

Claus Birkholz

# New Physics

*Dawn of Cognition*

Fundamental Physics Report

# Contents

- Source Record.....1
- Old Physics at Its End .....3
- The New Physics .....6
- Quantum Gravity .....8
- The Physics of Actions.....11
- The “World Formula” .....14
- The Cosmic Hyperboloid.....19
- Spin vs. Angular Momentum .....22
- The Grand Unification .....24
- The “Internal” Forces of Nature.....26
- Horizons and the “Quark Confinement“ .....29
- The System of Leptons .....31
- Dark Matter .....34
- Pauli’s Exclusion Principle .....39
- Old-Timer “Standard Model” .....43
- Flavours.....45
- Parity.....49
- Neutrino Physics .....52
- Speculative Selection Principles .....56
- Experiment .....61
- Research beyond Limits .....64
- Quantum Gravity and Life .....70
- Lost Ages .....75
- The Author .....80
- Impressum.....82

## Source Record

This is the English translation of a research report in German language on the common foundations of particle physics and cosmology, together with their unification to a "Quantum Gravity" and to a „Grand Unification Theory (GUT)“.

In parts, this is an extract – here and there: word for word – out of a more comprehensive report ('Die "Weltformel" / "The World Formula"') of the same author, see in the internet under

[www.q-grav.com](http://www.q-grav.com) -> Summary View.

In other 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 representation. 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 headings.*

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](http://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](http://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), see**

**ISBN 978-3-00-030847-6.**

## 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. Their (“chiral”) interactions seem to follow comparable (“gauge”) structures, too – although, until to-day, not well understood ones by the “Standard Model” with respect to their origins.

And quantum theory 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, everything must stay finite in physics. Even an elementary particle cannot be accelerated boundlessly, 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 are “unphysical”, too. Thus, they necessarily will have to be “discreticised”, or “quantised”, 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 (*gravitational*) force. Thus, Special Relativity is cancelling forces.

On the other hand, the current theories of elementary particles – i.e., the "quantum field theories" – are working with Special Relativity. 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 consistently combined Planck's quantum theory with Einstein's General Relativity. 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. (*They are comparing “apples with pears”.*)

This (*false*) conclusion, however, 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.

After the detection of nuclear forces, Einstein’s notion of a “World Formula” 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” 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 “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. And “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 a couple of hundreds of years more to come.

By the way sketched in the previous chapter, it can be shown that physical models of nature must basically 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 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 Ein-

**stein; still during the course of the actual century, it might take over the leading position in fundamental physics.**

## Quantum Gravity

From statistics – together with number theory – we derive that nature should manifest itself in terms of powers of eight dimensions. Measurability adds the condition that those powers should be even numbers. 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  $8 \times 8 = 64$ .

The first factor of 8, an octet of eight dimensions, had been identified to provide Dirac's four "covariant" plus his four "contravariant" dimensions; our 4-dimensionality of space and time derives from that. Thus, the 4-dimensionality of space-time (*and of energy-momentum*) is an output of theory. For all other models – Einstein's General Relativity included – it still is an external input feature!

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.

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 the physicists even before Einstein and Planck already had been well familiar with.

Modern models – like that of “Loop Quantum Theory” et al., 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 and quantitatively.

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 inverse (*squared*) length. This length reveals 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 detail by experiment.

On the other extreme, our universe is appearing “huge” to us, its variations, usually, are that slow that they hardly are observable, neither. 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 is not only reproducing 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 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. 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 meaning 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 phys-

ically executable procedure (*except just waiting*) is existing which might “perform” such a transformation there and back.

The mathematical background is the following: In Quantum Gravity, there are principally two opposing systems present which do not commute with each other, which, however, are acting on the identical physical base. These two systems are:

- a (“unitary”) reaction channel, opposed to
- a (“pseudo-unitary”) dynamic channel.  
*(Their operations, however, are belonging to the identical “complex Lie-algebra”.)*

Due to its captivity to the variation principle, which is demanding to decide for just one of both channels, the “Standard Model” is unable to support the simultaneous presence of both differing structures on an identical physical base.

Thus, the reaction channel simply is ignored in conventional physics. We still shall realize that this will drop fundamental properties of physics. This is one of the reasons why the “Standard Model” is working with coupling constants (*and form factors*) whose values cannot be calculated from theory but are accessible only by experiment. (*For, there is no “positive-definite norm” in order to conserve probability.*)

In Quantum Gravity, the parallel use of two systems which are not commuting with each other is no problem. When dropping the variation principle, the Heisenberg picture of operators is managing that job for both systems.

Their mutual non-commutativity, here, is the driving force of a perpetual “redagonalization” between both 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 transverse overlay structure.

But there are (sub)structures being equal in both channels – the “compact” generators, e.g. A CMS-space generator (*CMS = centre-of-mass*) is measuring a certain, selected amount of “matter, and CMS-time is comparing them. Hence,

- **(CMS-)space itself is representing a little piece of matter**
- **and (CMS-)time is relating different such pieces.**

**Let me strictly stress, however, that time and space are not com-  
measurable with each other (*their generators do not “commute”*)!**

## The “World Formula”

That part of group theory which is used in Quantum Gravity is constructing “actions” out of so called “generators”. Up to numerical factors, those “generators” are defined as the logarithms of (*a characterizing system of*) basic actions. Thus, like ordinary actions, generators are operators, too: specially selected ones.

For non-mathematicians, this might sound quite abstract. But be sure: for mathematicians, this is mere routine. The advantage of such a procedure is that the – sometimes rather sophisticated – “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”.

In its 4-dimensional subform, Quantum Gravity is based on a set of  $4 \times 4 = 16$  generators:

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

CMS-space-time is additive (*i.e.*, “linear”). After division by heavy mass, the resulting, ordinary, bent Einstein space-time is not additive any more (*it is “non-linear”, then*). This situation is similar to 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” – 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  $SO(2,4)$ , has equally.

“O” stands for “orthogonal”, i.e., an  $SO(2,4)$  is representing an ordinary group of rotations in 2 temporal + 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 (of particles)”, which both are based on this variation principle, this is delivering the death-blow – just one of a long series of death-blows; for, that “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 numbers is by chance. 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 to explain what a “Casimir operator” is:

*The above, additive “generators” are the defining operators of a group of “actions” (=“transformations”). Nevertheless, they also may be multiplied, where their products, again, are meaning a consecutive execution.*

*Among those products, there are some of them the mathematicians are calling “invariant” ones. For a basic “unitary” or “pseudo-unitary” group, they 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 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 the above 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 as well be characterized 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**

**Casimir = 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 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 a “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 covering 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 independent equations of motion, i.e., 3-location as a function of time (*and additional parameters*). This is the well-known 3-dimensionality of motion.

And, as a non-linear Casimir set equal to a constant (our “World Formula”!) is representing a non-linear condition, 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 total parameter space into slices of bent universes which are not further decomposable any more.

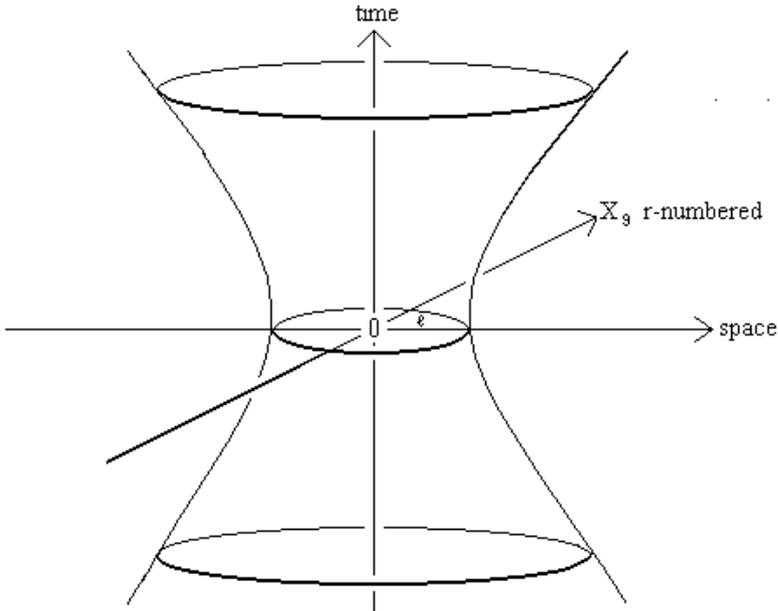
Without that irreducibility, our constants of nature would not be “constant”.

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, this is giving the following sketch:



Its axis perpendicular to the drawing plain, here, is the abbreviation of the collection of all parameters exceeding pure space-time. As a square root value, it might as well be imaginary. That special case, however, is not shown, here. 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 discussed 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, it will converge to the velocity of light. 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 the time  $t=0$ , and the Dark Energy effect is disappearing. Within the 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”. Therefore, an intransparent “Higgs” mechanism had to be invented, there, which, in Quantum Gravity, is superfluous.

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 “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 in particle physics out of it. It is set equal to some inhomogeneous term consisting of the remaining squared generators.

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, in all detail – either for our GUT or, with less 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 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 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, at most.

Thus, the reason why a particle will become “virtual”, 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 deal of “virtual” particle states, in addition; they can be “transformed” into each other. Those “virtual” states, thus, are to be considered as inevitable, collateral “tail” features of that “real” state.

## 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.

Let us, now, consider the 3rd- and 4th-order Casimirs of the conformal group. When grouping their terms according to magnitude – as resulting from the natural measuring units to be used in Quantum Gravity – we find that, up to additive (“*group-contraction*”) terms of experimentally negligible size *and additional mass factors*, both Casimirs just are reproducing the Casimirs of the Lorentz group of Special Relativity where, however, their special-relativistic generators of spin and boost are replaced, here, 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 assumed.

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!

For theory, this means a clear distinction between angular momentum on 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.**

## The Grand Unification

By first principles, nature had revealed 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 its “pseudo-unitary” dynamic overlay structure expands to a  $U(32,32)$ .

Dirac’s split into a pair of “co-” and “contravariant” substructures (particle/antiparticle) according to the sign of particle number is giving rise to a corresponding reaction channel in terms of a (pair of) group(s)  $U(32)$ , and his analogous split according to the energy sign to a dynamic overlay channel (particle/“hole”) 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 “internal” partial structures (plus spin) is purely arbitrary, secondary, on the surface; physics is playing in the reaction channel: dynamics is secondary. Current field theories – the “Standard Models” – are busy with secondary entities.

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, dropping, however, their restriction of gauge particle masses strictly to vanish, which, there, laboriously has to be adapted to the physical reality by that “Higgs” formalism.

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 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 (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 its 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 those  $3 \times 3$ -matrices.

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:

<b>N</b>	: particle number,
<b>Q</b>	: electric charge,
<b>T</b>	: triality,
<b>L</b>	: lepton number.

T is the main 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, these terms of 1/3 are mutually cancelling themselves.

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

<b><math>\Lambda</math></b>	: leptonic charge,
<b>E</b>	: exotic charge,
<b>A</b>	: strong charge ( <i>2nd component</i> ),
<b>M</b>	: strong charge ( <i>3rd component</i> ).

The reason is simple: The “Standard Model” is ignoring a couple of well-known nuclear quantum numbers: 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” unsuccessfully thinks to be able of attributing to (powers of) Q alone.

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  $\Lambda$  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	$\Lambda$	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 4<sup>th</sup>-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. 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 back to 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.

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”  $\Lambda$ . A research, at most, will be starting with the question “What would be if ...?”. Now, what would be if the horizon of  $\Lambda$  would be considerably – not greater but smaller – than that of triality  $T$  (and the horizon of the “exotic” charge  $E$  still smaller)?

According to the (colourful) table (above) of Quantum Gravity – up to spin – there are only two types of (equal-variant) quanta in the GUT which are carrying a non-vanishing value of  $\Lambda$  (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  $\Lambda$ .

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 as well, 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. Howev-

er, 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 point-like 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 just questionable character.

## 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. Its separate terms will differ in their spin content.

By the same mechanism, the product of two particle states will expand into a series of “irreducible” “intermediate” states, i.e., 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 picture 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” giving some partial state – in contradiction to the fact that their do not exist “partial” electrons in nature – followed by a

renormalization, which is unphysical as well, in order to supplement that partial electron to an “entire” electron. –

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, 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 functions 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. 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 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 a and b with the upper Dirac-“+” is carrying the unit  $+1/2$  of energy as a quantum number, and every quant a and b with the upper “-” 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 non-valence part of a particle. For an additional “Higgs” mechanism the “Standard Model” is requiring, there is no necessity.

Astronomers defined Dark Matter by

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

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

tistical mechanics, similarly, 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 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 inventing some “double-point mechanics” (“strings”), in addition. Our “New Physics” is installing an entire new level of 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. Thus, the “SM” tries to swallow all properties easily following from such a non-valence part into mystic “balcony mathematics” of physically rather intransparent provenience (*i.e.*, *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 the 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.**

## 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 are corresponding to an  $SO(3)$* ) together with a completely antisymmetric “Fermi-Dirac statistics” for “fermion” states (*particles with half-integer spins are corresponding to an  $SU(2)$* ). The latter one is giving rise to Paul'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 preliminary level of knowledge, then, had been frozen in and still remained the last cry in the “Standard Model (*of particles*)”.

Up to my knowledge, nobody had the idea that Pauli's exclusion principle also could be the result of the action of some intermediate particle as it is customary to assume for all other forces of nature in particle physics. The “Standard Model” still nowadays, a hundred years after the enthronement of those just two types of statistics, takes the statistics origin of Pauli's principle for irrevocably granted – for, 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, is 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 that factor:

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

After this extension, however, we have to measure the distance  $r$  not any more in units “cm” 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 in 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 by 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 exist-

ence 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”*).

However, it is declared to a taboo to correct eccentric ideas of the past. Thus, former misinterpretations are building up to some impenetrable jungle of predefined, premature trails.

Beside the variation calculus, this is belonging to the many fundamental assumptions of the “Standard Model” which are not proved. In addition, it served for the base of introducing the “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 eccentric ideas of the past.

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 illusionary 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" is succeeding 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 by “strong” and electromagnetic interactions only, but not by “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 flavours “top” and “bottom” as well.

“Hadrons” are 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	$e^-$	$\nu_e$	$g \ \gamma \ g_1 \ g_2 \ g_3 \ \dots$
charm	strange	$\mu^-$	$\nu_\mu$	$W^+ \ Z \ W^-$
top	bottom	$\tau^-$	$\nu_\tau$	$H_1 \ H_2 \ H_3 \ \dots$

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 immediate functions of our 64 quanta – in the “Standard Model”, however, for every individual one of its 144 quark states for itself, 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 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 in order to make disposable the desired minimal number of parameters 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 was 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"! No miracle that the understanding of the real physics behind it is fainting away.

Immediately after Gell-Mann's introduction of quarks, people still had argued more distinctly: The "orbital angular momentum" had been defined as the "internally" saturated compound of a co- with a contravariant quark as we, meanwhile, identified it as constituting a brick of Dark Matter and, slightly changed, of the non-valence part of particles 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 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 excita-

tion 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 multiplying 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*) nucleons (p,n) and the least heavy Delta-resonances (*with charges ++,+0,-*), then, still will stay 3-quant structures made of 3 a-quantas, each (*with the nucleons being of mixed symmetry and the Deltas totally symmetrical*). After substituting a single a-quant by its 3-quant flavoured a(ab) version of the second generation, above, the Sigma-resonance (*of charges (+,0,-)*) will result as a 5-quant resonance. (*In its ++ version, there is no down-quant.*)

Additional substitutions are yielding the Xi-resonance  $(0,-)$  as 7-quant structures, and the “Omega-minus” as a 9-quant structure. 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*). 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 (with "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.

A typical example is the acceleration of a particle at rest to a moving particle. In its moving frame, its 3-momentum will be inverted 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 to 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 to “violate” parity “maximally”. 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.

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  $360^\circ$  will reproduce the starting state – in a unitary group, however, we need  $720^\circ$ , 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 values, too. With hindsight (*to neutrino physics*), this is justifying the fact that Dirac, without being aware of it, once had separated his two variants of 8-dimensional spinors according to particle number into a pair of (*oppositely variant*) 4-dimensional spinors instead of treating particle number as just another type of spin (*as it would correspond to a “Majorana neutrino”, e.g.*).

In the 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 would attribute a lepto-nucleus bound to an antilepton-nucleus to them. The valence parts of such a “weak” boson, then, would have to be represented at least as 4-quant structures.

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, at least, to 6-quant valence structures. Such a (3+3)-quant structure has negative parity. In order to have a neutrino in its decay products, which is a 50:50 mixture of both parities, still another “ordinary” quant/antiquant pair should overlap, such that its total valence, finally, should be 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, will be both made 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 quant/antiquant pairs, by current experiment, are to be considered as an 8-quant valence structure, and in the other one as a 6-quant valence structure with one more pair-quant in its non-valence part.

According to current field theories, this additional “non-valence” pair, however, will be dropped, i.e., it will not be counted. Hence, we are apparently 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.

For 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 with the effective claim of eternity – no matter that quantum numbers, then, will have to be “broken”, 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 complicated.

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 “particles” (*i.e.*, no “wimps”)! – are not massive enough in order to effect any meas-

urable 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 can be summed up on their rally from sun to earth.

By a collision with the valence part of a neutrino, its internal structure could switch over. 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 "converting" neutrino.

The problem why a neutrino (*as a Majorana particle*) is presenting itself in just one of its theoretically two helicity states will be solved later. (*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.

## 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 two “3-components” on the 16-dimensional sublevel; and that without additional summations. But, contrary to all assertions, that does not yield a unit element!*

*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.*

Those pairs of quanta which, by current quantum field theories are swept under the carpet, last but not least, are summing up to the existence of Dark Matter (or to their variants as building bricks of the non-valence parts of elementary particles) the “Standard Model”, of course, is pretending not to understand.

Instead of curing those inconsistencies once and for all, the „SM“ tries to paste up this fact by supplementing its “vacuum po-

larization” 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 assumption 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 of universes related to each other. They are defining themselves by all possessing the identical total number of quanta and by coinciding in their linear (*i.e. additive*) quantum numbers – as far as realized. (*Not only these numbers of quanta will have to coincide but also their label sets.*)

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. (On such a level of super-clusters, thermodynamic processes, of course, will awfully throw them into disorder, such that, on this level, we are not to expect to meet such super-clusters in concentration: other types will have been mixed in.)

The finite number of its quanta *together with the physical prohibition of constructing mathematical limits*, in addition, 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!

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 and of 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 space-time properties to them (*including energy, etc.*) in terms of non-valence parts.

This, however, does not change anything with respect to the fact that, now as before, there can be stable just 64 different

types of states; they, only, are lumping together differently, now, 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  $\omega(0)$** .  
**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.

Hence, there will be left to investigate the distribution of the above non-summarized, "internally" saturated quantum pairs (*as Dark Matter variants*) of our total universe on the non-valence parts of

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

The 16 "bricks" of Dark Matter, however, are not attracting any of those quantum pairs because they are behaving similarly as a noble gas in chemistry. What matters is to knock this distribution key. This, actually, is an open, unsolved problem.

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

- ❖  $24 = 3 \times 8$  massive particle states and
- ❖  $24 = 12 + 12 = 2 \times (3 \times 4)$  massless particle states.

*(“massless” in the frame 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, there are left over only 3 masses still to be explained, lying in an effectively non-vanishing range! They should be functions of the mentioned distribution key, which, finally, 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 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 Model" 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. To fix it, means including additional parameters.

The postulate of a "freedom from parameters" is assuming the knowledge of the superior, "embedding" system fixing those parameters in this and no different way. Otherwise, remember the picture how somebody is 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, such an individual state is its (*intermediary*) "output channel".

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, when drawn over the collision energy, for every individual channel will typically remind on a bell-type curve with its "peak" in the centre. 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 – but which? – width?

Theoreticians made 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 classical point mechanics of long ago.

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. They are one of the unalterable reasons for the subsequent necessity of a, mathematically unreasonable, “renormalization” (*method: 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* 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. 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 of finite nature, their reactions will be calculated most simply by numerical methods, by putting the Young symmetries needed on a computer.

## 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 the leptonic doublet (“blue”). We are familiar with that table already.

	N	Q	T	L	$\Lambda$	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 is allowing the construction of an “exo-nucleus” in striking analogy to the “lepto-nucleus” of the leptons: In this “exo-nucleus”, 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 T, the main component of the “strong” nuclear force.

But, contrary to the situation in the lepto-nucleus bb with  $T=+2/3$ , the exo-nucleus aa is charged with  $T=+4/3$ . Hence, it can

bind 4 “ordinary” (“yellow”) quanta with  $T=-1/3$ . This small example shows already, 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 be sufficient in order 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.

As an “atomistic” brick within a more comprising world, we probably also could denote a universe as some “universal particle” I mentioned already. Actually, it is unknown what types of universes with what kind of dynamics there might exist beyond our own one.

This would be some research topic for mathematicians which might not be uninteresting. But also for experimental physics, it is excluded by no means that we could become able to peer beyond the curtains of our own universe. For, according to the rules of group theory, a particle, by its strict interpretation of “irreducibility”, just is to be understood as some interference maximum of components of our universe.

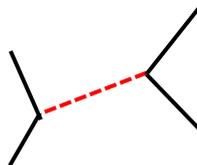
One level higher, then, our own universe should have to be interpreted as some interference pattern of some correspondingly higher “super”-structure. Its apparent “irreducibility”, then, would not be exact, either.

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*). “Free”, however, are particles 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 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 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 its 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 in the sky.**

**Due to the topological properties of Einstein’s differential-geometric equations, cosmology is treating only connected structures. Thus, more correctly, it has to manage a total event, which, by group theory, might be partitioned into several disconnected components, in terms of one single, *no matter how* connected structure.**

**Cosmology tries to cut short differing positions on its topological structures by “worm holes”. Its handicap is that Einstein’s topological concept is lacking the superposition aspect of quantum theories. On the other hand, its irreducibility concept, when for-**

ulated 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 relations to any other universe. In Einstein's differential geometry, every universe has its individual space-time parameters. Einstein's "worm holes" are representing narrow pathways inside one 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 "irreducible" on its own – whose 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 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 our 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 will permit "New Physics" to proceed to statements concerning

**the immediate environment exterior to our own universe which can be checked by experiment.**

## Quantum Gravity and Life

Due to  $1 \text{ sec} = 300.000 \text{ km}$  (with the velocity of light set equal to 1), times (in sec) are appearing to us humans as 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 ( $384.000 \text{ km}$ ) will proceed on a time scale within a second, in rough figures.

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

Now, on a time scale, such a “time-leaf” will not exactly be of zero thickness, in fact, but extended – whether by  $c$  not being infinite or by the action of “non-compact” operators “smearing out” discrete coordinates to continuous ones. 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 will belong to it, defined by the 2nd-order Casimir.

A living creature is some special, transient object, 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 for 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 some "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 copy procedures ("*genetics*") with variations (*creation, growing, aging, mutating, dying, decaying/being eaten*).

After having corrected the Copenhagen interpretation of the measuring process not to be a "projection" but a (*unitary*) "rotation", physics reveals to be totally deterministic – such as Schrödinger's equation between two measuring processes had been before, already.

Provided time would "run", indeed, i.e., would not be some fiction, then, everything would happen in some purely deterministic frame, everything would 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 would need to mark the predefined way with our marker – *corresponding to the additional Casimirs in connection with the initial conditions*. However, there would be no move, everything would be fixed, static!

In order, as asked for, only to store the local past ever actual, and not the future, in addition, our brain first would 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, will make necessary those 300.000 km. Decoding this algorithm would mean a grand progress in brain research, and in technology as well!

Now, only some (*mathematically*) "non-compact" generator like (*CMS*) time – i.e., some generator with hyperbolic structure – is able locally to split the respective parameter space (*given by the 2nd-order Casimir*) into 2 parts in such a way that past and future will be separable properly. A "compact" generator like (*CMS*) location does not allow to keep upright an absolute separation between differing signs of measured values with respect to (*admissible*) transformations.

Our organism, the above cube, thus, only is “knowing“ 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, would 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. Some step essentially beyond the above cube is mere subjective imagination or extrapolation, it is not real.

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 its sign, then, would amount to a matter of probability or, in the language of thermodynamics, a matter of entropy. The increases of the remaining parameters (*measurable simultaneously*), then, would result from the Casimirs (*+ the actual initial conditions*).

Without changing anything physically, due to its tightly wired, readable prescription, that object would develop something like an internal, static feeling for the sequence of times. The extremely rare case of such a prescription to exist within some object of the universe thus confined in space-time, by no way, is in conflict with the “dead“ matter in space and time around the object carrying those special properties. For, our world is hosting all interference structures already by (*its expected*) construction over all 4 space-time dimensions.

Our special object would 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 would be of purely deterministic nature. But I do not want, here, to follow up these ideas 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! As it should be, probability considerations, then, are secondary interpretations out of an imperfect description.

This problem that everything “would” move correctly but nothing “is” moving, indeed, surely, still will need some more detailed investigation, especially with respect to transferring ideas like those to finite-dimensional representations. The problem is open.

*My own ideas roughly are circling about the following direction: The compact generators of a  $U(2,2)$  or  $U(16,16)$  are distinguished by the fact that, in them – according to Dirac’s terminology – all creation and destruction operators are present in equal numbers, for the types  $a$  as well as for the types  $b$ ; their number differences, hence, are vanishing.*

*Inside the “non-compact generators”, however, those differences do not vanish. The time component, thus, will not just “count” its time leaving it untouched elsewhere, but it will abandon its present tense, interfering with its past and future. Smaller transitions will be hiding behind the experimental measuring uncertainty. Sufficiently great powers of a non-compact operator like time, however, will go across our 4-dimensional 3cm-cube. Thus, time will start “running” (beyond that cube), indeed.*

**Space and time are behaving totally differently in nature: While (CMS) space (as a “compact” operator) is appearing in “pieces” of quanta, time just is comparing different such pieces with each other.**

*Measuring values of compact operators are well-known as discrete quantum numbers. Measuring values of non-compact operators, however, still are needing continuous limiting processes in order to be “diagonalized”. But limits are unphysical. Measuring val-*

*ues of non-compact operators, thus, at all are representing approximations of physical processes. – Possibly, something like this will be behind the mechanism practised by the human brain.*

## 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, neutral 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 believe!

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 – including bureaucracy and censorship – thus, should be sharply attacked by every physicist. For, 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. Like chemistry, which once had been an independent science, with its origin in herbal lore and alchemy, meanwhile has fallen back to the state of a partitioned science, subordinated in parts under atomic phys-

ics and partly under thermodynamics, it might as well be just a matter of time when medicine will take the same way.

A 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 an 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 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 responsible for it – due to their prescriptions of censorship – will officially stay doomed to blind-man's buff.

As a mere employee, in 1905, Einstein still could publish, even without possessing a doctor's degree. On the other hand, because of this lack of title, his lack of membership in any official research institution, and his lack of being in the habit of presenting any sponsor, according to the above game combined with our actual rules, people like Einstein, would be kicked out edgewise when he would dare to try publishing anything.

According to the above regulations, the professional circles, nowadays, would treat him as a poor fool, stamping him to a local half-wit unable to work on science. Nowadays, Einstein would not

be admitted to publishing. 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, Middle Ages revived. The gloomy shadow of the Middle Ages 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-dependending 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.

The “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 have promised to produce – and all that since half a century.

What, instead, did just 3 decades effect 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. In those times, however, the proud principle "Content prior to Descent" still governed research. In the meantime, however, priorities have been inverted: "Descent prior to Content", back into the ages of small-minded dynasties of "noblemen". Long live their censorship!

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, according to the sign of their particle numbers.

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 will represent a "string" model which does provide physical results, indeed, i.e., some working form of string models – which, beyond this, even is in accord with experiment!

Hence, I am in opposition to degrading Quantum Gravity and the GUT by that denotation; the notion "String Model", since Veneziano (1968), approximately 50 years ago, acquired too ill a reputation.

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. The essential difference to

them is in their traditionally continuous, classical procedure by limit considerations, by applying Methuselah's old variation principle out of the "Stone Age" of theoretical physics (*point mechanics*), their ignorance of non-valence structures, etc. – briefly, in all what is that successfully constituting the difference between the inconsistent "Standard Model" and our Quantum Gravity and GUT.

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".

## The Author

Born in 1939 in Berlin. Sports, gossip, small talk, and 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 verifiable 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 got rather close to it already.



*Up to new horizons!*

Still as a student, I got furious at that wobbly house of cards theoretical physics looked 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 carrier of becoming a candidate for the doctor's degree after having passed his master examination (German "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 on 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.*

# Impressum

© 2013. All rights reserved.

This is a translation from the German e-book “*Neue Physik, Morgendämmerung der Erkenntnis*” serving as the original for an e-book dated 2013/11/20 published by BookRix, Munich with the

ISBN 978-3-7309-6353-1.

The German original of 2013/11/15 by the same publisher carries the

ISBN 978-3-7309-6222-0.