GENERAL CONCEPT & METHOD OF PHYSIMATICS

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.

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Introduction:

The concept and method of physimatic theory is intended to be a tool for achieving a considerable simplification in fundamental physical and mathematical meta-models. Its an experimental top-down-approach in concept and logic. The fundamental question is, how to "design" a model, that have the structural capacity to answer at the same time fundamental physical and mathematical questions[1]. Therefore this a top-down-approach that have to be verified after abstract developing. This verification is in looking after the connection from the concepts element to still established elements in physics and mathematics.

The theory consists of three parts, a conceptual, a physical and a mathematical one. The first two of them are almost far developed, the third is work in progress. The choosen conceptual categories represent symmetries of thinking as well as mathematical and physical ones. These symmetries we might find useful for decoding suspected deeper connections between physics and mathematics in their very foundations. This aimed to a simplification and streamlining of such as physical as well as mathematical understanding of the reality in which we live.

The logical basis of this theory regarding physics is a top-down-approach that claims as a prerequisite the existence of the physical universe as generated by a "bigger", more extensive system, called the "substrate". The mathematical basis of physimatics is a kind of an iterative permutation- based group algebra, generally founded on n-fold relations, i.e. for the majority of the elements, i.e. groups within that algebra, binary relations based on universal associativity and commutativity are not applicable. Instead we have to define n-fold relations, which can be expressed by groups, that members are groups again and that n-fold element connection is determined by symmetries between these groups. Following this concept, the algebra should represent finite, infinite and infinitesimal elements in one unified framework. While structures, i.e. special group systems in that framework should be equivalent to physical observations, anyway whether we determine them caused by physical laws or not, the concept calls itself physimatic. In this concept physics is in some way the statistics of a special mathematical group system inside a much bigger one.

1. physical extensions

We treat physical "existence" as a still ongoing process, constantly at work and only in some invariants once completely stated in the "big bang", but in much more aspects still afloat. We referring to that model with local, non-local and – regarding the functional integration of substrate elements – global components. The algebra of these elements includes in a natural kind nonlinearity, that way integrating "events" and "irreversibility". Because the universe will treated as a derived "phenotype system" that is not fully closed to its generating environment, we got "gravitation", that we can rework from this standpoint now as a hypothetical kind of submicro-entropy or PLANCK-entropy. Since the "keeping alive" of the universe on the substrate is connected with substrates-to-universe integration resources, we got relativity, that is in here only a synonym for non-unlimited resources for transformations regarding the universe – or some of them – on the substrate. Since even "existence", seen as a process, causes a universal substrate-to-universe-dynamic, we got inertia and gravitation. Two parts of the same medal of globality seen from this conceptual standpoint.

The individual influence from the substrate to the universe is roughly speaking in the "freedom of events", in the balance between reversible and irreversible developments, which we can summarize to a statistical measure that we call "global event rate". The global event rate is determining, whether the space in universal scales is expanding or contracting. Tends it more toward reversibility or entropy, then space is contracting, is it balanced more towards irreversibility and negative entropy, space is expanding.

The universal influence of globality is in the existence process itself with its local material and its non-local spatial aspects. Seen from the global side of the universal influence, we find the systemic side effects of the connection between universe and substrate what is expressed in the universe by inertia and gravitation.

So between the substrate and the universe we postulate within the physical part of physimatics a kind of "infinitesimal transmission". A finite change in the universe causes a infinite change on the substrate and in the counterpart will find finite changes on the natural infinite substrate its opposites in in-

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[1] We have to integrate here mathematics because modern physics is expressed in mathematical terms quite extensive. So making progress in physics seems to be necessarily connected with new mathematical concepts .

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finitesimal changes in the universe. Gravitation and negative entropy are the ways, we are connected down to substrate; inertia and entropy, anyway whether its positive or negative, is the way upwards.

2. Mathematical extensions in the physimatic concept

The mathematical implementation of physimatics seems to require the connection of very different parts of existing mathematics and based on this some new methods, especially a kind of a common n-fold algebra. This algebra is reflecting the built-in nonlinear characteristic of the substrate and is defined in a multiple-set-structure with cardinality rising from Aleph null to Aleph n, the group-generating rules, i.e. element connections, and some derived layers with finite count of elements, from which one of them incorporate the non-local aspects of our universe. This succession is to be encoded in a "fractal" manner with aspects of self-similarity, where the simplest layer is the known number system. The whole set construction should be also denoted as "substrate". The physimatic concept is requiring a group-in-group-structure, where groups are elements of other groups, building up a possible infinite intertwining as well as interchanging of these groups. The connections between the groups are defined by their symmetries over substrate elements. Substrate element from different Aleph-layers are "prime" to each other, if an element of deeper layer is not parallel an element of an higher one. While the deeper consecutive layers can be treated regarding its basic elements as power sets of higher layers, all deeper layers elements are multiple combinatorial sets of higher layers elements. In general we're using here sets of numbers to encode things that can't be coded only by single a number, i.e. qualities. And these sets we find intertwined in the above described way. So we should, following the physimatic concept, can remodel topology, probability and causality by this kind of twisted group structure over a set of consecutive defined power sets. What we should get by thinking in a top-down way are at least some finite sets, that are representing roughly speaking different universes.

On the finite and therefore at least in principle countable layers we can form now a finite "universal group" ("UG"), coding local and non-local basic universal properties of space, local interaction types and spatial dimensions. This group is via a special exchange algebra, its non-local and on the substrate purely algebraic based. Inside the group we find localizations, that represents individual connections to the substrate. These localizations are represented itself in groups, called "individual groups" or "IG's". These groups are individual with nonlinear aspects in behavior. These nonlinear aspects of the UG's symmetries, the individual but systematic and cyclic break of them, create in an universal way mass and in an individual way irreversibility and events. Because of the integration of the universal IG's to the substrate is better then the one of the individual IG's, the representations of the first types "only" gravitates while these of the latter are "aging". Now we can get the basis structure of time by mapping the universal IG to the non-local UG algebraic properties. The algebraic coding of IG's to the local aspects of UG requires as mentioned above a combinatorial approach, simplified as a model we can use possible an encoding in permutations. This leads to a kind of "exchange algebra", that we denote as "prime element exchange algebra" or *PEA*. These prime elements encode on the substrate level in a philosophical sense not quantity but quality. Now we state for this type of algebra five relevant principles that are "algebraic identity", "algebraic return"; "algebraic distance", "algebraic exchange" and "algebraic transport". This principles will used to develop in the end a substitute algebraic system for known mathematical methods, that are originally based on the use of infinitesimal values and logical models based of them. What we have to do here, is to encode two different systems, that are separated in a nonlinear way, the generating substrate on the on hand and the generated universe on the other.

The non-linear permutation algebra which represents that kind of infinitesimal coupling, is based on a algebra of "general n-fold relations", further called "general n-folds" or "GNF". With the GNF-algebra we can state an abstract algebraic model of an infinitesimal small value and of a quality as well. In the framework of this algebra an infinitesimal value can be characterized by algebraic properties, namley that can be formed by GNF's. The notion of "infinitesimal small" should be redefined in an algebraic way. The more reduced a GNF-environment, virtually defined by sub-GNF's intertwining, the more "small" in a physical meaning the represented system is. "Size" in this algebraic sense is connected with the "deepness" or transcendence of the algebraic environment of GNF and with the algebraic distances of PSE's[2] inside a GNF. The more recursive potential we found, the "bigger" is the system. The more "flat" the environment, the "smaller" the system.

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[2] PSE = Prime Substrate Element; i.e. a symmetry that is not universally incorporated in the PSE's GNF-environment

3. Hypothetical physical implications

All matter within the physical universe forms a group, the universal group UG. This group is at the same time open and closed in an, from the universe seen, infinitesimal way. Infinitesimal openness is connected with the transport of positive and negative entropy[3] from the substrate to the universe and with event integration or desintegration. Furthermore we can identify the universal aspects of gravitation and inertia connected with changes of these substrate connections.

Infinitesimal closeness/openess indicates a constant "algebraic activity" towards the substrate. This is the real content of the existence hypothesis. These activities exchanges substrate level groups (IG's) by others (PEA), getting the upper groups always the same in a universal way while preventing existential symmetries, but not in every individual symmetry beneath. This comes up with infinitesimal changes in local parts of the UG, that causes a change of the UG properties and therefore the geometry of the universe as well as local geometry. So the infinitesimal disturbance of UG's closeness is connected on the one hand with an individual infinitesimal change of matters position ("heat") on the other, local-to-local one, with the appearance of gravitation.

Universal Group	Individual Group	
	universal	*individual*
local	matter	event
non-local	space	time
universe	global impact by substrate connection	

Table 1

On the substrates side the execution of the existence algebra or PEA is connected with resources that are keeping the "infinitesimal transmission" alive. If we change now the PEA-status, substrate resources have to be rerouted and these extra rerouting efforts are causing *inertia* in the physimatics model. And the "flaws" in reintegrating new lower infinitesimal groups (qualities) on substrate near levels are causing new integration paths "upwards" from IG's to UG and so were getting the effect of *gravitation* regarding space. This appears here as a kind of an "algebraic misfit" down on the substrate level.

Going down to the scale of physical particles this means that every particle has two in a different way localized parts of UG, that are on the one hand presenting behavior in accordance to natural laws on the other the integration in events.

Globality or integration of other substrates potentials always indicates action or influence of individual groups, that can be put in a classification of more universal ones on the one hand and more individual ones on the other. The universal part of substrate integration, i.e. its non-locality provided by UG, is encoding position in space and provide spatial dimensions as a consequence of PEA, i.e. PSE exchange. The local non-linear IG-based part is connected with event integration or irreversibility. Mapping the latter to the first, were getting a scale for irreversibility over the existence process, *time*. Taking the global universal parts in the known physical model, we have to enrich Newtons classical "actio = reactio" by the attributes "local", "non-local" and "global".

So Newton is now "local actio = local reactio". But inertia is then "local actio = global reactio", while gravitation in its categorization is represented by "global actio = local reactio". This notion depends from the state of equilibrium before action and whether it is seen as induced from substrate side or the universe side. Because of that, gravitation can not furthermore be treated as regular physical interaction, at least not as locally based one in this model. If we treat the three local interactions as the universal "gearshift" of the universe, Gravitation is the clutch to the main engine. Gravitation is that way not "local" except in a "infinitesimal" way and its not in a functional way integrated in the UG but

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[3] that can be connected with the flow of energy and information

only in a genetic one. Gravitation is a property of UG as a whole group coupled with the substrate exchange mechanism. It is represented by changing IG-integration to the UG and it concerns so in general the type of connection between the non-local UG space generating mechanism and the substrate. It opens the infinitesimal small functional door from substrate to physical reality that can only be functional passed through by acting like a bunch of Maxwell's demons. What can pass are only groups with symmetries, that are part of other symmetries, "traveling" that way an algebraic distance until they will be integrated in events, means in an IG. Relativity is now "local actio = global reactio" and so on. In the equivalent way we have to extend local interactions[4] by non-local or global "actions"[5], open and half-open algebraic cycles, forming topology and probability. The physimatic concept treats gravitation, inertia, relativity as actions in that non-local and global sense.

Without going in detail we can suppose for some reasons, that one can connect the number of *true* local physical interactions[6] with the number of independent geometry dimensions of space, although this establishes not a one-to-one correspondence. If the algebraic and combinatorial approach to the inner nature of space in that theory is valid, then the non-local degree of freedom in space found its direct counterpart in the local structure of *individual* particle symmetries. So we have three seemingly independent dimensions in space and necessarily three universal types of local symmetries or physical interaction types. A universal, i.e. local independent, interaction type requires a "space dimension" to encode the whole global exchange group of this particles and to integrate it with other interaction types, i.e. other non-local exchange groups, and already existing dimensions. Local interactions can in that model be treated as the gears of the infinitesimal transmission between substrate and universe. Simultaneous this transmission is compressing unconnected substrate elements to topologies, further to probabilities and in the end to causality. In this transmission scheme entropy, or as a general kind of it gravitation, can be treated so as the substrates *default mechanism* for the universe, that prevent the substrate of disconnecting parts of itself.

4. Physimatic concept

Even in its actually given abstract top-down-shape with natural gaps in detailing, the structure of the physimatic approach including its nonlinear n-fold exchange and permutation algebra seems to show some new ways for solving different severe physical problems. There can be established a mathematical and a logical model thats behavior is in a structural fit with effects like gravitation, inertia, space expansion and space contraction, matter, energy, entropy, information and time. Since the model in an essential and logical way is "mixing" in its heuristic physical and mathematical items, I called this approach *physimatics*. Physical symmetries drill mathematics; mathematical symmetries drill physics. Logical symmetries drill both.

Shortly speaking this work is about the logical possibility of an extended mathematical framework that aims to the algebraic reconstruction of the whole space-time-framework and other physical constituents of the universe. This begins with the logical description of the possibility to build an essential algebraic theory to form *space*, *matter* and *inertia*. Seen from this, under special reconsideration of the algebras nonlinear parts, we can reformulate issues like *event*, *irreversibility*, *entropy*, *energy* and *information*. From were we're getting logical reformulations of time and gravitation. In the end the gravitation gets two new meanings. In the mathematical focus it is a kind of an cyclic algebraic "misfit" within a recursive basically n-fold cyclic permutation algebra. If we take notions of chaos theory this means a constant infinitesimal movement of an attractor, incorporating matter by PSE structures. Seen from a new physics perspective, gravitation is now a kind of "Planck-entropy" or "existential entropy". Every movement in space is furthermore based on coordinated PEA-action or PSE-exchanges in non-local and partly global scales, which can be roughly translated in a combined group action between UG and IG (table 1).

Moreover the presented type of algebra indicates, that every measurable property in the universe is a symmetry of a group and therefore of algebraic type, anyway whether it is of particle or of event type. That all measurable things are composed of somewhat else and are not basic on the substrate level. While the UG group is local commutative and associative, this is for its non-local part not true. For that reason the multidimensional sub groups coding inertial systems and events are neither homogeneous nor isotropic nor universal. Universality in this meaning is connected with the smoothness-property of the corresponding space dimensions.

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[4] In German: „Wechselwirkungen"
[5] In German: „Wirkungen"
[6] Without gravitation