The Ultimate Possibility Physics
Anthropological *Daseinisation*.

Essay

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Abstract. In the taste of the day question " What is Ultimately Possible in Physics ? " is an attempt to define some kind of semi-experimental and semi - intuitive Anthropological Physics ("The Ultimate possibility Physics ") or, may be, some new Anthropologie (= Metaphysik) of cognitive limits of the human physics , associated today with J. Barrow's Science of the limits (1998) and M. Kaku's Physics of the impossible (2008). However, thanks to Pyrrhonists and Immanuel Kant, taking Anthropological Physics seriously, had both grand and, may be, paradoxical history during last 2000 years .Fortunately, in 19th - 20th centuries the right definitions for such "Physics – at- the - bound -state " were found by experimental physics and K. Gödel and our recent attempt to "bring - a – bounded – physical - propositions -into – existence " (or " *Daseinisation* " in the terms of post-Kantian temporary philosophy of *Dasein* by Martin Heidegger,) could be considered as a possible answer for decidedly problematic question of **FQXi** 2009.

Two definitions of the Ultimate Limits.

1.1 The Ultimate Limit as an Idealistic *mentalitė*

Certain characteristics of quantum particles cannot exist without the experimentalist. This kind of idealistic pre-established harmony between a presence of man and untold truths of Nature,cannot ,however, always be tolerated.

In accordance with Albert Einstein , such "Quantum Solipsism " (using the Einstein's term [1]) is a "risky game, playing with reality – reality as something independent of what is experimentally established "[2].

In contradiction with his own idealism (and this fact has to be emphasized , see, for instance, K.Gődel's "Remark about relationship between Relativity theory and idealistic philosophy "[3] and contemporary studies on the pseudo-tensor problem in General Relativity [4]) Albert Einstein (like Vladimir Lenin with his "undergovernable passion"to trivial materialism earlier [5]) suggested that physicists must believe that certain characteristics of quantum particles can exist without the experimentalist's presence, even if quantum experiments prove the opposite [6] (similar attitude also could be found in *Tractatus logico-philosophicus* : 6.375 ; 6.3751 [7]).

The EPR-paradox, formulated by Einstein – Podolsky - Rosen in 1935, was not, however, able to stop development of the New idealism in quantum physics. And, today, when the Entanglement effect,[8] in which strong correlations are observed between presently non-interacting particles, even if they are detected arbitrarily far away from each other , is routine in the laboratory [9] , we may suggest that an idealistic mentalitė is remained in quantum physics as the ultimate possibility. Indeed.

According to E. Schrödinger (1961) " scientific knowledge forms part of the idealistic background of human life" [10], thus, such sort of the Ultimate Limit can have humanistic and anthropological sense beyond quantum physics.

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1 . 2 The prediction

Non-trivial idealism cannot be " fundamentally decadent " in experimental physics , and, physics - in - the-bounded - state could be connected with unreasonable fears of idealism and paranormal.

2 . 1 The Ultimate Limit as the mathematical object (category).

In 1879-1884 Georg Cantor made an attempt to introduce in mathematical logic the most simplest mathematical object – a notion of set ("Menge").

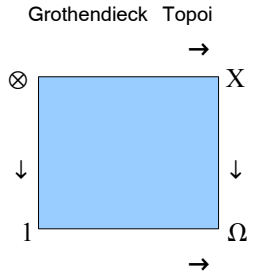
In accordance with Cantor, an intuitive set could be considered as a replacement of " a divine " number, hence, mathematicians can use a set as a constructive unit to create new language as well as to construct new objects in mathematics.

However, as it is known, Cantor's "superstructure" faced with fundamental logical paradoxes and his continuum assumption (CH) on an existence of two different measures of complexity of the infinite sets – $\aleph_0$ – complexity and $2^{\aleph_0}$ - complexity were found to be unprovable (Cohen result by 1963) and non-computable (there is no such simple algorithm to define the unknown length of pointed cardinality $2^{\aleph_0}$ by another known length of pointed cardinality $\aleph_0$, in time t ($\aleph_0$).).

In 1950's-1960's there made attempts to develop alternative to Cantor set theory (to avoid doubtful idea of set – membership) , where classical notions of "set", "function", "one-to-one -function"," surjection", "bijection", "cartesian product" and "disjoint union" were replaced correspondingly by the notions "object", " morphism" , "monomorphism" ," epimorphism" ," isomorphism", "product" and "co-product".

New method of constructing of the notions had made set-theoretical custom of disputation of set-theoretical paradoxes irrelevant. But such good intentions were only slowly fulfilled . Almost immediately, new intuitive difficulties with pre-existing topological spaces and classification of the logical volumes of mathematical worlds of the categories in the new brave world of new spatial imagination were found. Because any attempt of the classification now is assumed a very serious aspect of theory (in fact this means "new mathematical universe "), it is quite expedient to make even short abstracts of the general picture of contemporary category theory. Nevertheless, there are certain structure and "ontologies of the presence " for well - established objects , for instance, the category **Set** (where objects are sets, morphisms are maps of sets), the category **Grp** (where objects are groups, morphisms are group homomorphisms) , the category **Top** (where objects are topological spaces, morphisms are continuous maps), the category **Cat** (where objects are small categories, morphisms are functors ;and, when bi-category (a kind of double category) is arisen when a notion of 2-morphism between morphisms is accepted), the **n** -category (supposed an existence of 2-morphisms, k-morphisms) and the **1**-category (where morphisms are morphisms of all orders), etc.

In 1950s Girard discovered a non-elementary characterization of the category of sheaves on a site. Such category was called in peripatetic manner as a topos by Alexander Grothendieck in 1958.[11]



In *Grothendieck' Topos ("intuitionistic superstructure of Mathematical Universe ")* there is a logical object (a sub-object classifier Ω), whose elements are the truths values. Topos C has a sub-object classifier Ω with an element t □ Ω, the generic sub-object of C having the property that every monic m : ⊗ ⟶ X arises as a pullback of the generic sub-object along a unique morphism f : X⟶Ω.

In 1970-1971 Lawvere and Tierney introduced the notion of an elementary topos as a generalization of category where a Grothendieck topos is a complete elementary topos.

This was comparatively productive post-Kantian step in category - theoretical unification of an intuition of time (arithmetic) and an intuition of space (geometry). However, Grothendieck unification of the different kinds of intuitions was essentially geometrical, reducing arithmetical intuition to topological(geometrical) intuition (intuition of space).

If human mathematics is based on mathematical intuition of space-time (in post - Kantian Grothendieck's sense) ,the ultimate limits of mathematics and mathematical physics could be presented by intuitionistic mathematical objects (categories , toposes , meta-styles) . Not surprisingly, hence, that different areas of theoretical physics – classical (including relativistic physics) and non-classical (quantum) are needed different kinds of toposes (for example, classical physics arises when the topos is the category of **Set**, whereas other toposes may employ a different toposes).[12,13,14,15,16 and 17].When such theoretical constructions are not connected with experimental events, the ultimate limits of physics are intuitionistic mathematical objects.

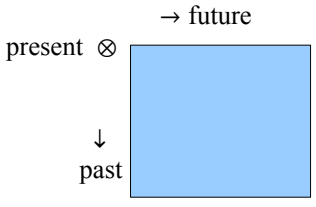
2 . 2 Predictions.

2.2.1.Physics in the bound state ,represented by intuition of mathematical objects and bounded rationality of computable structures ,is defined usually as unified theories of physics and cosmology iff they cannot be supported by experimental facts. In particular, string theory speculates that all elementary particles are actually intuitive mathematical objects – strings, and supersymmetry theory is based on the idea of parallel mathematical universes where to any particle there is an other particle whose spin differ by ½. These theories cannot be completely supported by experiments and they merely reflect the ultimate limits of human speculative knowledge.

2.2.2. Non-Grothendieck's ways of the unification of mathematical intuition are also possible. Heidegger's reduction of an intuition of space to purely arithmetical intuition (intuition of time) represents another model of mathematical intuition (Heidegger's *Timespace meta-style ,* see , also my Heidegger-inspired experiment with Time [18]). However, some more balanced unification (of Kantian meta-style) can be found in more traditional 2-model with non-reducibility of arithmetic to geometry and vice versa, and, where general physics,thus,correspondingly, is based on intuition of time (" pure mechanics especially can attain its concepts of motion only by employing the representation of time " I. Kant *Prolegomena* ,***283***).

Historical Addition. As is known, Heidegger's attempts to define arithmetic intuition of time (in Kantian and post-Kantian philosophy arithmetic attains its concepts of numbers by successive addition of units in time) by formal maps are connected, perhaps , with his summer semester of 1923 in Freiburg University. German edition of his Freiburg's lectures ("Ontology -The Hermeneutics of facility ") reproduces quite puzzling hand-drown map in the following form

Freiburg's Diagram of M. Heidegger



that may formally express an idea that "Past and future as definite horizons, which each define the present-pressing forth into there from out of the past and future " [19; p.72].

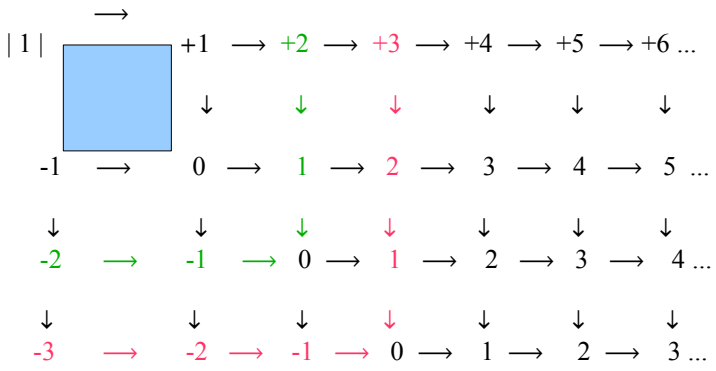
Later, in *Being and Time* (section **70**))(1927), *Besinnung* (1936-1944) and especially in *Time and Being* (1962-1964), Heidegger introduced more exact definition of four-dimensionality of arithmetical intuition (in explanation of a notion of *Ereignis or* the event of Appropriation *)*.

Accordance with Heidegger, unifying unity of future,past and present is a kind of space (time-space) as the name of openness with opens up in the mutual self-extending of futural approach,past and present. "This openness exclusively and primarily provides the space in which space as we usually know it can unfold. The self-extending ,the opening up, of future, past and present is itself pre -spatial, only thus can it make room, that is, provide *space* " [p14]. Thus,

> " Dimensionality consists in a reaching out that opens up, in which futural approaching brings about what has been, what has been brings about futural approaching, and the reciprocal relation of both brings about the opening up of openness. Thought in terms of this threefold giving, true time proves to be three-dimensional . Dimension, we repeat, is here thought not only as the area of possible measurement, but rather as reaching throughout, as giving and opening up. Only the letter enables us to represent and delimit an area of measurement .But from what source is the unity of the three dimensions of true time determined, the unity, that is, of its three interplaying ways of giving, each in virtue of its own presencing? We already heard : In the approaching of what is no longer present and even in the present itself, there always plays a kind of approach and bringing about, that is a kind of presencing. We cannot attribute the presencing to be thus thought to one of the three dimensions of time,to the present , which would seem obvious. Rather, the unity of time's three dimensions consists in the interplay of each toward each. This interplay proves to be the true extending, playing in the very heart of time ,the Fourth Dimension , so to speak – not only so to speak, but in the nature of the matter. **True time is four – dimensional** . But the dimension which we call the fourth in our count is, in the nature of the matter, the first, that is, the giving that determines all. In future, in past , in the present, that giving brings about to each its own presencing, holds them apart thus opened and so holds them toward one another in the nearness by which the three dimensions remain near one another. For this reason we call the first, original, literally incipient extending in which the unity of true time consists "nearing nearness" "nearhood' (Nahheit), an early word still used by Kant. But it brings future, past and present near to one another by distancing them " (*Time and Being*,[19] p.15).

Let us Heidegger's Present will be "| 1 |", Past " - 1", Future " +1"and the forth dimension - as Grothendieck 's classifier $\Omega = (+1 - 1) = 0$, hence, Heidegger' 4-time intuition (|1|,+1,-1,Ω) can be represented as a kind of double category – the category of all commutative squares in **Set** of the form :

Heidegger's 4-timespace flow



Heidegger's 4 Dimensional intuition of time produces 4-timespace "flow". It is the first visual demonstration of the most enigmatic Heidegger's definition of Time in history of post-Kantian philosophy of the 20th century.

LHC game experiment

Some games are older than science and when scientists are playing quantum - like games against Nature in their experiments, they can help to realize the ultimate limits of science or physics itself. Large Hadron Collider (LHC) at the CERN was designed for search of the Higgs particles, however, LHC does not cover the complete spectrum of manifestations of the Higgs particles actually. Hence, there is uncertainty which can transform systematic LHC experimental program at the CERN into classical game with a trend to be quantum.

Following our definitions and predictions (1.1/1.2 -2.1/2.2) we may suppose that real LHC game can be defined as zero-sum game where each player has only a finite number of strategies, random moves are permitted ,the game might not be deterministic and there is no requirement of perfect information.

Definition 1.(*LHC game*) The LHC game is a competitive game between team of experimentalists[**LHC**], presenting opposite winning strategies ("skeptics" [**S**], believing in negative predictions on an existence of Higgs particles and Nature's"conspiracy" (including emergency of mini - black holes,unexpected collapses and other abnormal consequences [20]) and" optimists" [**O**] , suggesting positive predictions on the existence of Higgs particles [21]) and - a referee (Nature). In the initial phase of game, the referee (Nature) chooses a type of random event,associated with true manifestation [T_{hp}] of the Higgs particles,or,false manifestation [F_{hp}] in the terms of phenomenology of LHC experiment.

Definition 2. (*Winning strategy*). Winning strategy for LHC game is defined by following matrix:

		Nature	
		strategy T_{hg}	strategy F_{hg}
LHC team	strategy **O**	**1**	**0**
	strategy **S**	**0**	**1**

In other words, a player wins when Nature and **LHC** team synchronously choose strategy T_{hg} and strategy **O**, as well as when they choose strategy F_{hg} and strategy **S.** Correspondingly, a player loses when Nature and **LHC** team synchronously choose strategy F_{hp} – strategy **O,** as well as strategy T_{hp} - strategy **S.**

Definition 3. (*Quantum - ness of LHC game*).We say that the LHC game tends to be quantum iff the player **Q!** wins always and there is no counter-example during all program of LHC experiments, indeed. In the terms of category theory such condition can be expressed (non exactly) by following horizontal composition in computable double category **Đ** :

$$\begin{array}{ccccc} \mathbf{Q!} & \longrightarrow & T_{hp} & \longrightarrow & F_{hp} \\ \downarrow & & \downarrow & & \downarrow \\ \mathbf{O} & \longrightarrow & \mathbf{1} & \longrightarrow & \mathbf{0} \\ \downarrow & & \downarrow & & \downarrow \\ \mathbf{S} & \longrightarrow & \mathbf{0} & \longrightarrow & \mathbf{1.} \end{array}$$

The prediction.

Impossibility to win can mean that experimentalists faced with some intuitive ultimate limit of physics.

References

1.Einstein A, in Louis de Broglie: *Physicien et penseur* (Paris: Michel, 1953)

2 "Letter by A. Einstein to E. Schrödinger dated 22 December, 1950",in Pais A. "Subtle is the Lord....": the Science and the Life of Albert Einstein (Oxford: Oxford Univ. Press, 1982) p. 143

3.Gödel K. "Remark about the relationship between relativity theory and idealistic philosophy", in Albert Einstein, Philosopher-Scientist (The Library of Living Philosophers, Vol. 7, Ed. P A Schilpp) (Evanston, III,: Library of Living Philosophers, 1949) p. 555.

4. Logunov A.A., Loskutov U.M., Mestvirashvili M.A. Uspechi Physics, **155**, 369(1988)

5. Lenin V.I. Materialism and Empirio-criticism. Remarks on the most reactionary philosophy(Moscow, Gospolitizdat,1973)

6. "Letter by A. Einstein to M. Besso, 24 July 1949", see Ref. [2] p. 463

7. Wittgenstein, L. *Tractatus Logico-Philosophicus* .transl.D.F.Pears,B.F.McGuinness .NY Humanities
- Press (1961) 6.375;6.3751

8. Bell J. Phys. World 3 (8) 33 (1990)

9. Pan J-W et al. Nature 421 721 (2003)

10. Schrödinger E. Science and Humanism. Physics in Our Time (Cambridge: Univ. Press, 1951) p. 11

11. Grothendieck, A. Recoltes et Semailles. Russian translation by U.Freedman and M.Finkelsber. - (Notices of the American Math Soc ,51(10),1196-1212 (2004))

12. Archutin A. Methodological analysis of Reichenbach's space and time conceptions- in:
- Reichenbach,H. Philosophy of space and time (Moscow Progress publ , 1985)

13. Guts A.K., Grinkevich E.B. Toposes in General Theory of Relativity (arXiv :gr-gc/9610073v1/1996)

14.Isham C.J. Topos theory and consistent histories (arXiv:gr-gc/ 9607069v1/ 1996)

15. Doring A.; Isham C.J.II. Daseinization and the Liberation of Quantum Theory(quant-ph0703.062v1)

16. Doring A. Topos theory and ' neo-realist' quantum theory (quant-ph/ 0712.4003v1/2007).

17.Abramsky S.;Tzevlekos Introduction to categories and categorical logic. In: New structures for
- physics. B. Coecke (ed.) Springer Lecture Notes in Physics (2009).

18. Popov M.A. Testing Two-Dimensional Time / FQXi 2008.*The Nature of Time*.

19. Heidegger M. On Time and Being. Transl. By J.Stambaugh (The University of Chicago Press,2002).

20. Ellis J, Giudice G., Mangano M., Tkachev I., U.Wiedelmann. *Review of the Safety of LHC Collisions (* CERN-PH-2008-136).

21. Armesto N., Borghini N., Jeon S., Wiedelmann (eds). Heavy Ion Collisions at the LHC – Last Call for Predictions. (arXiv:hep-ph/ 0711.0974v1/2007).