

## Concept & Method of Physimatics, the Logic of Existence and the Logical Time Formula

Conceptual approach and heuristic method for an investigation of the possible algebraic structure of the interdependence between mathematical and physical reality and about the connection between local, non-local and global properties in physics and mathematics, expressed by a General N-fold Algebra.

This paper describes the underlying Logic of Existence (“LOE”) and the idea of an ontological substrate and its function in a rough shape. Due to the general non-associativity of substrate elements we are describing a logical mechanism to build quantity from sub-quantity. That way we are performing the transformation from local physical interactions to weaker global-related actions based on probabilities and topological connections.

Special consideration of the question of time in physical and algebraical context is given. The Logical Time Formula is presented. Due to this we can answer the question what time is in terms of physics and Physimatics. The paper as well described a generalized mechanism of physical irreversibility.

*Work in progress*  
*Version 2.0*

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May 2<sup>nd</sup> 2010

**Physimatics or PMX-Theory is an integrated theory on three subjects:**1. *Logic of Existence*2. *Mathematics*3. *Physics*

Logically seen PMX-Theory is treating systems that are in accordance with the existence criteria:

- a) There is a generating or existence giving system  $gE2S$  for the physical universe(s), that we are calling the "substrate"
- b) There are one or more generated systems (universes) =  $E2Sg$
- c) Both system types are separated in a almost complete way, i.e. we are talking about an only "infinitesimal openness" against each other
- d)  $gE2S$  can influence the local dynamics of  $E2Sg$  in a in only a global way, i.e. only by information or gravitation
- e)  $gE2S$  influences the universe in a non-local way by inertia that is caused by limited rearranging capabilities of  $gE2S$

**For short we are denoting  $gE2S$  as the "substrate".**

**Definition: *Globality*** is a category that maps the dynamics from  $E2Sg$  to  $gE2S$ .

Processes related to the existence level of the universe will be attributed as "global". Individual and stable configurations within  $E2Sg$  (its invariants in a global context) will be denoted as "non-local". Universal configurations, invariants (matter) will be denoted as "local".

**This logic describes the "Process of Actual Existence" ("PAE").**

**Summary regarding PAE with the view towards physics and mathematics**

The physical related part of PMX-Theory applies the *Thesis of the Actual Existence* ("TAE") to physics and gets surprising insights and relevant conceptual simplifications.

We are not starting anymore with the universe or **Standard Model Particle Schemes** but with the generating of the universe and its components matter, energy and space itself.

The mathematical part of PMX-Theory handles the question of how a system that suffices to the existence criteria can describes the Interaction  $gE2S-E2Sg-gE2S...$  *mathematically as a whole*.

This general mathematical approach to the math or "sub-math" within PMX-Theory is the idea of a common algebra of n-fold relations that represents as a same time as a sort of a **Common Theory of Associativity** ("CTA"). This sort of algebra should describe relations

that commonly are not associative between arbitrary elements; there even associativity is the rather rare case, not to speak from commutativity.

This math consists of special groups that are permuting or combining their elements between each other in a combinatorial way, mapping that way dynamics from a higher standpoint. The basic elements of these groups can't be of quantitative nature because of the logical place within the PMX-framework as a generator to quantity. They are an algebraically kind of sub-quantity in the above described manner.

**Thesis:**

**The existence of the universe is an "actual/ongoing" process based on weak and non-causal actions (*instead of "interactions"*) with direct implications to the evolution of its global, non-local and local components** (existence, events and individual behaviour of invariants).

*-> This statement is not excluding the former event of a so called "big bang" but it is defining this event in a new way. In PMX-theory a big bang event can not be simply the birth of the universe itself but represents the upcoming of a new universal - and therefore local - interaction type (-> physical interaction, "force type") connected with the birth of a new spatial dimension.*

*It is the process of the algebraical universalization of sub-quantitative group interactions in that sense, that the underlying group system is closing towards a big group with a consolidated (infinitesimal closed) permutation scheme that represents the new spatial dimension. The universal interactions in this new group/dimension are expression of the new local physical interaction (force). May be the big bang was a threefold cascaded event in this meaning.*

**Remark:**

*By the way, before the group became "universal", the dimension was "broken".*

Within Physimatics is the big bang finally not the beginning of all physical existence but the beginning of physical existence based on universal invariants, respective universal interaction types.

If we want to map a physical meaning to the existence process there are not much free places within the consolidated building of current physics. The most important of these places is the creating and destroying of events that is strongly connected with our sense for the flow of time. All these processes are connected to irreversibility. Processes with connection to the existence process or the substrate are attributed in Physimatics as "global".

**Processes influenced by Globality are:**

- + Events / Irreversibility (-> the agent is here the new item of "physical information", "upwards stream")
- + Gravitation (-> existential entropy between the substrate/**gE2S** and the universe/**E2sg<sub>i</sub>**), "downwards stream")

+ Time

+ Inertia (into the universe transformed energy of substrate processes/of the **gE2S**-processes - > leads among others to the preservation of energy and prevent self-acceleration of physical processes).

Globality and its sources are within PMX-Theory denominated as the "Substrate". The ontological status of the substrate is unclear and its elements are towards the universe still "black boxed". What we can say about substrate elements is related to the connections between these black boxed elements and with the changes of these connections, which we find in encoded form on the physical level of the universe.

The logical necessity of the introduction of the substrate and of the existence thesis is striking with a view towards special relativity if we want to understand **why** we have phenomenon like *length contraction, time dilation and relativistic mass-energy equivalence* with  $v \rightarrow c$ . In an absolute closed system it should be forbidden to touch the generating mechanism of the most elementary physical values like length, time, mass from inside of the physical universe by such a simple operation as increasing the velocity of a system against  $c$  - even if this influence is only locally restricted to the accelerated reference frame.

Finally relativity shows us that the STF (Space Time Framework) is a generated system with only seemingly basic or even ontological categories because the physical representations of these categories can be influenced from within the system of the universe.

More over, in a second logical step we can deduce from this fact that the basis of the universe is not chaotic but only weakly structured. "Weakly" possibly means here not causal, may be not even probable, not even topological but defined by special sets of black boxed elements following new algebraic rules of associativity. And only the mapping or the projection to a higher derived and integrating algebra - like the projection of sub-waves to a hull curve - creates known elements of mathematics, i.e. quantity, numbers etc. and connect accordingly to the hitherto known realm of physics.

The global mechanism of the substrate and their projections to the universe are the source of irreversibility, of events. More general these asymmetrical processes are the foundations of time. The LOE can actually not be mapped by known mathematics. This for the reason, that the elements **gE2S<sub>i</sub>** and **E2Sg<sub>j</sub>** are not commonly associative. Binary, i.e. universal associativity is the "lucky case" but don't can be in general assumed.

So PMX-theory is in general a theory about the dichotomy between universality and individuality and the development of these seemingly contradictory approaches in nature. And this dichotomy is expressed by the two general group systems.

*By which means we can express Globality (the influence of the existence process)?*

The local incorporation of the global level of physics (the substrate) is represented by individual environments to all elementary particles.

These environments are extensions of algebraical type, moreover of individual algebraical type and all these individual elements are forming a big group.

To be more detailed: some of them and regarding the physical space three of these groups of a semi closed (infinitesimal open) character. Every dimension is incorporated in such a semi closed group.

These three finite groups are intertwined, reflecting the cascade of local physical interactions. And the non-local components of these groups are representing physical space. These components are placed in the middle between nearly total universality expressed by local interaction of matter, i.e. matter itself and individuality expressed by generation and destruction of events, i.e. individual groups of temporary or individual characterization.

But the can express the infinitesimal openness by algebraical means as well, but it's of an infinite characteristic. Then we are getting a cascaded group system of another algebraical characteristic that is connected to gravitation and physical information, describing the impact of entropic and non-entropic tendencies within the universe.

	<b>character</b>	<b>Algebra Type</b>	<b>Physical Representation</b>	<b>context type/ type of associativity</b>	<b>mathematics Type</b>
1	<i>local</i>	<i>universal</i>	<i>matter</i>	<i>causality</i>	<i>equation</i> closed/ semi closed groups
2	non-local	intermediate	space	probability	black boxed; definition by connection
3	global	individual	substrate	infinite element system	open groups and opening
4	non-local to global	universal to individual	gravitation	topology	open groups and closing
5	global to non-local cycling	individual to universal	<b>Physical Information</b>	topology	CTA = Common Theory of Associativity
6	global to local and local to global	integrating	<b>time</b>	invariant building	

And within the semi closed and finite intertwined groups should find a cyclic permutational/combinatorial process that is connected to:

+ Space or the possibility of parallel events

+ Movement

As "force" is coming into consideration we are getting contact to the second and infinite group system, the Infinitesimal Virtual Environment "IVU". Physics is treating "force" as the source of movement. But eventually is force in its correlated macroscopic form a non-local category where the light cones of many local events on particle level are involved. Looking back locally to single elementary particles the foundation of forces in physics are interactions according to "actio = re-actio" (Isaac Newton), which means on this level according to the Standard Model of Elementary Particles the exchange of messenger particles.

In Physimatics physical interactions are describing prevented symmetries but due to their commutativity and time symmetry this can not be the source of irreversibility and time.

But in Physimatics we find exchange processes as well, but not with a result of a force but with the result of an event. And the exchanged things are not messenger particles but physical information which can be described and represented by algebraical means, mainly combination of them. The exchange follows algebraical rules based on connected groups that build together a semi-closed master group. And within this master-group we find a cyclic combinatorial process between individual elements of these groups.

So, the exchange processes are not regarding the universal group components but regarding the individual ones. We are deriving these mathematical or algebraical features from logical necessities in the substrate construction process.

If we know nothing special about the substrates elements then it can happens that in process regarding our universe are elements involved in a non-continuous way. But the rule of n-fold integration is that the n-fold will collapse if an element simply vanishes. Or that in the case of an exchange of an element the n-fold is changing in a way that changes its topology and therefore the stability of the universe-sided process in which the n-fold is integrated.

The process of this principal type I called the "**Algebraical Misfit**" ("**AMF**") and it is acting effectively like an infinitesimal change. Due to Physimatics the transitions of **Individual Virtual Environments** ("**IVE**") are the foundations for movement of matter within space. The IVU creates an algebraical space while the (**IVE** + **IIE**) represents the whole geometry. Due to the IIE we can address space as a continuum.

**The IVE is related to:**

- a) Movement
- b) Particle related symmetries

**The IIE is related to:**

- a) Gravitation
- b) Physical Information

The local shift of the IIE by the substrate induced AMF represents itself as gravitation. So the AMF or the gravitation is the most fundamental kind of entropy, because the local shifts are adding up globally to entropy regarding the very existence of the physical universe (gravitational collapse of the universe).

Non-local IIE-patterns we can address as **Physical Information** ("**PHI**").

PHI is causing irreversibility and events. In its global form it is responsible for the existence of the whole physical universe.

What we have to made clear here is that all dynamics in the universe is based on algebraical actions of the IVE and IIE. Universal components are simply invariants within this process without any life of its own except the change of its relations by changing the IVE's and the

IEE's. Nonetheless these invariants have a structure that represents algebraical patterns of the IVE/IEE-process.

Physical interactions are in Physimatics representations of universal aspects of open actions. The change type of the IVE and the IIE is not interaction but action, which refers to the open characteristics of this process.

The substrate must for logical reasons based mainly on individual processes representing weak coupling between elements. You came to these specific topics if you are going to construct an General N-fold Algebra ("GNF") or an Common Algebra of Associativity. Try it to think yourself.

Physimatics is building the universal components from individual ones, it is building causality up from probability and probability up from topology. And together with universal associativity we are losing the **Axiom of Choice** on the substrate level. That is the price we have to pay here.

We are losing the world made only by universal components. In Physimatics we still have universal components as well. But they are secondary; they are invariants of a bigger but weaker process, a small remainder of a much more mighty process. So, what we now are finding is a world based on weak "**actions**" and individual processes instead a world based on causality and universal **interactions**.

As we are putting the substrate first we have to turn the typical physical approach from its head to the feet first. What we are knowing about substrate elements is the following:

- a) These elements are black boxed
- b) Substrate elements are mapping themselves to the universe only mediatory
- c) They have to create quantity as well, so they could not themselves be of quantitative nature.

To put all this into known mathematics without blowing it up, we have to find a good place for it.

**So what we have to get are mathematical descriptions for elements with the following properties:**

- 1) They are not quantity
- 2) They are not associative in a general way
- 3) They are not commutative
- 4) They can create quantity
- 5) They do not need infinitesimal arguments or finite limits towards infinity

**Question:**

*If the individual elements are the basis of the world, the basis of the physical universe how we find the creation of the universal elements, elementary particles messenger particles etc.?*

Within Physimatics mathematics these individual elements are in different scales and cardinal orders elements of the generating N-folds. But what are real quantities then?

The Answer of Physimatics / PMX-Theory is the following:

Quantities are invariants over certain exchange processes on substrate level between host groups based on n-fold relations. The set of all these invariants creates an infinitesimal closed system or a "universe".

A quantity is therefore a "cyclic invariant" or an upward integration over cyclic permutations / combinations over a that way connected set. The detailed process between the host groups represents the foundation for the Individual Virtual Environment **IVE** of the related invariant.

According to this logic 6 isn't in every case 6. Exactly defined on substrate level the reality matrix of 6 are never 6 again but 6 plus something virtual and/or infinitesimal that connect the reality matrix of this 6 with other representations of 6.

This logic find its justification in the always physical incorporated process of counting because in reality we are counting something real or the abstraction or representation of something that is real. The virtual environment of a number stores that way the parameters of the process of the counting itself.

The individual virtual environments IVE of particles and its integration to events is the key for the solution of the diverse problems of the interpretation of quantum theory.

Especially gives us the mechanism of n-fold integration a theoretical basic procedure for the so-called non-linear reduction in Quantum Theory ("QT") that describes the transition of the quantum superposition to a time-bounded event, which means that this mechanism describes the transformation from a reversible system configuration to an irreversible one. Non-linear reduction is the prerequisite of event-building and that way is it the basis for a detailed description of the mechanism of time.

**Time is in the PMX-Theory expressed in a logical way as followed:**

A) Looking from physics: by the mapping of non-local dynamics (movement, energy flow) to global dynamics

B) Looking from mathematics: by the mapping of the  $E2Sg_i$  invariants to the virtual and infinitesimal environments IVE and IIE of the invariants  $gE2S_j$ .

The logical time formula expressed in a rough and general way is now:

$$t = \left[ \frac{\Delta E 2 S g}{\Delta g E 2 S} \right]$$



What in a logical way means that time is following the mapping of the non-local stream to the global stream and backwards, finally in a circular way.

Because of the non-local stream represents the summarized invariants of the whole global stream ("upstream + downstream"; physical information + gravitation) we got finally a dynamical mapping from the upstream to the downstream, from the sources of the physical information to the sources of gravitation, i.e. the dynamics of matter and energy. This represents a rough sketch to show the logical idea behind, to show at the same time the nature of the underlying heuristical process.

Now we could drive easily into the realms of metaphysics, but PMX is in fact a very restrictive scheme and the seemingly freedom of thoughts within should not be confused with arbitrary placed assumptions.

### **Translation/mapping to mathematics:**

Of course we have to translate this logical expression regarding  $\mathbf{gE2S}_i$  and  $\mathbf{E2Sg}_j$  into mathematical expressions. For basic structural questions we have to use to ingredients to do so:

#### 1.) Globally related:

**General n-fold relations to reconstruct quantity (some elementary kind of irreversibility) on the level of UG, the Universal Group**

#### 2.) Non-local related:

**A group system of some different groups that elements or the groups itself fits into each other in an algebraic way so that these groups can travel along individual but algebraically determined paths ("travelling" along topologies)**

### **Program:**

Using physics knowledge and physical given verification methods we are looking for an underlying structure of the physical universe, expressed in fundamental mathematical terms that should be capable to bring up quantity in a universalized manner.

Structures within physics / the physical universe are represented by different groups, possibly very large or even infinite ones, and dynamics will be expressed and mapped to exchanges of groups elements and the groups itself within bigger groups.

The really bigger groups belong to cascaded sets with infinite characteristics, denoted by their Aleph-numbers.

Group structures can be determined at first by best guess assumptions based on PMX-Theory, than we can do logical differentiation backwards to physics and we will see whether we get know physics back or whether we have to check additional structures.

This is the **L->P->M->L** - Drill. (L = logics, P = physics, M = mathematics)

We get additional methodical and heuristical support by the idea of reconstruction of known mathematics, following the in PMX-Theory necessary reconstruction of quantity itself, i.e. at least prime numbers. This follows the thesis, that the mathematics of binary relations has a foundation in some sort of undiscovered mathematics of General N-fold Relations (GNF). To reconstruct quantity GNF-math itself can not be of common associative nature.

Maybe this requires a **Common Theory of Associativity (CTA)** itself. Because only  $n$  ( $n$  have to be possibly prime) elements of the substrate can establish a prime entity of the physical world.

But "prime" means not necessarily prime numbers but general prime elements in the by PMX given algebraical framework.

This describes the direction of the second Drill **L->M->P->L**.

### **Outlook:**

Here we have to question the fundamental ideas of Democritus that the physical world consists only from matter and empty space. But the space isn't empty, at first because what we are calling space is not only "curvature" but the whole set of connections between the individual virtual (non-local) and infinitesimal (global) environments of all matter. And the dynamics of matter and energy in space should according to PMX-Theory caused by the semi systematic changes of these environments. While virtual or non-local changes are following a permutation scheme, causing that way "heat" (no group structure) and "movement" (group structure).

As Globality comes in as a new player we are getting another order criterion or dimension: time. While time in the meaning of our experience is the mapping of the non-local dynamics to the global determined one (events, irreversibility), only global connections can cause and prevent stability.

All non-local aspects of that exhausting themselves only in superpositions that has to be "sealed" globally in order to get stability. This mechanism describes at the same time the "non-linear reduction" as described in connection to Quantum Theory.

We have to give up now the idea that the physical universe is elementary composed only from matter and space. We could burden to space to be the carrier of all the individual organization potential of matter. But we would overload the concept of universal space that is isotropic and homogeneous. This would be mean to make space to something conceptional unclear because of we have to get married space and events. We have to give up as well the notion of the universal spatial dimension and we have to come up with a mixture of different, incomplete and partly broken dimensions. To such a mixtured space we could not apply the instruments of classical differentiation and integration. Beyond the universal property of smoothness thing are becoming meshed, partly vanishing in the realm of sub-quantity suddenly they came up again to reality. Every prime element of more common nature could be attached to a single dimension of very individual nature.

Imagine the world, the universe composed of a collection of mainly individual elements. And the universal elements are invariants, finite things, of a new algebraical type, crossing over from different stages of infinity and we find universality first on bigger scales. And these bigger scales are the first universal ones. This perspective represents something that we not used to know. But our knowledge is question of perspective as well. The type of the questions inspires the answer.

Physimatics is inspired by the search of conceptional and operational simplification. Physimatics is looking for tools that are more effective not by grade but by the entire dimension of the approach. This includes a very conceptional simplification by extension and "systematically individualization" regarding mathematics. This is resulting in complete new mathematical approaches and operational potentials regarding effectiveness and possibility of calculation.

Though there is a price for all this progress. Complexity is seemingly rising to the sky and we have to give up some uncertainties regarding our existence, may be some belief that beyond the physical universe is only religion to find. We have once again to extend the realm of science to the level where physical existence is born.

The transition to a lot more individual components of reality, i.e. in a wider sense to physics, requires regarding mathematics the comprehensive conceptional change from analysis to a new kind of algebra. Only that way we get an urban mechanism to represent existence, events and finally the fundamental mechanism of irreversibility. This is not only just about "emergence" without any fundamental mechanism. Emergence is the phenomenon side. LoE and Physimatics represent the genetic approach, at least one out of the possible sets of solutions.

With this necessary transition from events to non-locality in different scales in mind, we have to relativize the once fundamental role of natural laws. This because of the substrate itself is an extended sphere of sub-reality, bringing up these laws as a subset of its weak and individual dynamics.

The nearly universal logical solution of the dichotomy between mathematics and physics within the presented theories heuristical scheme justifies in my opinion the notion Physimatics.

So well, this is a pretty big picture and for someone a possibly pretty bold approach at all. But I think we need this extension to our reality to get results easier and faster. Current physics is bound to a kind of mathematics that allows due to its complexity no fast progress any more. And there is another heuristical drawback of the current approach: the relative far distance to intuition and to macroscopically based reality.

Physimatics indicates that there could be a tighter link between physics and mathematics that is not only of technical nature but is founded on the assumed fact, that physics and mathematics are coming together on substrate level and that this can justify the standpoint of Platonism regarding the connection between mathematics and reality.

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