The Formula of Justice:
The OntoTopological Basis of Physica and Mathematica*

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February 02, 2015

Dialectica: Mathematica and Physica, Truth and Justice, Trick and Life

Mathematica does not permit lie.
It demands the statements to be not only declared but also be proven.
It teaches to ask questions not fearing that the answers will be misunderstood.
It is democratic by nature:
Its democracy is caused by mathematical nature of the truth.
V.Uspensky [1]

In 2010 the global businessman and the philanthropist, the graduate of Physical faculty of the Moscow University Yury Milner introduced the important idea: "The era of people with mathematical mentality comes".[2] In 2012 Yu.Milner established world's largest award on fundamental physics − "*The Breakthrough Prize in Fundamental Physics*".[3] During the interview to the Forbes magazine Yu.Milner explained one of the purposes of the Award : "The gap between physicists and ordinary people in understanding of the world should be reduced".[4]

In 2013 Yu. Milner became the cofounder of "*The Breakthrough Prize in Mathematics*". During an interview he gave the following explanation of the establishment of the Award: "Everything that is considered to be intellectual achievement is situated not only out of the center of public attention, but even not on its periphery. Public attention is focused on the concrete physical achievements or achievements in the field of entertainment. And this imbalance is very dramatic. Our award is an attempt to balance the situation and to create the platform for scientists so that they could better inform the public that the science is cool, interesting and fascinating."[5] But why does this drama imbalance exist?

At the same time there was another drama in the international mathematical community. In March, 2010 The Clay Mathematics Institute awarded mathematician Grigory Perelman by one million US dollars for the proof of Poincare hypothesis. G. Perelman refused the Award, and motivated the refusal by the following: "I refused. You know, I had many reasons to take one side as well as another side. If speak absolutely shortly, the main reason is the disagreement with organized mathematical community. I don't like their decisions, I consider them unjust. I consider that the contribution to the solution of this task of the American mathematician Hamilton isn't less at all, than mine."[6]

Unfortunately, the science still has not developed mathematically strict "The General Theory of Justice" penetrating being at all its levels. But probably doctor G.Perelman knows "the Justice Formula" that is still unknown to us? Formula which is identical to the moral law of Immanuil Kant: "Two things fill the mind with ever new and increasing admiration and awe, the more often and steadily we reflect upon them: the starry heavens above me and the moral law within me."[7]

What is Justice which is above "The Rules" for the mathematician?

I remember the remarkable book of the mathematician Yury Manin where the author defined "Mathematics as Metaphor of human being", and the mathematician's life as "loneliness of the runner on a long distance."[8]

So, let's start our journey in the way of "the Formula of Justice" search …

* Mathematica, Physica, Metaphysica, Logica, Ethica, Dialectica − in the author's text of the essay in Latin

Mathematica as Constructive Metaphysica

The educated people without metaphysics - like the temple,
variously decorated, but without shrine.
G.W.F.Hegel [9]

Why do we use Latin "**Mathematica**" and "**Physica**"? Mathematica and Physica were always an example of the maximum severity therefore the accurate and deep etymology of each word has paramount importance. In accordance with the dictionaries, the word "Mathematica" in Ancient Greek **μᾰθημᾰτικά**. Μάθημα - means studying, knowledge, science, μαθηματικός - originally means susceptible, succeeding, later connected with studying. In such etymology of the compound word "Mathematica" there is some uncertainty in understanding of its nature and deep essence.

There is a version that the origin of the word "Mathematica" (Mathemati**ka**) is more ancient and deeper, than it is interpreted in modern dictionaries and textbooks. It is known that first great Ancient Greek geometers lived and studied in Alexandria, in Egypt. Perhaps the word "Mathematica" came from "**Maat**" – the name of the Ancient Egyptian goddess, personifying universal harmony, space order, truth, justice, representing the concepts of Right, Just Law. Maat was the wife of the god of wisdom **Tot** and the daughter of the god of the sun - **Ra**. **Tot** and the **Maat** were represented with the plate of the copyist and an ostrich's feather – symbols of **primary word creation** which is imprinted in **memory of the Universum**. "Maati" are two "Eternity rooks" on which two sisters Maat are floating in different directions: one across "heavenly Nile", and another across "underground Nile". "**Ka**" in "Pyramid Texts" is an embodiment of the vital force inherent in the Pharaoh. At the end of the Ancient kingdom **Ka** was the "goddess of abstraction" personifying the vital force, reason and knowledge.[10,11]

To the word "Physica" comes from Ancient Greek "physis", "nature" - from a verb **φυω** which means "giving birth". Ancient Greeks were focused on **mobile, developing, borning things**.[12] It was possible to tell about this or that as something having the "physis" ("nature") if it gets some **form as the purpose** of this process in the course of the formation. Later the term "physis" extended to understanding of the set of everything that exists, and the nature appears at the person not only as "**Cosmos**", but also as the vital growth seeking for transition from one form to another with **the invariable generating source**.[13]

Thus, such metaphysical interpretation of the words "Mathematica" and "Physica" gives a clear idea of ancient people that two sciences have a uniform source, namely **meta-law**, the funding **order, harmony of Cosmos and its generating structure**. Mathematica of Ancient Greek naturalistic philosophy representatives was used mainly for creation of the model of Cosmos as the metaphysical model of the world. The special role belonged to geometry. It is known that on an entrance of Academy of Plato there was an inscription: "**Let No One Ignorant of Geometry Enter Here!**".

I. Newton's statement came to us from ancient times: "Physicist, be afraid of metaphysics! " And nevertheless I. Newton was a metaphysicist: he proved the idea of "absolute space" metaphysically. D'Alembert criticizing all philosophical systems spoke about the necessity of constructive metaphysics: "We must replace the obscure metaphysics by metaphysics the application of which takes place in natural sciences, and first of all, in geometry and in different areas of mathematics."[14]

According to Plato, mathematical objects possess existence as actual infinity, but only in "heavens" ("heavenly triangle"). Aristotle eliminated actual infinity to overcome Zenon's aporia and to explain an apparent motion of bodies. For elimination of the dilemma between actual infinity and experiment G. Kantor tried to construct the continuum as an actual infinity.[15] But G.Kantor's metaphysics was insufficiently constructive. Counter-revolution happened in Mathematica. A. Zenkin was right saying: "**truth should be drawn** …"[16]

Physica "rested against consciousness" (M. Mamardashvili) also rested against the "point". And it returned to space of Metaphysica [14] "The cross point" of Mathematica and Physica is

an event of "catching" **of absolute forms of existence of matter (unconditional, limit forms - absolute states)** and their representation in the language of Mathematica.[17] This is the understanding of matter according to Plato: matter is that from which everything is born. But there is something "imperceptible" that forms matter, gives it qualitative and quantitative definiteness which allows to speak about the world as entire form and gives the chance to represent this entireness in mathematical language. But in addition to "physical problems" the problem of time and information arises in that case.[18] Mathematica has to be **Constructive Metaphysica** in order to find a proper solution for this problem.

Mathematica as Constructive Ontology of Cosmos

In "Ontology of a mathematical discourse" G. Gutner makes two important conclusions: "Understanding is the establishment of the point" and "Catching the structure means understanding".[19] Euclid defines the "point" apophatically: "the point is something, that partly consists from nothing."[20] Whether Mathematica can get into the "point" and see its "structure", and then see the Universum as whole? A. Akhutin notes that "the mathematics still lags behind the ontology, it is necessary that its points and units comprised the start of motion. As well as physics still lags behind the ontology while considers mobile, becoming "physis", before it doesn't concentrate in the point of being."[21]

Mathematica and Physica "rested" against "**point**", "rested" against "**structure**", without having approached us to understanding of the nature of the "laws of the nature" and fundamental constants, the nature of information and time.

So, a fundamental **onto-gnoseological problem** of Mathematica and Physica is the structure of "point": "material point", "ideal point", "point-center", "point of support", "points of coincidence of maximum and minimum", "determination points", "singular point", "point of a probabilistic cloud", "point with a vector germ" (E.Cartan). The search is based on the most deep general structural attributes of being and its limit values**.** It is not the process of guessing of primordial structure of the Universum, but the process of **ontological construction** where Mathematica acts as the **Constructive Ontology of Cosmos as the whole** in all levels of its being, and Physica - as the **Universal Ontology of Nature.**

The purpose of ontological constructing is coming through dialectic synthesis of ontology of Mathematica and Physica to **the uniform existential-extremum** of two worlds - "res extensa" and "res cogitans" represented by a **uniform eidos of being and thinking** in the form of a mathematical symbol.

Mathematica as Constructive Existential Method

Mathematica is the main tool in the intellectual revolution of the New era when the **dialectic breakthrough** to a new Universum eidos was made. The revolution in minds changes its logical structure and enters new primary categories of mind. Aristotle's Cosmos, this world of common sense and daily experience, is broken and replaced by the infinite and uniform Universe – "abstract world of the realized geometry".[22]. Rene Descartes made the important conclusion: "In my physics there is nothing that wouldn't be available even in geometry."[23] Physica becomes some kind of applied geometry, and geometry becomes a source of concepts for physics, that is the **method of thinking** (from Ancient Greek μετά-+ ὀδός -"way").[24].

In B. Spinoza's philosophy bodies are the bundles of the movement different from each other only in "proportion", or a movement measure.[25] The intermediary between language and thinking is "**ordo geometricus**" - a geometrical order of the proof. "Ordo geometricus" – is just the instrument of thinking. And the method is an "**idea of idea**". Like Descartes, Spinoza

sees in mathematical knowledge "**an example of truth**" - veritatis norma. That is why in his "Ethica" Spinoza addressed to Mathematica and borrowed the "proof order" accepted in geometry.[24] But Spinoza was mistaken when he hypertrophied ratio to the detriment of spirit ontology and **dialectica of "rest" and "movement"**.

G.W.F.Hegel qualified "ordo geometricus" as the tool of reason which was not able to transfer dialectics of concepts. Simuteneously he claimed that the dialectic mind has no right to act bypass reason.[26] Hegel called Mathematica "lean" science. We can explain the metaphor "lean" by the fact that the methodology of Mathematica doesn't "cover" all existential completeness of the "LifeWorld" perception. The whole history of gnoseological breakthrough in Mathematica and Physica shows that it is necessary to have dialectic synthesis of the ways of research, formation of the methodology of Mathematica as **the constructive existential method** for the purpose of reaching the reliable ontologic basis of knowledge.

Consciousness and Mathematica: Dialectica of Eidos and Logos

Mathematica is the **Tot**al Dialectica: wise connection of unconnectable in a sign-symbol. According to Plato, Dialectica is means of comprehension of the true being. It "crowns all knowledge", disclose "interwoven eidoses" and a process of combination of diversity in the unity of concept,the unity of "logos" and "eidos".[27] Connecting unconnectable, Mathematica overcomes existential crises of mind and makes the **dialectic breakthroughs** to new knowledge. The mathematician carries on simultaneous dialogue both with eidos, and with logos. "Eidos" and "logos" - the perfected tools of thought of the mathematician constructing concepts. A. Losev in his "Philosophy of name" reflects dialectics of "eidos" and "logos".[28] Eidos has own **eidetical logic - dialectica**. There are two moments in eidos — contemplatly static and dialectically mobile: one does not exist without other. These definitions of eidos come from dialectica of essence. The essence doesn't need formal logic and lives in other logic, in dialectica.[28]

E. Husserl noted that the substantiation of Mathematica consists in clearing of its **basic eidentical structure**.[28] Eidos lies in the basis of mathematical practics and represents the unity of different mathematical facts. But what way eidos is understood by consciousness and what way the connection between the act of catching of an eidos and the concrete mathematical reasoning is established? Here Gusserl's idea about **the intentionality of consciousness**, i.e. its orientation, can be remind. In his "Origin of Geometry" he describes "an eidetical catching" as the act of the science establishment of.[30]

In the essay [17, 18] it was shown that the first step on the way to "catching" of proto-eidos of the Nature, **its eidetical structure** - is applying the concept of "**consciousness vector**" representing limit (ideal) states of matter, connecting Cartesian "res extensa" and "res cogitans" in "point with a vector germ". Following Protogeometr in his way to "origin of geometry" on which E.Gusserl insisted - is one of the first steps on the way to **primordial structure of the Universum** - unified basis of fundamental knowledge.

The basic maternal Structure - "La Structure mère"

In "Architecture of Mathematics" N. Bourbaki note that there is a close connection between the experimental phenomena and mathematical structures but the deep causes of it are unknown. And pessimistically conclude: "perhaps, we will never know them."[31]

N.Bourbaki use the axiomatic method and mathematical structures which are "the mathematician's tools" as the main arguments in favor of conceptual unity of Mathematica. N. Bourbaki distinguish three mathematical structures (the Bourbaki mother structures-"les

structures mère"): algebraic, topological and order structures which are carrying out the role of the generating basis for mathematical theories. As Bourbaki note, the structures don't remain invariable neither on their number, nor on their essence and it is quite possible that further development of Mathematica will lead to increase in number of fundamental structures. In the second half of the XX century the theory of categories appeared as a new paradigm of mathematical knowledge. It reflected the transition **to**   "functional ontology" where the part of secondary essence is assigned to things, and the priority is given to relations and functions as a mathematical analog of these relations.[32]

"Les structures mère" of N. Bourbaki is the core idea which is also actual for modern Physica.[32] The analysis of paradigms of mathematical knowledge shows that new **dialectic breakthrough to deep ontology** which will help to find **the required basic** "**La Structure mère**" is necessary for the whole system of fundamental knowledge.

Mathematica and Physica: Loss of Existential Certainty

In "Mathematics: The Loss of Certainty", Morris Kline carries out the deep analysis of the development of Mathematica for 2,5 thousand years, the dialectic breakthrough to new knowledge overcoming its gnoseological crises – to the Antique era, at the beginning of the New era and the third deepest "crise in the foundations": "Disagreements concerning the foundations of the most "firm" of the sciences are surprising and disappointing."[34]

If the first two crises in Mathematica were successfully overcome, the third crisis was a deep onto-gnoseological crisis which mathematicians tried to overcome by inadequate methods. Doctor Yury Neretin noted that "the situation in mathematics and mathematical physics of the last 10-15 years quickly becomes more and more ominous…"[35]

Ludwig Faddeev convinced that "as the physics solved all theoretical problems of chemistry, thereby "having closed" chemistry, and the mathematics will allow to create "theory of everything" and "will close" physics."[36] But how will Mathematica be able to "close" Physica if Mathematica remains science without **ontological justification**?

The solution of the problem of justification of mathematical knowledge ("foundations of mathematics") is solution of the problem of ontological justification of fundamental knowledge. L.Faddeev called Mathematica "the sixth sense of physics". It is possible to raise a question: Whether deep "sixth sense" is enough?

"The loss of certainty" in Mathematica caused "the loss of certainty" in fundamental Physica. It was fully reflected by physicists Lee Smolin [37] and Yury Vladimirov.[14] Such situation in fundamental sciences may be considered not only as "the loss of certainty", but also **the loss of existential certainty.** "Falling in uncertainty" of fundamental sciences is the onto-gnoseological crisis of the whole knowledge, crisis of mind and spirit shown as "the crisis of understanding",[38] "the crisis of interpretation and representation."[39]

It is necessary to remind Plato and taking into account the accumulated knowledge, including traditional knowledge, to comprehend the method of creation of ideal Cosmos once again. According to Plato the creativity is creation of the new knowledge having **the axiological depth of the Good**. As a result of **onto-gnose-axiological breakthrough** in overcoming of the modern crisis of the fundamental knowledge the new comprehensive paradigm of knowledge setting **the basis - framework, structure and foundation of knowledge** not only for Mathematica and Physica, but for all spheres of the "LifeWorld" will born.

Is Effectiveness of Mathematica "**Unreasonable**"?

"The Loss of Certainty" aroused the problem of "unreasonable effectiveness of mathematics". Let's analyse Eugene Wigner's lecture "The Unreasonable Effectiveness of Mathematics in

the Natural Sciences", given on May 11, 1959 at the New York university. Eu.Wigner places emphasis on the mathematical language which helps physicists in their dialogue with the nature: "… mathematical language has more to commend it than being the only language which we can speak; it shows that it is, in a very real sense, the correct language."[40] And further Eu.Wigner places semantic "reference points" for searching the solving of the problem of nature of "unreasonable effectiveness of mathematics", namely, limits of "laws of the nature" and the world as a whole: "whether the different regularities, that is, the various laws of nature which will be discovered, will fuse into a single consistent unit, or at least asymptotically approach such a fusion? " . As a result Eu. Wigner sets a task "stablish a theory of consciousness, or theoretical biology, which would be as coherent and convincing as our present theories of the inanimate nature" and … "to find rather abstract argument which shows that there is a contradiction between such theory and the accepted principles of physics."[40]

Morris Kline clearly points to a source of efficiency of mathematics: "The mathematics can be presented, as some kind of storage of mathematical structures. Some aspects of physical or empirical reality surprisingly precisely correspond to these structures as if the last "are adjusted" to them."[41]

Thus, the problem: to find one single structure - the source of "ureasonable effectiveness of mathematics" – the basic "La Structure mère".

The Ontological Structure of Space

In the essay [17] the evolutions of views on space in Physica were analysed. Nowadays the problem of structure of space is the core problem. With opening of "non-Euclidean geometry" the transfer of formalism of mathematical spaces having the gnoseological status in Physica without reasoning of their **ontological status**, without correlation of the category of "space" to matter and its limit (absolute, unconditional) states begins. Physicists behind mathematicians introduced additional dimensions without clearing of the ontological status of dimension as **qualities (structure) of space.**[42]

Today various ideas of space and time without their ontological justification are represented in physics: "curve", "fluctuating", "extending", "toroid shaped". Responsibility for this is held on Mathematica: Intending "to close physics" Mathematica - "the queen and the servan" (Eric Temple Bell)- takes responsibility for it on itself. Mathematica gradually, step by step erased epistemological fasets between the categories "description", "explanation" and "understanding". A classical example - Ptolemaeus's system. Its substantial model was incorrect, but the used mathematics was so exact that only Newton formulas could surpass its accuracy.[43] The concept "field", fundamental for Physica, also didn't get the ontologic status.

The physicist Yu.Vladimirov proposes the solution of problems of fundamental physics on the basis of a relational metaphysical paradigm.[14] He sees the core purpose in formation of classical space-time theory. Physicists Yu.Kulakov and G. Mykhaylichenko in "The theory of physical structures", while constructing a relational paradigm, developed mathematical methods which represented the universal theory of the relations.[44] The analysis of the conception shows that its ontology is not deep and it won't give the chance to catch "Proteus of Nature".

Eidos of "Idea of Ideas", the Symbol and "Formula of Justice"

Sic cogito, ergo, mundus talis est.[45]

Hilbert's sixth problem - "Mathematical Treatment of the Axioms of Physics", presented in the report on the II International congress of mathematicians. He found it possible "to develop all

physical constants to mathematical constants" and "to make science similar to geometry from physics science."[46]

But as it is known all programs of the foundations of mathematics were not successful. A. Sukhotin noted that classical directions of the foundations of mathematics (logicism, intuitionism and constructivism, formalism) and modern approaches shows: the problem will in the future.[47] It is impossible to agree with such conclusion. It means, in fact, the refusal of search of truth.

S. Cherepanov notes that the problem of the foundations in the conceptual plan is not understood and all programs are inadequate. He gives the course of a solution: "to construct the model of regular process which does not dwell and always lead to something new and new."[48] But we can not agree with approach proposed by S. Cherepanov. Problem requires more fundamental synthetic approach and synthetic method.

Construction of the model of the primordial process of Nature as the basic maternal structure ("La Structure mère") of fundamental knowledge is conducted **on the basis of one axiom, one principle and one mathematical object** - "point with a vector germ" (E.Cartan). The method: **the ontological construction**. "Ordo geometricus" dialectically extends and goes deep to "**Ordo onto-topological**", but not as "order of proof", and as "order of construction" of ontological basis of fundamental knowledge any more.

The main ideas and concepts of the ontological construction: conceptual - figured synthesis (I. Kant), the absolute as coincidence of opposites (coincidentia oppositorium) is the universal foundation of things, lively ideal process (F.W.J. Schelling), the dialectic triad (G. W. F. Hegel), "les structure mère" (N. Bourbaki), "logos", "eidos", "topos", "measure", "proto-tekton", "matter", "form", "absolute states of matter", "vector of absolute states of matter", "primordial process", "source-drain", "limit transition", "increment", "center", "existential-extremum", "invariant", "identity", "primordial structure", "ontological way", "tension", "memory", "symbol". Each mathematical object and concept is characterized by deep ontological interpretation.

The basic principle of ontological constructing (super-principle) is advised by the Nature and Tradition: "the principle of triune" or "the principle of Justice". According to Plato "Justice" is a "metron" which is interpreted in a wide sense as "measure". The concept of "measure" comes from dialectic synthesis of concepts of limit and infinity. Plato says that a limit, entering dialectic identity with infinity, stops being just a limit; it becomes a measure. "Justice" is also understood as a "measure" connected with action which creates harmony, beauty, order and the Good.[27]

In "Logic of threeness" B. Raushenbakh noted that "the triune" penetrates all Nature.[49] But he didn't connect his mathematical model of the triune with the fundamental concept of physics − "state" and with the fundamental dialectic triad of the Nature establishing ontological frameworks of fundamental knowledge - absolute (unconditional) forms of existence of matter (absolute states): absolute rest, absolute movement, absolute becoming. The mathematical model of B. Raushenbakh doesn't represent dialectics "3 in 1", to dialectician limit and unlimited, to the dialectician of "eidos" and "logos". The principle of the triune is the primary principle, it funds all other ontological, gnoseological and methodological principles of fundamental knowledge: integrity, compliances, simplicity, invariance, causality, systemacy, anthropic.

The axiom of ontological constructing as the superior absolute basis of Tradition: "**In The Beginning Was The Logos** …", on Ancient Greek Ἐν ἀρχῇ ἦν ὁ λόγος… where "Logos" was understood as "the law of laws", "the meta-law". Equilateral "heavenly triangle" Plato ("Δ-Delta" as prototekton, "qualitative quantum") represents "**logos**", "**eidos**" and "**measure**" as **qualitative quantity of states of the primordial process**, the dialectic triunity of the absolute (limit) states of matter. Tops of the "delta" are the points of places coincidences of the maximum and minimum of absolute states of matter (existential-extremum) symmetric in

relation to generating center - source of absolute states of matter, each of which has its own **ontological way (ontological vector)**.

The mathematical symbol constructed on the basis of the principle of a triune – three aligned disjoint invariants of "heavenly triangle" (three representing absolute states of matter and their ontological ways) is the symbol of required basic structure of the primordial process, "La Structure mère" (The absolute generating structure), synthetic eidos of structural basis of the Universum as whole. The basic maternal structure -"La Structure mère" is intrinsic unity of "the maternal structures" of fundamental knowledge. "La Structure mère" symbol: "9-top star" [50], "Justice star" - onto-topological model of the extremely simple lively process of generation of absolute complexity. The linear allotment of "the symbol of Justice" gives "the Formula of Justice" ("the formula of open absolute identity") representing ontological "horizontal" and "vertical" of the Universum:

$$\equiv\Delta\equiv\Delta\equiv\Delta\equiv$$

The ontological (absolute) space is the limit values of absolute states of matter: linear (ontological continuum) + vortex (ontological discretum) + wave-vortex (ontological discontinuum). Their dialectic unity (not-fusion, indivisibility, consubstantiality) is "the absolute field". Geometrical reprezentant: cube + sphere + cylinder is the absolute (natural) system of coordinates of the Universum. The absolute space has three "measures" (linear, vortex, wave) and 9 "dimensions": 3 linear + 3 vortical + 3 wave.

Thus, the method of ontological construction as constructing of eidos of "idea of ideas", brings to the unified onto-topological basis - **"the general framework structure**", "**carcass**" and "**foundation**" of knowledge. **The meta-paradigm** of fundamental knowledge is the synthesis of three historical paradigms of formation of knowledge - "sphere paradigm", "beam paradigm" and "segment paradigm". The basic maternal structure (Absolute generating structure) gives understanding of the nature of fundamental constants, the nature of "laws of the nature", the nature of time and information as polyvalent phenomena of the ontological (structural, cosmic) memory - "the soul of matter", qualitative quantity of absolute states of matter.

→Dubito→E rgo→ Cogito→

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