonal" to each other. Rotations in this 3-space are making up a group $SO(3)$ of transformations. But its spin-covering group is an $SU(2)$. With respect to this covering group, however, parity is not well-defined (because it is no group element)!

This fact does not change when proceeding to the Lorentz group of Special Relativity. Only in Quantum Gravity, parity, again, is a well-defined operation (an element of the group) with measuring values $+1$ and -1 . Particle physics, however, is restricting itself to Special Relativity. In particle physics, hence, the distribution of parity values is somewhat arbitrary, by chance.

The biggest partial problem with parity is that current particle physics is ignoring all non-valence parts of physical states; current particle physics only is handling valence parts (calling them "quarks" instead of "quanta"). On the other hand, by "irreducibility", a valence part of a state is inseparable from its non-valence part – otherwise, it will be mathematically inconsistent! Hence, current quantum field theories all are either mathematically inconsistent or not mapping

nature (or both).

A typical example is the acceleration of a particle at rest to a moving particle. In its moving frame, its 3-momentum will be inversed by parity, i.e., 3-momentum and parity are not measurable simultaneously (they are not commuting with each other). In its rest frame, however, 3-momentum is vanishing, and $+0 = -0$. In the rest frame, thus, for integer spin, parity might be defined by its valence part alone. Field theories are doing so.

Their propagation of this definition to a moving state, however, is mathematically wrong. For, then, selected aspects of the non-valence part will have to be entered again – this time by the backdoor – namely when, artificially, “p-waves” will have to be introduced into the calculation, e.g.

As one result we, thus, can state: To a moving state, no definite parity can be assigned; in a moving state, both parity types are overlapping in a percentage to be calculated from the acceleration parameter. Asymptotically, when converging toward the speed of light, there will result a parity mix of a 50:50 percentage.

Experimentally, this is best reported from the (non-valence parts of) neutrinos. They are blamed “maximally” to “violate” parity. As they are perpetually moving with the speed of light, there is no rest-frame to be scrutinized. Thus, by way of exception, people are forced to accept the existence of their non-valence parts. And, wow, people do not understand the world any more!

Well, Quantum Gravity shows that this behaviour of the neutrinos is exactly the correct one: not the neutrinos are “violating” parity but, in the framework of current field theories, the massive particles are not treated in accord with mathematics.

This parity of space inversion is a rotation just in the area common to the reaction and to the dynamic channel of our gravitational $SU(2,2)$. The additional parities of time reversal and charge conjugation, however, are $U(4,4)$ -rotations connecting both types of Dirac spinors, indeed. A “CP-violation”, thus, is some first direct experimental evidence in favour of a higher transformation group – like our $U(4,4)$ – beyond pure General Relativity ($U(2,2)$).

A lot more could be told about parity. But let me cut it short:

Quantum field theories are inconsistent. One of the major reasons is their ignorance of the implications of the mathematical notion of “irreducibility”, which, last but not least, can be traced back to Einstein’s “background independence” of General Relativity, especially in its quantized form, i.e., of Quantum Gravity.

I mentioned it already: The “missing link” between Planck and Einstein just is group theory giving Quantum Gravity. It is cutting the Gordian knot of misinterpretations piled up in an entire century.

Neutrino Physics

The exceptional property of the $SU(2,2)$ with respect to the conformal $SO(2,4)$ mentioned above is topology. In an orthogonal group, a rotation by 360° will reproduce the starting state – in a unitary group, however, we need 720° , i.e., double as much. Thus, a “simple-connected” orthogonal group only knows spin values being some integer multiples of unity, while a “double-connected” unitary group is admitting half-integer spins, in addition.

In the language of mathematicians, the $SU(2,2)$ is the “covering group” of the $SO(2,4)$. Experiment shows that in nature the covering group materializes, i.e., we do observe half-integer spins, too.

Now, in current field theories, “weak” interactions are alternatively mediated by one of the two electrically charged W -mesons or by their neutral Z -meson variant, respectively; and these mesons are known from experiment, too. Their lepton numbers are vanishing ($L=0$).

In order to split into a lepton/antilepton pair, the simplest ansatz for such a “weak” boson would be a lepto-nucleus bound to an antilepto-nucleus. Its valence part, then, would have to be represented at least as some 4-quant structure.

In order to mirror their appearance in terms of an electrical charge triplet, another, “ordinary” quant/antiquant pair will have to be bound in, making the “weak” bosons to 6-quant valence structures, at least. Such a $(3+3)$ -quant structure has negative parity. In order to get a neutrino into its decay products, which is a 50:50 mixture of both parities, still another “ordinary” quant/antiquant pair should overlap. Then, its total valence, finally, would become some $(4+4)$ -quant structure.

Two such “overlapping” partial states, however, are not “irreducible” as a whole. Hence, both overlapping structures should belong to the same GUT-representation, which, then, both would have to consist of a $4+4$ quant-structure. Then, however, their valence parities should not be opposite but equal. A chaotic tangle of contradictions is displaying.

Well, the way out of these apparent contradictions is swiftly uncovered: In one of the overlapping substructures, all four of its quant/antiquant pairs together are to be considered as an 8-quant valence structure, while, in the other substructure, three of its pairs are considered as a 6-quant valence structure with its pair #4 belonging to its non-valence part.

According to current field theories, this additional “non-valence” pair #4, however, will not be counted. Hence, we apparently are observing a “reducible” “valence mix”, which, in fact, is an “irreducible” superposition of partial terms of the total particle. Only, the “Standard Model” is providing misleading information because of its ignorance of non-valence structures, which, however, are inseparable in correct mathematics.

Hence, the problem is not with parity but with the “Standard Model”. Its ignorance of non-valence parts again and again is giving rise to sophisticated complications, preventing people from understanding nature. According to the “Standard Model” we are handling a “reducible” valence mix; according to the GUT, however, this is an “irreducible” total representation constructed of partial components each of which are consisting of valence and non-valence parts.

After that jumble in the “Standard Model” which does not properly distinguish among spin, orbit, and total angular momentum, here is its next muddle between valence and non-valence structures. Thus it should be clear why the “SM” is unable to incorporate the “weak” bosons into the set of “ordinary” bosons:

- 1. They are 8-quants with respect to valence ($8 > 2!$),**
- 2. Valence and non-valence parts are overlapping, and**
- 3. Non-valence parts are dropped in field theories.**

In terms of the dogmas collected to form the “Standard Model”, hence, the “weak” bosons are “exceptional” bosons which “cannot” be represented as “ordinary” bosons by quarks but need some special treatment in terms of an additional “balcony” to be annexed as

another one to the many of them still existing in the “Standard Model”.

It is this exception mysticism which advanced to the integral message of the entire “Standard Model”. People simply are refusing to believe that fundamental physics could work according to unified regularities.

Instead of consequently searching for some unified structure, the “SM” – always according to the politics of the day, short-sightedly, tactically – developed to an instrument of obscuring facts and, contrary to solemn declarations, with the effective claim of eternity – no matter that, then, quantum numbers will have to be “broken”, atomic physics (with its principal quantum number and its s/p/d/f/...-wave formalism) cannot be reproduced, etc, etc.

In my lectures, I proved that even the entire realm of “weak” interactions – leptonic as well as non-leptonic processes – is working without violating any quantum number!

As a last example, here, let me explain the solar neutrino conversion in the light of the Grand Unification. According to the “Standard Model”, for this “neutrino oscillation”, its three actually known variants of neutrinos should be massive. The problem only had been: The heavier neutrino should “decay” into the lighter one. But all three types are “decaying” (“oscillating”). The “Standard” solution, hence, is looking rather troublesome.

The GUT allows representing this oscillation as a scattering process with still massless neutrinos, instead of applying sophisticated decay scenarios. The other scattering partner is Dark Matter – remember that, in the GUT framework, the detailed structure of Dark Matter has fully been clarified and is at disposal.

Contrary to the situation in conventional scattering processes, the Dark Matter “states” – which are no elementary “particles” (“wimps”) – are not massive enough in order to effect any measurable change in the neutrinos’ energy-momentum. But, if all neutrinos are equally “heavy”, i.e., massless, the rare events of scattering at their valence parts are summing up on their rally from sun to earth. By a collision with the valence part of a neutrino, its internal structure could happen to flip to that of another neutrino type.

Different internal lepton valence structures, however, are signifying different lepton flavours. As the product of two irreducible states, usually, will not be irreducible as well, there are non-vanishing final neutrino probabilities for more than just the incoming type. Thus, oscillations to and fro are no problem; non-vanishing masses are not needed.

This, of course, only is observable as long as no competing process having a higher probability is masking it. For neutrinos, thus, it is ideal. This neutrino oscillation could be applied for measuring the Dark Matter density on the way covered by a “converted” neutrino.

The problem why a neutrino is presenting itself in just one of its theoretically possible two helicity states will be shifted to the next chapter. (Helicity is the projection of spin onto its direction of motion.) This fact, however, is already providing the answer to why the neutrino is massless: For, otherwise, it could be rotated to a state of opposite helicity keeping its particle number.

Speculative Selection Principles

The reaction channel of Quantum Gravity and its GUT-extension is conserving all individual quanta separately. For the “Standard Model”, this does not hold: By its “2nd quantization” of current field theories, an input quant (of “destruction” type) is allowed to annihilate another input quant (of “creation” type). Both input quanta, however, are equally-variant (of “ket”-type).

This, however, means a misuse of the commutator logics in order to circumvent the group-theoretical “reduction” mechanism: The sophisticated commutator logics of current quantum field theories is inconsistent, it is widely violating the conservation of probability.

Unitarity – pseudo-unitarity included – in its correct application, only is permitting the contraction of two tensor labels of opposite-variant quanta (“bra” vs. “ket”) to some double-quant singlet state. “2nd quantization”, however, is contracting just two “3-components” on the 16-dimensional sublevel. But, contrary to all assertions, this does not yield an overall singlet! Due to lacking summation, this even neither would work on an 8-dimensional level.

Especially, the conservation of the number of quanta (the first-order Casimir in the reaction channel, which is providing the positive-definite norm for probability conservation) is violated. In a mathematically correct application of group theory, an interaction process is causing nothing else than a reshuffling of the input quanta: No input quant is allowed to cancel another input quant, and no output quant another output quant.

By current quantum field theories, those pairs of quanta are swept under the carpet. There, however, they are summing up to the existence of Dark Matter, last but not least – or to its variants as building bricks of the non-valence parts of elementary particles, respectively. The “Standard Model”, then, of course, has to confess not to have the slightest idea what Dark Matter could be. Instead, the “SM”, without any success, is blindly playing around with its “wimps”: this is the old balcony tactics without strategy.

And, instead of curing those inconsistencies once and for all, the

„SM“ tries to paste up this fact by supplementing its “vacuum polarization” in order to fumble those pairs of quanta out again from under the carpet. –

But let us move to another point. Neither do we know how many fundamental quanta there are in our universe, nor do we know where they came from. But even if the clarification of their origin still is lying in the dark, actually – whatever there might have happened: according to what we are observing in nature, the conjecture is looking plausible that the subsequent two steps should have followed its creation history:

- Some selection should have found place: “Take that many quanta of that type”.
- In order to create an irreducible universe out of them, i.e., one in which all constants of nature are adopting fixed values not smeared out, some “Young symmetrization” of this selection should have taken place.

Now, the number of all those quanta, obviously, should have been awfully great. Hence, there should exist some giant number of such symmetry variants, in addition. To every variant, there will correspond some universe. There is no reasonable argument visible why those additional Young symmetries should not have materialized in nature, as well – on the contrary: just draw the parallel of a set of universes to a set of particles.

Last but not least, this point, of course, will be subject of some later confirmation by experiment – although our technology will have to be expanded considerably until then.

The above primary “selection” is grasping at a system of maximal “reducibility”: all quanta are existing independently of each other. Young’s symmetrization (on the 64-dimensional level) is creating some supercluster (a “multiverse”) of universes all related to each other. They are defining their membership by all possessing the identical total number of quanta and by coinciding in their linear (i.e. additive) total quantum numbers – as far as realized.

Only their Young symmetries, and, thus, their non-linear

quantum numbers will be varying inside our cluster from universe to universe. This is like the relation of the nucleon doublet to the quartet of delta-resonances.

Now, Quantum Gravity is based on the generators of a complex Lie algebra. As a product of 64-dimensional spinors lacking all symmetries, this multiverse, in its form "reduced" to a "direct" sum of universes each symmetrized according to Young, is subject to two differing structure principles: to an open system of $U(32,32)$ -representations and to a closed system of $U(64)$ -representations.

As a whole, both types of symmetries will have to coincide. For, both systems are originating from the identical multiverse. Hence, both systems, each one considered as a whole, will result from the other one in some well-defined way: a universe of one of these types will admit to be represented ("expanded") by the universes of the other type.

This repeated transformation ("rediagonalization") to and fro is relating the universes with each other. Hence, the boundaries of a single universe are not that important when handling a complex Lie algebra – instead, the multiverse is to be considered as the unit among whose "components", the universes, we will have to navigate.

By some totally different interpretation – which, however, is of no use physically, i.e., for an application to nature – the string-brane fans estimated the number of such universes in a multiverse to be of the order of 10 to the power of some 3-figure integer ("solutions" in their way of argumentation).

(On such a level of superclusters, thermodynamic processes, of course, will throw them into disorder to an extent that, on this level, we are not to expect to meet the members of such a supercluster = multiverse in concentration: great numbers of other types will have mixed in. Compare it with particle types on earth.

Insofar, we might as well consider the existence of Dark Matter as a resulting property of the other universes of relevance – having the interaction effect to make (not only our) time "flow".

The finite number of its quanta, in addition, together with the physical prohibition of constructing mathematical limits, is implying the finiteness in the extension of a universe. For, the values of a

spatial coordinate (here, in the CMS system) are summed up by the (finite) amounts of the individual quanta taking part in this summation. And beyond the last quant – there just is not anything more (i.e., the “raising operator” is breaking off)!

Our quanta are carrying eight types of “internal” charges $Z = N, Q, T, L, \Lambda, E, A, M$, as we learned. The finite number of quanta – summed up depending on Z (with differing signs), in the given chiral constellations of our universe is providing differing values for the oscillator horizons involved. Corresponding results will hold for the eight energy values.

I went already into the differences between horizons of microscopic, macroscopic, and cosmic orders of magnitude. A special reference will be needed for the observable particle spectrum depending on which horizons we are watching from outside and which ones from inside.

The boundary between both types, however, is some purely biological, i.e., chemical product, depending on our own size in meters. Thus, a certain aspect of subjectivity will enter the physics described by us! More of it in a subsequent chapter.

But let us return from philosophy back to physics. We had observed that, in our final universe, valence quanta are acting as condensation germs (“vacuum cleaners”) for not summarized quantum pairs, which, according to the law of great numbers, are assigning dynamic properties to them (space-time, mass, energy, etc.) in terms of non-valence parts.

This, however, does not change anything with respect to the fact that, now as before, just 64 different types of states can be stable, there; they, now, only are lumping together differently under the action of their forces – oscillator forces, Coulomb/ Yukawa forces, many-body forces:

16 states	Dark Matter,
8 states	electron/positron,
8 states	proton/antiproton,
8 states	„exotic“ (anti-)fermion,
12 states	3 (anti-)neutrinos,
4 states	photon,
4 states	graviton,
4 states	Pauli's $\otimes(0)$.
64 states	

Such a special selection of the correct number only can be the result of a consistency check "in nature". But what is behind it?

By nature, all primary "internal" quantum numbers are equivalent. Only their differing numbers selected for our special universe are leading to their different radii of horizons and, beyond them, to their differing secondary properties. The Young symmetry of our universe will have a certain, confining influence, in addition.

Beside the Dark Matter bricks, whose "internal" quantum numbers are summing up to "internal" singlets (like in a noble gas), there still should be crowds of non-summarized, "internally" just "neutral" quantum pairs in our universe (having all $Z=0$). They are expected to contribute the majority of the non-valence parts of particles in addition to the Dark Matter bricks. It still is an open task to find out their distribution on the non-valence parts of

- **the three massive fermion types,**
- **the three massless fermion types, and**
- **the three massless bosons.**

Knocking this distribution key depending on the selection manifold of quantum types for our universe is an actual challenge.

Implicitly connected is the smaller problem why quanta are organizing themselves just in those particle classes as there are:

- ❖ **24 = 3x8 massive particle states and**
- ❖ **24 = 12+12 = 2x(3x4) massless particle states.**

(“Massless” in the context of measuring uncertainty).

Somehow, this “smells“ of some behaviour according to symmetry/antisymmetry not yet identified. In addition, some 3-partition seems to play some role. These could become points for an onward treatment of the patient by appropriate subgroups.

Experiment

Observe that, in the above table with 64 entries, beside Pauli's boson, just 3 masses are left still to be explained. They should be functions of the distribution key mentioned, which is representing nothing else than some approximate "consistency relation" among the different aspects of our universe, based on the differing numbers of quantum types attributed to it by its Young-Tableau.

All additional massive states should be considered as being instable, "virtual" – sometimes with some rather long half-time, though. Atomic nuclei, e.g., are decaying into their components by thermodynamic collision processes of sufficient energy. –

The declared endeavour of the "Standard Models" to cancel all parameters out of a theory, is led to absurdity by group theory. For, a configuration – including that of our universe – is characterized by the parameters of its representation (in our GUT, their number is 64) from outside. Beyond this, however, a configuration also means a certain component in the interior of this configuration. Its fixation means including additional parameters.

By its "freedom from parameters", the "SM" pretends to know the superior, "embedding" system fixing those parameters in this and no different way. Otherwise, remember the picture of somebody trying to tear himself out of the swamp by his own hair!

Now, a scattering process has two sides: input and output. Both sides are representing product states to be "reduced out", i.e. to be multiplied and expanded into a sum of "irreducible" (i.e., not further separable) states, each. For the input side, it is the spectrum of its (intermediary) "input channels".

Their relative probabilities, however, still are depending on the collision energy, too: The stronger the collision, the more additional output channels will show up. The probability for every individual channel, when drawn over the collision energy, will typically remind on a bell-type curve with its "peak" somewhere. The location of that peak, its width, and its height are parametrizing the "resonance" mass, life time, and coupling strength.

The “rest masses” of “resonances”, contrary to those of stable particles, are no fixed values but varying more or less widely. As these curves, usually, are not even symmetric, it is a matter of definition which value will be accepted as its rest mass: are we to take the energy value of its maximum? Or do we take some value averaged over a certain width? But over which one?

Theoreticians agreed on some arbitrary definition. From their calculations according to the “Standard Model”, they, usually, obtain (overlapping) symmetrical resonance curves (“pole models”) which they are classifying according to height and width. For the experimental curves, these are pretty rough approximations. But people are living with them, they got used to it.

The reason why current theoretical models are fitting the experimental curves not exactly, is that theoreticians are not applying models which are conserving probability exactly: “Feynman graphs” are not unitary; they are abounding in inconsistencies, singularities, and arbitrary ansatzes out of the ancient relic “variation calculus” of yesterday’s classical point mechanics.

To those relics, “coupling constants” are belonging, too. Strictly speaking, we would expect that those couplings, as consistency criteria (“Clebsch-Gordon coefficients”), should be fixed uniquely.

But just this symptom of an inconsistency – I am not talking about its reasons – is massively hitting Feynman’s graphs. It is one of the unalterable reasons for the subsequent necessity of a, mathematically unreasonable, “renormalization” (whose method is: infinite minus infinite = finite!). The mathematicians could kick themselves!

Thus, the introduction into the model of one inconsistency is giving rise to having to introduce the next one – just in order to compensate the biggest mistakes triggered by the previous inconsistency – the well-known *circulus vitiosus* inherent in the “Standard Model”!

Quantum Gravity and its extension to a Grand Unification are avoiding those mistakes. As a general-relativistic model, our GUT is respecting all that by construction. In the GUT, resonance structures are calculable exactly, their coupling constants included.

Now, nobody can prevent us from introducing arbitrary measuring units, as we have seen already with the gravitation constant, where the natural parameters had been replaced by the metrical measuring units. For gravity (including Pauli's principle) the origin of those fatal measuring units is clear.

The magnitudes of the coupling constants of "internal" interactions, however, will find their origins in their horizon parameters, and they in the above "distribution key". Thus, the scattering parameters of particle collisions are traced back to the properties of our universe.

Let me remind that, for a primary input, we only have a few stable (types of) particles at disposal, and that all output channels, last but not least, are decaying into these stable particles again. A decay width greater than zero means some non-vanishing half-life time. This, however, is indicating the necessity of considering the time expansion of an open system. In the GUT, all those reactions are principally calculable.

By the knowledge of those parameter values, hence, all resonance structures are predictable in detail, and, thus, all resonance "masses" and widths (half-life times) – and the total spectrum of all resonances and the decay of resonances, in the widest interpretation of this vocabulary, in addition. Their resolution for special, short-living intermediary states is calculable, too, like those the Feynman graphs typically are providing, even if inconsistently.

Technically measurable, however, are those "intermediary" states – below some minimal half-life time – only indirectly, whether by summing up decay products which, presumptively, are belonging together or by the interpretation of summed resonance curves. All additional structures possibly might be of intellectual interest, but they are of purely theoretical nature.

As all representations are finite, their reactions will be calculated most simply by numerical methods, by putting the Young symmetries needed on a computer.

What we still need from the mathematicians is a concept based on selected 4- and higher-dimensional Young frames beyond Fermi

and Bose statistics giving approximate expectation values of the non-compact generators in terms of emerging parameters.

Research beyond Limits

The “internal” octet part of the Grand Unification defines eight distinguishable types of quanta of Dirac’s (“creation”) type “a”, grouped in 4 isospin doublets. Two of these doublets (those in “yellow” and “green”, below) are similar to those the “Standard Model” has accepted as its up-and down-“quarks”.

The first generation lepton doublet of the “SM”, in our GUT, is replaced by our “leptonic” doublet (in “blue”) – which, however, is closer to the origin of “weak” interactions than the “SM” is with its three “weak” bosons. We are familiar with that table already.

	N	Q	T	L	Λ	E	A	M
a_{i211}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$-\frac{1}{3}$	0	0	0	0	0
a_{i111}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	0	0	0	0	0
a_{i222}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{2}{3}$	0	0	0	$+\frac{1}{2}$	$+\frac{1}{2}$
a_{i122}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$+\frac{2}{3}$	0	0	0	$+\frac{1}{2}$	$-\frac{1}{2}$
a_{i212}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$-\frac{1}{3}$	$-\frac{1}{2}$	$-\frac{1}{2}$	0	0	0
a_{i112}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{2}$	$+\frac{1}{2}$	0	0	0
a_{i221}^+	$+\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{2}{3}$	$+\frac{1}{2}$	0	$+\frac{1}{2}$	$-\frac{1}{2}$	0
a_{i121}^+	$+\frac{1}{3}$	$-\frac{1}{3}$	$+\frac{2}{3}$	$+\frac{1}{2}$	0	$-\frac{1}{2}$	$-\frac{1}{2}$	0

The last doublet left (in “red”) is our “exotic” one. Its lepton number L is opposite to that of the leptonic doublet. This doublet is the only one carrying the “exotic” quantum number, and the “exotic” horizon is assumed to be the smallest of all horizons, even much smaller than that of the leptonic doublet.

Based on “exotic charge” to substitute the “leptonic charge” of the leptonic doublet, this charge allows the construction of an “exonucleus” in striking analogy to the “leptonucleus” of the leptons: In this “exonucleus”, the (“red”) “exotic charges” of both participant quanta again are saturating each other exactly. As those “exotic” quanta do not carry leptonic charge, in addition, their next higher horizon is that of triality, the main component of the “strong” nuclear forces.

But, contrary to the situation in the leptonucleus bb with $T=+2/3$, the exonucleus aa is charged with $T=+4/3$. Hence, it can bind 4 “ordinary” (“yellow”) quanta with $T=-1/3$. This small example shows, that the binding power and the binding variability of the “exotic force” are much greater than those of all other forces.

A huge range of subnuclear types of crystals, polymers, and metal-like “exotic” matter will offer. And, due to the enormous forces acting, extraordinarily high compound masses will be created on a minimal space volume. Remember that, on earth, crystal-like structures are building up mountains, continents, even the entire outer crust of our planet, while its core is made of iron, which is a metal.

It even might happen – but, without having calculated it, this must remain a speculation at the time being – that those correlations of mass and space somewhere in our universe could suffice to trigger a gravitational collapse. This would explain why we did not yet observe any “exotic” matter, and this could explain (one of) the mechanisms how a Black Hole might be initialized.

Our atomistic model is working on 3 levels. With increasing orders, these are:

- the $8 \times 8 = 64$ quanta.
- elementary particles,
- universes.

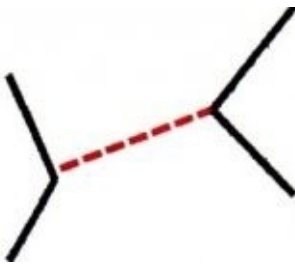
One level higher, then, our own universe should have to be interpreted as some interference pattern of some correspondingly higher “super”-structure. Its apparent “irreducibility”, then, would not be quite exact, either.

Black Holes and their event horizons that typical for them, in the sense of particle physics, which only is reflecting Special Relativity, are “virtual” sections of our universe. As such, in the sense of particle physics, Black Holes should be asymptotically unstable, inclining to split off parts in order to pass over into stable, “real” states – and that not only in terms of a mere thermodynamic radiation of heat a la Hawkings.

In particle physics, the collision of one “partial complex” with another one means a scattering process. It may also be “inelastic” if it is leading to the absorption of one of the complexes (= particle) by the other. The product of two “free particles”, usually, will be reducible (i.e., there is more than just one resulting state). Particles are “free”, however, only if we are considering their embedment into the total system to be switched off.

In summary, without any explicit calculation, our statement will read: A Black Hole should be the point of attachment for some interaction. In the sense of particle physics, this interaction might be internal or external. If internal, we would talk of a “fluctuation”.

The external variant, however, is worth to be investigated somewhat more thoroughly:



For, the 3-vertex of an intermediary exchange component (dotted line in red), can be either a starting or a target point, and for an “external” interaction, we would have to consider 2 (partial) systems instead of just one (the two black lines passing through on the left- and right-hand sides).

(The notion of an “external interaction”, if taken seriously, is a contradiction in itself. For, 2 “free” states cannot really “interact”, and, provided they do interact, then they are not “free”. This contradiction has its origin in the asymptotically abstracting S-matrix formalism of particle physics. We shall have to live with it.)

A target point for absorption is some object which once had been called a “White Hole”. It should distribute at least parts of its absorbed energy to its environment. Unfortunately, experimental analysis is proceeding rather tediously. At the time being, only quasars would come into question as such “radiators” – if at all:

there still are objections by cosmologists.

When disregarding that the existence of the (red) exchange particle, which explicitly is documenting the interaction, just is one of the characteristics of the irreducibility of the total system, and when – in the sense of particle physics – considering the two (black) states passing through as "free universes", then, in this terminology, Black and White Holes could well be interpreted as package stations to or from "other" universes.

In translation to the level of elementary particles, these "packages" could be compared with the individual quanta (or pairs of them) which, in the escort of their valence part, are making up the non-valence part of a particle in summary.

Because of that, they neither must all arrive at precisely the same time nor location in terms of one "single" White Hole. They could, as well, maintain some (in cosmic dimensions:) longer lasting firework of a multitude of hits, one after the other, at several locations distributed all over our universe.

Due to the topological properties of Einstein's differential-geometric equations, cosmology is treating only "connected" structures. By group theory, on the other hand, such a sometimes rather sophisticated structure might be partitioned into several simpler, formally disconnected components as well, while, by Einstein's method, such a structure will have to be managed as one total event in terms of one single structure, no matter how it might be connected.

Cosmology tries to cut short different positions of its topological structures by "worm holes". Its hopeless handicap, however, is that Einstein's topological concept is lacking the superposition aspect of quantum theories. On the other hand, its irreducibility concept, when formulated in terms of background independence, here, even is looking somewhat more conclusive than in naked particle physics.

In Einstein's differential geometry, every universe has its own space-time, without any relation to any other universe. By Einstein's differential geometry, every universe has its individual dynamic parameters. Einstein's "worm holes" are representing narrow pathways inside one and the same universe.

Quantum Gravity and GUT are more flexible. Their product structures are not contradicting their own “reductions” into sums of “intermediate” structures each of which is “irreducible” independently of any other one. Their individual space-times, all the same, are deriving from each other in some calculable way. They are supplementing Einstein’s world by quantum-theoretical effects.

The “worm holes” of differential geometry, which are purely internal to a universe, in Quantum Gravity and GUT are becoming internal but also external (“intermediate”) exchange structures in the sense of particle physics.

The exciting fact in Quantum Gravity including its GUT-extension is that all that can be calculated explicitly, step by step, in detail.

And this holds both for the level of elementary particles as well as for the level of a universe. The calculation routine still might be at its start. However, we finally have got the mathematics necessary for doing it, now!

By experiment, the slow-time procedure of cosmic reactions may be of use for understanding the details of particle reactions proceeding ultra-fast. Reversely, the interaction processes of particle physics might contribute to the long-term understanding of the fate of Black (and White) Holes as well as of our universe as a whole.

The introduction of a new level of “quanta” below the level of elementary particles into physics by Quantum Gravity, thus, is immediately leading to the introduction of some similar level above the level of our own universe. The ability of “perforating” the notion of “irreducibility” in the sketched way, in near future could permit “New Physics” to proceed to statements concerning the immediate environment exterior to our own universe which might be checked by experiment.

Quantum Gravity and Life

With the velocity of light set equal to $c=1$, $1 \text{ sec} = 300.000 \text{ km}$. To us humans, thus, time is appearing badly compressed with respect to location: $3 \text{ cm} = 1/10.000.000.000 \text{ sec}$. What might happen in location at a journey (of a light ray) from the earth to the moon (384.000 km) will proceed on a time scale within roughly a second.

On a time scale, a 4-dimensional cube of 3 cm edge length just is $1/10.000.000.000 \text{ sec}$ wide. In human scales (cm , sec), this cube will resemble a “time slice” of almost vanishing width perpendicular to space. “Motion” in time direction will appear to us like skimming through a stack of paper leaves.

Now, such a “time-leaf” will not exactly be of vanishing thickness, in fact, but extended – whether by c not being infinite or by the action of “non-compact” operators “smearing out” coordinates to become continuous. An object will extend over ranges in 4 space-time (+ additional) dimensions. Hence, a great number of points of the bent hypersurface of our universe, as defined by the 2nd-order Casimir, will belong to it.

A living creature is some special, transient “object” (some constructive interference), confined in space and time. We humans, too, our brains, the neurons therein, ... are “objects” extended over coordinates hardly longer than the “order of magnitude” of the above cube. Without doubt, a (higher) living creature is constructed in a way that the installation of some storage called “memory” will belong to it, which will be continuously copied and supplemented in its neurons. Its degree of filling is a measure of elapsed lifetime. – That far the static frame.

“Extension”, however, will comprise more than just one “point” in a system of coordinates. Provided, among them, there are such ones, in addition, which are representing some physical measuring device + storage, then, the extension of that object across those points will dynamically enable the construction of some fixed memory out of input + output.

This combination, however, yet is representing an “action”. A

static “consciousness” on special “events” of the past – repeatedly re-readable and selective in time – does not contradict the laws of nature. The static extension in time direction might be interpreted dynamically as an event of genetically predefined copy procedures with variations (creation, growing, aging, mutating, dying, decaying/being eaten up).

After having corrected the Copenhagen interpretation of the measuring process not any more to be some abstract, mathematical “projection” but a (unitary) “rotation” including the measuring equipment, physics reveals itself to be totally deterministic – such as Schrödinger’s equation had been before, already, between two measuring processes.

Now, the notion “velocity of light” will have to be handled with care, however: Due to the non-commeasurability of the four components of space-time with each other, measuring the quotient of space to time deltas hardly will yield an exact value!

On the other hand, we do need some conversion factor between cm and sec. This constant conversion factor on the one hand and the unprecise measuring result on the other hand, usually, are identified with each other in physics; both are denominated “c”. This is misleading. However, both are allowing to be fixed separately: the conversion factor in an exact way by the Lie algebra, and the approximate, measured value by experiment.

With time running, everything will happen in some purely deterministic way, everything will show up to be correctly synchronized with each other. Statically, Einstein’s bent hyperspace of our universe will correspond to some type of wallpaper with a rigidly imprinted event pattern, on which we only need to mark the predefined pathway with our marker – corresponding to the additional Casimirs in connection with the initial conditions. At a first glance, there will be no motion, everything is fixed, static!

That “pathway” to be marked, however, will be pursued, indeed, only because we are not in a “closed” system in the sense of thermodynamics but in a (partially) “open” system (cf. the chapter “The Flow of Time, the Time Arrow”).

In order – as asked for – just to store the local past ever actual,

and not the future, in addition, our brain first will have to determine the sign of our time arrow. It might be this determination of the direction of temporal increase which, together with filtering out the essential extract, which will make necessary those 300.000 km. The decoding of this algorithm would mean a grand progress in brain research – and in technology as well!

(Let me remind you that, in echo-sounding, a bat is able to properly resolve differences in travel time of the order of a millionth of a second, while the human eye still is managing this for a colour in the green range for frequencies of light down to 10 to the power of 13 per second!)

Our organism, the above cube, thus, only will “know” the past out of its storage, including the rich world of feeling deposited there. According to our above ansatz, however, it does not “know” anything of our present and future. Some “jump in time“, forward or backward, on this static scenery, within its own life span, would stay unobserved by this organism. For, its ever actual home (i.e., its consciousness), at any time, will be its castle: additional information beyond its actual state of mind plus its remembrance of the past will not be available, there!

A jump back from future, inevitably, also will cancel the storage it is disposing of, there, in future, resetting it to its now “actual” state. Its memory unilaterally directed backward will give it the subjective impression always to proceed forward in time.

This generating algorithm for a temporal increase would be expected as some tightly wired component of the respective object, like a gene in its DNA or like the sound on a disc. The final fixation of the sign of the arrow of time, then, will amount to a matter of the constellation encountered in our universe. The increases of the remaining (commeasurable) parameters, then, will result from the Casimirs (+ the actual initial conditions). Without moving anything physically, only due to its tightly wired, readable prescription, that object will develop something like an internal, static feeling for the sequence of times.

Our special object will have exactly those contacts to the surrounding parameter space of our universe at every time of its

delimited existence which is corresponding to the laws of physics as fixed by the Casimirs on that “wallpaper”. Even the “free will” by which we want to contradict, on the base of our 64 types of fundamental quanta will be of purely deterministic nature.

But I do not want, here, to follow up those ideas of a more philosophical background in too much detail.

The total “wave function” – as everybody knows – is working on a completely deterministic base – and not according to some principle of chance as the probability aspect could suggest if not interpreted correctly. (Only the “eigenvalues” are “physics”; intermediary interpolations just are reflecting the superposition character of differing “eigenfunctions”.) As it should be, probability considerations, then, still are secondary interpretations out of an imperfect description.

The problem that everything “would” move correctly but nothing “is” moving, merely is a problem of the “reaction channel” in a “closed” system. In the “open” system of its “dynamic channel”, however, due to its definition (“open”), just the range of consideration will change by successively in- and excluding more and more quanta. Substantially, however, nothing will change.

This varying multiplication pattern is giving rise to a corresponding variation of output channels, too. The smallness of time jumps is the source of a subjective, quasi-continuous “flow of time”. On the “wallpaper” mentioned above, the arrow of time will point into the direction described in the respective chapter by means of an algorithm.

– Possibly, something like this will be behind the mechanism practised by the human brain. In any case, the (necessary) introduction of a level of “quanta” into New Physics far below the level of Gell-Mann’s quarks has been giving rise to recognizing that quantum theory does not owe any mysterious, peculiar, own concept of probability and indeterminism, as fans of the Old Physics love to ascribe to it.

Let me conclude with a remark on the two aspects of time never to be confounded with each other. In the reaction channel, time is a group generator having finite “eigen”-values in a “closed” system.

For adapting to the “open”, dynamic channel, however, this system will have to be extended by some component of pure tensor multiplication according to Young’s rules.

In conclusion, let me return to the leading ideas behind introducing a new title to this booklet. These have been the two aspects of time never to be confounded with each other:

In the reaction channel, (CMS-) time is a group generator made of “raising” and “lowering” operators in a “closed” system. In the “open”, dynamic channel, however, the system is continuously changing its size, in addition (within our delimited universe). By continuously adapting to it, time apparently will be looking unbounded, there, at least as long as it does not thrust its boundaries.

Insofar, time will extend itself from a pure generator in the “closed” reaction channel to some “total time” in the “open” channel by swallowing up more and more additional quanta of its environment, multiplying them according to Young’s rules of tensor multiplication:

$$T_{\text{open}} \equiv T_{\text{generator}} + T_{\text{tensor}} \cdot$$

Compare it with a spin extension by orbital angular momentum to some total angular momentum. It is that “tensor” component of the “open” channel, which is responsible for the irreversible, “steady flow of time”.

However, the same effect will hold for location as well. The reason why this twin effect had not yet been realized officially is the huge conversion factor between time and space: the velocity c of light. The steadily growing absolute time is accompanied by steadily growing absolute space coordinates in our universe. This is the spatial

”expansion of our universe“.

But, in order to really perceive it as some „flow of space“, the corresponding object should not have human size but – factor „ c “! –

astronomical extension and longevity!

Lost Ages

Nature is complex – fortunately not that complex that we could not be up its tricks. This, however, is a task to be accomplished step by step. For, we are a part of nature. Hence, we are kept from watching nature completely as some external observer could do it "from outside". We are embedded in it, being able to extend our horizons from generation to generation just gradually.

This extension of horizons is the duty of fundamental physics. At the time being, medicine and psychology still are intervening strongly. They have to teach us how our human senses are working by which we are trying to uncover nature: We cannot judge what is, but only what our senses and the technique generated by them are providing to let us perceive.

A shark is in the habit of observing electric fields, the seasonally conditioned migration of birds is based on their orientation by the magnetic field of the earth. We humans, instead, will have to investigate special technologies in order to achieve some corresponding knowledge of phenomena which are part of the medical senses of animals.

But we can do that. And even much more. In every case, we only must know what exactly we want to find out. Then, one day, we shall succeed somehow. But nobody can deprive us of this targeting. Dogmas are requests of capitulation. They are documenting the wealth of ideas of outdated eras embedded in concrete. The creation of dogmas of any kind should be sharply attacked by every physicist. Dogmas are the death of science.

Still far back we, actually, are in the research of our brain – although progress is proceeding rapidly in this field, too. Chemistry once had been an independent science, with its origin in herbal lore and alchemy. Meanwhile, it has fallen back to the state of a partitioned science, subordinated in parts under atomic physics and partly under thermodynamics. It might be just a matter of time when medicine will take the same way.

A more serious problem is the influence exercised by not fully

occupied amateur politicians disinterested in long-term cognition. Fundamental research is increasingly advancing to be reorganized according to the short-term conceptions of medieval upper classes, which, since the economization of science on behalf of Globalization, are systematically working on the suppression of any liberal and democratic structures of competition. This is harbouring the huge danger of reflecting some kind of medieval "Stone Age", with its omnipresent inquisition and censorship. Their functionaries already are standing by in their starting holes.

With their special interests, concerns are defining the working scopes of universities, stigmatizing fundamental research as uneconomic, to run the gauntlet – unless governmental grants with their inexhaustible tax money, like at CERN and with the Strings, are backing it. Not any more results and solutions are asked for but "the road is the target" – the advertising success with people not understanding anything of the problems, neither intending to do so. This is politics at its "best".

One day, the sparrows will whistle from the roofs what Quantum Gravity and GUT had detected and described decades ago already. Everybody will know the solutions to century-old problems. Only universities, which are responsible for it, due to their prescriptions of censorship will officially stay doomed to blind-man's buff.

As a simple employee, Einstein still could freely publish his ideas in 1905, in spite of lacking a doctor's degree, in spite of lacking a membership in any official research institution, and in spite of lacking any sponsor. To-day, with our actual rules, he would be kicked out edgewise when daring to try officially to publish whatsoever. To-day, references are what is counting, not scientific results nor solutions.

According to our actual regulations, professional circles, nowadays, would treat Einstein as a poor fool, stamping him to a local half-wit unable to work on science. Nowadays, a person like Einstein would not be admitted to publishing anything. Imagine what our world, thus, is losing, year by year.

The economic censorship of research results, meanwhile, has become a superior maxim of the governmental instinct of self-

preservation. Real cognition is rigorously prosecuted and punished as a threat to the assets of their most intimate circles. Think bans are trumping, the darkness of mediaeval ages revived, whose gloomy shadow is rising from musty graves. The cementation of non-science as a means of power in a self-glorifying plutocracy. The execution of policy by lobby-dependent puppets and their compliant authorities.

The actual Crux is: Nobody is interested any more in the creative detection of novel relations, i.e., in “research”. Just the combinatorial assembling and maximizing of long-known pieces to new entities, i.e., “development” is asked for. For “research”, we would need universities, for “development” technical collages will do it.

It is this fine difference which is brutally swept under the carpet by transforming researching universities to technical colleges. The result of such a purely engineering development only means stress and incompetence to replace open-mindedness for novel foundations. It is living on the substance.

That “technology by balconies”, as exemplified in the “Standard Model”, is thrusting aside the acceptance for novel insights. It is the typical example of a monotonous tinning factory. Working style: Casting – the pricing of unimportant trends of fashion by chance, the merciless suppression of all productive outsiders.

Didn't we meet all that in past centuries already?? History is repeating. “Change” is exhausting on its vocabulary. Modern funeral piles are more subtle. Without research, one day, development will idle away.

45 long years of Strings and Branes, with 10.000's of theoreticians, without any result of physical relevance are documenting this more than evidently. String handling reminds me on the medieval alchemy: a field boasting of activity but unable to present the “gold” they had promised to produce – and all that since half a century.

What a revolution in fundamental cognition, instead, did just 3 decades bring about with only a few theoreticians – from Planck via Einstein, Schrödinger, Heisenberg, and Dirac up to deSitter! Their research results, once, had given rise to turning upside down our world in a considerably shorter time and with much less expenditure.

Their key to success had been physically to uncover the laws of nature instead of “decreeing” them by jurisdiction (cf. the strings, cf. the “Standard” Model), and woe to the “law” breaker!

Of course, it is much quicker to look up a specific name in a list than to peer-review the quality of a scientific idea. Publishers are lazy – too lazy in order to defend scientific standards! In Einstein’s times, the proud principle “Facts prior to the author’s descent” still governed research. In the meantime, however, priorities changed: “Descent prior to facts”, back into the ages of small-minded dynasties of “noblemen” telling to the folk what is to be “true”. Long live this censorship on the level of selling bananas!

In his time, Dirac once had represented his fundamental fermions in terms of his 4-dimensional spinors. He did not even arrive at the idea that they could be parts of a far more embracing 8-dimensional structure separating off his covariant labels from his contravariant ones by assigning both types of 4-dimensional labels to different, individual groups – each set according to the sign of particle number.

By such a mere reorganization of components, an 8-dimensional structure, formally, is splitting into a pair of 4-dimensional structures, i.e., a single point into two points. While a single point still will denote some 0-dimensional entity, i.e., a point, 2 points, formally, are characterizing some 1-dimensional format – a line, a “string”. “Branes”, finally, are the higher tensor levels.

The $U(4,4)$ - and $U(32,32)$ -variants of the 8- and $8 \times 8 = 64$ -dimensional Quantum Gravity and GUT, thus, might be sold as well as additional “String Models”. But contrary to the still existing models of that name, they would be representing a “string” model which does provide physical results, indeed, i.e., some working form of a string model – which, beyond this, even is in accord with experiment!

Hence, I am strictly in opposition to degrading Quantum Gravity and the GUT by that denotation; in those approximately 50 years since Veneziano (1968), “String Models”, acquired too ill a reputation with their bombastic expenditure of formalism.

On the other hand, it will be no miracle if one or the other

property current to us from the string/brane models will come across in our QG/GUT-model as well. For, last but not least, the string models cannot deny our double 8-dimensionality, either. Instead of multiplying them to $8 \times 8 = 64$, however, they are adding them up to $8 + 8 = 16$. By some correct handling, they (unnecessarily) just would renounce 6 of the 8 chiral components of our GUT.

But, contrary to our transparent top-down management, string models are sticking to their classically circumstantial infinitesimal methods according to the bottom-up “Stone Age” principles of theoretical physics, i.e., of point mechanics, arbitrary Lagrangians, and continuous pathway parameters, to the ignorance of non-valence structures, etc. – briefly, according to all making up the difference between the inconsistent “Standard” Models on the one hand and Quantum Gravity and GUT on the other hand.

By decomposing the 16×16 -dimensional adjoint representation, with an appropriate definition of Hermitecity, we obtain 10 symmetrical coordinates of location plus 6 antisymmetrical coordinates of time type of some double-connected vector space of dimension $4 \times 4 = 16$. As the variation calculus is inevitably requiring the existence of exactly one time direction, the 6×6 -dimensional temporal matrix had been shrunk to its singlet component. Together with the 10 space directions, this yields the 11 dimensions of string/brane theory.

Now, after decomposing the original 16×16 matrix into a temporal 6×6 part plus a spatial 10×10 part, there still are left the two 6×10 and 10×6 matrices, whose factors 6 will have to be reduced to 1, each. When attributing them to one co- and one contravariant fermion state and the 10×10 matrix to a boson state, then we obtain the ill-reputed “supersymmetry” between fermions and bosons.

With all those non-transparent bottom-up tricks with the strings, based on the dogma of a variation calculus, it is not only the top-down survey which has broken down. No miracle that none of the predictions either made by the string/brane models or by supersymmetry ever had been in accord with experiment. It might sound hard, but the working power of 10.000's of string

theoreticians of almost half a century has been invested for the rubbish heap!

In a concise formulation: The classical string/brane models developed too far away from a model "beyond the Standard Model" towards a model "beyond physics".

Knowledge, however, cannot be caged up in the padded cells of a lunatic asylum. Actually, we are subjects to political systems arrogantly torn and driven by anxiously repressing any individual impulse, by lobbies having no antenna for the yield of long-term cognition. Simply formulated, a couple of financial ministers are disposing of too much money. Thus, they are artificially keeping alive "theories" making no sense, pushed by clever lobbyists speaking of "research" but meaning the incompetent muddling on.

Blind on this eye, this mental inbreeding of ideas is limiting its Sisyphus' activities to the bureaucracy of a short-term administration of financial titles, to institutions bearing high-blown names of a great past, but long since being depleted in substance, and to absurd budgets of whatsoever.

But the academic title mania of pigheaded institutions will not prevail. The digital world doesn't give a damn about their censorship and dogmas: It might take some time – then, however, the truth of physics will take over.

The Author

Born in 1939 in Berlin. Sports, gossip, small talk, and the exposure to a steady stream of music ever had been a horror to me as a former amateur pianist. Thus, there has been sufficient time left for veritable challenges.

During my school time already, I followed first problems on the field of comparative linguistics, which, during my subsequent study of physics (theory of elementary particles), focused at the complex of problems around a common ancestor language of the Indo-European and the Chinese languages.

The challenge of fundamental physics, on the other hand, 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 (“unified field theory“).

It was obvious that all this could not be worked out in the frame of a simple thesis (German “Diplom”). Neither did I accomplish this sophisticated target during my subsequent long-term activity as a scientific assistant at the Free University Berlin; however, I came rather close to it already.



Up to new horizons!

Still as a student, I got furious at that wobbly house of cards theoretical physics seemed to be founded upon, the way it was presented in the lectures and, later on, in the seminars. Especially with quantum theory. It was amazing 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.

I could well feel with the young Einstein when he once dropped his career of becoming a candidate for the doctor's degree after having passed his master examination ("Diplom") in physics in order to get rid of that intellectually dull routine work with the accent not on cognition but on activity. This way, as a privateer, he could better serve his hobby, which was physics. –

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 with Siemens. That software, however, was 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 visit at a conference on particle physics attested me again: The state of my field of interest still was the same as at the end of my time as an assistant many decades ago, I had missed nothing – only, at that turn of the millennium, string/brane fans were occupying and blocking (almost) all resources of particle physics.

C. Birkholz, Christmas 2012, supplemented in 2013.

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