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A Formal Deductive Inference of the Law of Inertia in a Logically Formalized Axiomatic Epistemology System Sigma from the Assumption of Knowledge A-Priori-Ness

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Abstract

The *general purpose of the research*—systematical clarifying and explicating the too vague proper philosophical concepts of space, void, matter, motion, inertia, for making a logical harmony between them and the corresponding notions of proper physics. The *special purpose of the research*—invention (construction) of a *formal inference of the well-known Newton's first law of mechanics* within a logically formalized axiomatic epistemology system from a set of precisely defined presumptions. For realizing this aim *the following work has been done*: a two-valued algebraic system of metaphysics as formal axiology has been applied to philosophical epistemology and philosophy of nature; a formal axiomatic theory called Sigma has been applied to physics for realizing the above-indicated special purpose of the research. Thus, constructing a discrete mathematical model of relationship between universal epistemology and philosophy of physics has been done. *Research results*: The main hitherto not published significantly new nontrivial scientific result of applied investigations presented in this article is *a formal inference of the well-known Newton's first law of mechanics* within the formal axiomatic epistemology system Sigma from conjunction of the *formal-axiological analog* of the proper-law-of-mechanics (which *analog* is the *formal-axiological law* of two-valued algebra of metaphysics) and the assumption of a-prioriness of knowledge. For obtaining this main research result, a set of accessory nontrivial novelties has been used, for instance; a precise algorithmic definition is given for the notion "*law of metaphysics*" in the algebraic system of metaphysics as formal axiology; a *formal-axiological equivalence* in the algebraic system is defined precisely. Precise tabular definitions are given for relevant evaluation-functions determined by evaluation-arguments, for example; "movement of (what, whom) *x*"; "speed of *x*"; "vector of *x*"; "velocity of *x*"; "magnitude of *x*"; "finiteness (definiteness) of *x*"; "dynamical closed-ness (isolated-ness) of *x*"; "constant-ness, immutability, conservation of *x*".

Keywords

Relative-Space, Law-of-Inertia, Formal-Inference, A-Priori-Knowledge, Formal-Axiomatic-Epistemology-Theory-Sigma

1. Introduction

To begin with, let us introduce the *research background*. In times of Aristotle, substantial differences between physics and metaphysics had been not recognized; in many significant aspects his "Physics" had repeated his "Metaphysics" [1]. In perfect accordance with Aristotle's "Physics", which had been dominating during very long time, a discovery of the law of inertia had been impossible. Since times of Aristotle, during many centuries up to times of Galileo Galilei, it had been considered that every motion (even the *uniform* one *in a straight line*) implied existence of an external cause (the "mover"). Owing to the strong and long influence of Aristotle's "Physics" and "Metaphysics", the law of inertia had been formulated originally by Galileo Galilei [2] [3] and then generalized by R. Descartes [4]. From experiments with the horizontal motion on Earth, Galileo Galilei figured out that a body in the motion should remain in the motion infinitely, if no force caused the body to come to rest [2] [3] [4] [5]. Today, as a rule, the law of inertia by Galileo Galilei is called "Newton's first law"; here the famous "Three Newton's Laws of Motion" are implied [6]. Certainly, from the *historical* standpoint, it is more precise and more just to call the law in question "Galilei's law" or "Galilei-Descartes law". But it is a linguistic fact that today, as a rule (*statistical* one), the law by Galileo Galilei is called the law by Newton. Now it is a *linguistic tradition* (*habit*), therefore, as the investigation represented in this paper is not a historical one, I shall accept an abstraction from the historical aspect of the theme and concentrate on its proper theoretical contents. Thus, in the present article, I shall follow the contemporary linguistic *tradition* (statistical *norm*) of using the name "Newton's first law" instead of "Galilei's law" or "Galilei-Descartes law" while speaking of the law of inertia in classical mechanics. Certainly, the name "Newton's first law" is somewhat *conventional* one, but, from the viewpoint of proper *theory* of mechanics *abstracted from its history*, it is not a serious problem.

The present article submits a psychologically unexpected (surprising) and, therefore, hitherto not-well known *formal-axiological* interpretation of the law of inertia in classical mechanics. The *formal-axiological* interpretation of Newton's first law is a ground-breaking interpretation as it contradicts to the dominating paradigm in philosophy of science. With respect to the still dominating paradigm, it seems quite obvious that metaphysics and physics (especially metaphysics and mechanics) are incompatible. Modern mechanics is a respectable part of physics based on observations, facts and measurements. Nowadays, in perfect accordance with the still dominating paradigm, plenty of physicists believe that metaphysics and axiology have nothing to do with observations and experiments, facts and measurements [5] [7]-[17], *et al*. However, if human culture must be a consistent union of all its aspects for the sake of human consciousness unity (mankind psyche health), there must be a universal (common) for the two particulars: the piecemeal approach must be complemented by synthesizing one. The present article submits an option of the synthesizing approach to the two extremes: the uncompromisingly empiricist epistemology and the uncompromisingly rationalist (metaphysical a-priori-ism) one. The conceptual synthesis is realized by means of two-valued algebra of metaphysics understood (interpreted) as algebra of formal axiology.

This algebra makes up an indispensable aspect of the research background to be defined precisely in the next paragraph. Contents of the paragraph 2, namely, precise definitions of basic notions of two-valued algebraic system of metaphysics as formal axiology are already published, for instance, in [18]-[23]. Nevertheless, including these already published contents into the paragraph 2 of the present paper is indispensable as it makes up the research background; otherwise, the significantly new nontrivial scientific result represented in this article should be not understandable completely and, hence, not examinable by peer-reviewers and readers.

With respect to applying discrete mathematics to philosophical grounds of physics, it is worth mentioning here that in the present article the following evaluation-functions determined by one evaluation-argument are considered: "movement of (what, whom) *x*"; "speed of (what, whom) *x*"; "vector of (what, whom) *x*"; "velocity of (what, whom) *x*"; "quantity of *x*"; "finiteness (definiteness) of *x*"; "dynamical isolated-ness of *x*"; "constant-ness (immutability) of *x*". The functions are precisely defined in the mentioned algebraic system by tables. It is demonstrated in this article that by accurate computing compositions of the relevant evaluation-functions anyone can establish (and scrutinize) such a *law of algebra of metaphysics* which (law) is a *formal-axiological analog* of Newton's-first-law-of-mechanics. During long time the word-combination "law of metaphysics" has been considered as a verbal representation of an "absolutely dark (necessarily unclear, obscure vague)" concept or as a term possessing no meaning at all [5] [7]-[17]. Therefore, submitting (below in paragraph 2) the unhabitual (almost unknown) exact algorithmic definition of the allegedly inexplicable-on-principle (necessarily incomprehensible) concept "law of metaphysics" is an important part of introducing the research background. In general, metaphysics represented (in paragraph 2) as an algebraic system of formal axiology plays the role of *formal-axiological semantics* for the syntax of artificial language of formal axiomatic theory Sigma (represent in paragraphs 4 and 5), which theory is a consistent synthesis of universal epistemology, abstract axiology, and proper philosophical ontology.

As the main significantly novel nontrivial scientific result is obtained (in the paragraphs 3 and 7 of this article) within the framework of a qualitatively new paradigm, which scientists and philosophers are not used to, they have to have exact definitions of all the novel basic notions at their disposal before: 1) starting to construct, read, and understand *formal deductive proofs* and to examine them at syntax level; 2) interpreting the formally proved theorems and discussing the interpretations. The precise definitions necessary and sufficient for complete understanding and rigorous scrutinizing perfectly new contents of the paragraph 3 are given in the paragraph 2. The exact definitions and formal proofs necessary and sufficient for complete understanding and rigorous scrutinizing contents of the paragraphs 7 and 8, which have been never published elsewhere, are given in the paragraphs 2, 4 - 6. The paragraph 6 makes up another necessary aspect of the research background by repeating the formal proof of the theorem-scheme published in [21] [23]. This repeating is indispensable because the mentioned psychologically unexpected and philosophically nontrivial theorem-scheme is used in this paper necessarily as a principal tool (instrument) for making and demonstrating the main hitherto-not-published discovery located in the paragraph 7. Now let us begin submitting the basic definitions.

2. Algebra of Metaphysics as Algebra of Formal Axiology

According to the contemporary abstract notion of algebra, generally speaking, algebra may be based upon *any set of objects having any nature*. The *habitual* sets (of numbers, quantity relations, space forms, etc.) are implied by the well-known *habitual* concrete *applications* of algebra to the concrete (fixed) objects for solving the concrete (fixed) classes of problems of human life. For instance, originally, Boolean two-valued algebra of logic had broken the habitual paradigm of algebra as a mathematical apparatus for operating *exclusively* with numbers. Boolean algebra of logic is based upon the set of thoughts, which are either true of false ones. Numbers and thoughts have qualitatively different nature but it does not matter if one talks of abstract algebra in general. Consequently, from the universal algebra standpoint, one can create an algebraic system based on a set of *any* (*even very unhabitual*, *extraordinary*, *odd*) *objects*. Hence, in principle, nowadays it is possible rationally to talk of constructing and investigating even such an algebraic system which is based upon a set of objects having either *proper ethical* (moral) or *proper metaphysical nature* as well [18] [19] [21] [22] [24]. Certainly, elements of the set, which hypothetical *algebra of metaphysics* is to be based on, are to be neither numbers of arithmetic, nor figures of geometry. (Certainly, if Pythagoreans knew this statement of mine, they would be irritated). According to the standpoint accepted in the present article, elements of the set which algebra of metaphysics is based on are objects of *abstract axiology*, which is a *universal theory of abstract values*. Obviously, the nature of objects which are elements of the set which algebra of metaphysics is based on is odd (extraordinary) one. Nevertheless, below in this paragraph, in spite of the oddity, relevant notions of algebra of metaphysics are to be introduced and defined precisely.

The odd (unhabitual) algebraic system mentioned in the title of this paragraph is based upon the set Δ. By definition, elements of Δ are such (and only such) *either existing or not-existing objects*, namely, things, processes, persons (individual or collective ones—it does not matter), which are either good, or bad ones from the standpoint of a valuator *V*, who is a person (individual or collective one—it does not matter), in relation to which all valuations are generated. Here the terms "good" and "bad" have abstract axiological meanings which are more universal in comparison to the particular ones exploited in ethics: in the present article, "good" means abstract *positive value* in general; "bad" means *abstract negative* value in general. Certainly, *V* is a *variable*: changing values of the variable *V* can result in changing valuations of concrete elements of Δ. However, if a value of the variable *V* is fixed, then valuations of concrete elements of Δ are quite definite.

Algebraic operations defined on the set Δ are abstract-valuation-functions (in particular, moral-value-ones). Abstract-valuation-variables of these functions take their values from the set {*g*, *b*}. Here the symbols "*g*" and "*b*" stand for the abstract values "good" and "bad", respectively. The functions take their values from the same set. The symbols: "*x*" and "*y*" stand for axiological-forms of elements of Δ. Elementary axiological-forms deprived of their contents are independent abstract-valuation-arguments. Compound axiological-forms deprived of their contents are abstract-valuation-functions determined by these arguments.

In this article, talking of *evaluation-functions determined by* (a finite integer of) *evaluation-arguments* means talking of the following mappings (in the proper mathematical meaning of the word "mapping"): {g, b} → {g, b}, if one talks of the valuation-functions determined by *one* valuation-argument; {g, b} × {g, b} → {g, b}, where "×" stands for the Cartesian product of sets, if one talks of the valuation-functions determined by *two* valuation-arguments; $\{g, b\}^N \to \{g, b\}$, if one talks of the valuation-functions determined by *N* valuation-arguments, where *N* stands for a finite positive integer. To exemplify the above-defined general notion, let us introduce and define precisely by tables the following evaluation-functions determined by one argument. This is not merely an exemplification as the below-introduced one-placed functions are to be exploited essentially for obtaining the main new nontrivial scientific result of this article.

Glossary for **Table 1**. C_1x—"*change*, flow of (what, whom) *x*". P_1x—"*place*, *position* (unique location in space), special room, *own territory* of (what, whom) *x*". R_1x—"*rest* (nonbeing of mechanical movement) of (what, whom) *x*". M_1x—"*mechanical movement* of (what, whom) *x*". U_1x—"*uniform* (what, who) *x*", or "*uniformity* of (what, whom) *x*". S_1x—"*straightforward* (what, who) *x*", or "*straightforwardness* of (what, whom) x". S_2x—"*speed*, *quickness* of (what, whom) x". D_1x—"*immanent direction* (own *inner vector*) of (what, whom) x". V_1x—"*velocity* of (what, whom) x". P_2x—"*part* of x". N_1x—"*nonbeing*, nonexistence of x". N_2x—"*absolute nonbeing* of x". These evaluation-functions are precisely defined by the below-submitted **Table 1**.

Glossary for **Table 2**. B_1x—"*being*, existence, life of (what, whom) x". B_2x—"*absolute being* of (what, whom) x". G_1x—"*God* (what, who) x". Z_1x—"*thing* (what, who) x". O_1x—"*opposite* of/for (what, whom) x". E_1x—"*extent*, *extension*, *length* of (what, whom) x". F_1x—"*finite*, *definite* (what, who) x" or "finiteness, definiteness of (what, whom) x". I_1x—"*infinite*, *indefinite* (what, who) x", or "infiniteness, indefiniteness of (what, whom) x". M_2x—"*magnitude* (quantity) of (what, whom) x". R_2x—"*relativity* of (what, whom) x", or "relative (what, who) x". V_2x—"*void*, *vacuity*, *emptiness* of (what, whom) x", or "empty, vacuous (what, who) x". V_3x—"*absolute void* (absolute vacuum) of x". These functions are defined by **Table 2**.

Glossary for **Table 3**. S_3x—"*metaphysical* space of (what, whom) x". S_4x—"*physical* space of (what, whom) x". S_5x—"*absolute* space of x". S_6x—"space of x in *general*". P_3x—"*property* of (what, whom) x". A_1x—"*attribute* of (what, whom) x". B_3x—"*body* of (what, whom) x". C_2x—"(*dynamically*) *closed*, isolated, protected (what, who) x", or "*dynamical closedness*, isolated-ness, protected-ness of (what, whom) x". H_1x—"*flesh* of x". M_3x—"*matter*, *material*, *materialness of* (what, whom) x. M_4x—"*matter*, *material for* (what, whom) x. These functions are defined by **Table 3**.

Table 1. The functions determined by one argument.

x	C_1x	P_1x	R_1x	M_1x	U_1x	S_1x	S_2x	D_1x	V_1x	P_2x	N_1x	N_2x
g	b	g	g	b	g	g	g	g	g	b	b	b
b	g	b	b	g	b	b	b	b	b	g	g	b

Table 2. The one-placed evaluation-functions.

x	B_1x	B_2x	G_2x	Z_1x	O_1x	E_1x	F_1x	I_1x	M_2x	R_2x	V_2x	V_3x
g	g	g	g	g	b	g	b	g	g	b	b	b
b	b	g	g	b	g	b	g	b	b	g	g	b

Table 3. The unary evaluation-functions.

x	S_3x	S_4x	S_5x	S_6x	P_3x	A_1x	B_3x	C_2x	H_1x	M_3x	M_4x
g	g	b	g	g	g	g	g	g	b	b	g
b	b	g	g	b	b	b	b	b	g	g	b

Glossary for **Table 4**. S_7x—"*sensation* of (what, whom) x as an object, *i.e.* x's being an object of sensation". M_5x—"*measurement* of (what, whom) x as an object, *i.e.* x's being an object of measurement". P_4x—"*possibility* of (what, whom) x". I_2x—"*impossibility* of (what, whom) x". N_3x—"*necessity* of (what, whom) x". C_3x—"constant-ness, immutability, conservation of (what, whom) x". W_1x—"*struggle*, *war for* (what, whom) x". A_2x—"*action on* (what, whom) x", or "*application of a force to* (what, whom) x". M_6x—"*many-ness* (*multitude*) of x". F_2x—"*form of* x". F_3x—"*form for* x". These evaluation-functions are defined by **Table 4**.

Now, let us turn from the evaluation-functions determined by one evaluation-argument to evaluation-functions determined by two evaluation-arguments.

Glossary for **Table 5**. The symbol K^2xy stands for the two-placed evaluation-function "*being* of y *with* x", or "*joint being* of x and y", or "x's and y's *being together*". The symbol W^2xy means "*being* of y *without* x", or "*joint being* of y and *nonbeing* of x", or "y's *being together with* x's *nonbeing*". E^2xy—"*equalizing* (*identifying values of*) x and y", or "*axiological coincidence* (*identity*) of x and y". R^2xy—"x's being related to y", or "*being* of x *in relation to* y", or simply "(what, who) x *in relation to* y". T^2xy—"y's *terminating*, *annihilating* (what, whom) x", or "x's being terminated, annihilated by y". P^2xy—"*preservation*, *conservation* of x by y". D^2xy—"*defense*, *protection* of x by y". A^2xy—"y's *action on* (what, whom) x", or "y's *application of force to* x", or "*violating* (what, whom) x by y". The mentioned two-placed evaluation-functions are defined precisely by the following **Table 5**.

Glossary for **Table 6**. M^2xy—"*matter*, *material*, *materialness of* (what, whom) x for (what, whom) y. U^2xy—"*reduction of* (what, whom) x to (what, whom) y. C^2xy—"*being* of y in x". I^2xy—"y's *independence from* x", or "y *independent of* x". F^2xy—"*form*, *formalness of* (what, whom) y for (what, whom) x. V^2xy—"*movement*, *change of* (what, whom) x by (what, whom) y", or "y's being a mover (moving cause) of/for x". O^2xy—"y's being an outer, external (transcendent) cause of/for x". Y^2xy—"y's being an inner, internal (immanent) cause of/for x". The mentioned two-placed evaluation-functions are defined precisely by the following **Table 6**.

The notions: "*formal-axiological equivalence*"; "*formal-axiological contradiction*"; "*formal-axiological law*" (or, which is the same, "*law of metaphysics*") in the two-valued algebraic system of metaphysics as formal axiology are precisely defined as follows.

Table 4. The one-placed functions.

x	S_7x	M_5x	P_4x	I_2x	N_3x	C_3x	W_1x	A_2x	M_6x	F_2x	F_3x
g	b	b	g	b	g	g	g	b	b	g	b
b	g	g	b	g	b	b	b	g	g	b	g

Table 5. The two-placed evaluation-functions.

x	y	K^2xy	W^2xy	E^2xy	R^2xy	T^2xy	P^2xy	D^2xy	A^2xy
g	g	g	b	g	b	b	g	g	b
g	b	b	b	b	b	b	g	g	b
b	g	b	g	b	g	g	b	b	g
b	b	b	b	g	b	b	g	g	b

Table 6. The functions determined by two arguments.

x	y	M^2xy	U^2xy	C^2xy	I^2xy	F^2xy	V^2xy	O^2xy	Y^2xy
g	g	b	b	g	b	b	b	b	g
g	b	b	b	b	b	b	b	b	b
b	g	g	g	g	g	g	g	g	g
b	b	b	b	g	b	b	b	b	g

Definition DEF-1 of the two-placed relation called "*formal-axiological-equivalence*": in the algebraic system of formal axiology, any evaluation-functions Ξ and Θ are *formally-axiologically equivalent* (this is represented by the expression "Ξ=+=Θ"), if and only if they acquire identical axiological values (from the set {*g* (*good*), *b* (*bad*)}) under any possible combination of the values of their evaluation-variables.

Definition DEF-2 of the notion "*formal-axiological law*": in algebra of formal *axiology*, any evaluation-function Θ is called *formally-axiologically* (*or necessarily*, *or universally*) *good* one, or a *law of algebra of formal axiology* (or a "law of algebra of metaphysics"), if and only if Θ acquires the value *g* (good) under any possible combination of the values of its evaluation-variables. In other words, the function Θ is *formally-axiologically* (*or constantly*) *good* one, iff Θ=+=g (good).

Definition DEF-3 of the notion "*formal-axiological contradiction*": in algebra of formal *axiology*, any evaluation-function Θ is called "*formally-axiologically inconsistent*" one, or a "*formal-axiological contradiction*", if and only if Θ acquires the value *b* (*bad*) under any possible combination of the values of its evaluation-variables. In other words, the function Θ is *formally-axiologically* (*or necessarily*, *or universally*) *bad* one, iff Θ=+=b (bad).

Definition DEF-4 of the two-placed relation called "*formal-axiological-entailment*": in the algebraic system of formal axiology, for any evaluation-functions Ξ and Θ, it is true that "Θ *formally-axiologically follows from* Ξ", iff C^2ΞΘ=+=g (good).

Now, being equipped with the set of necessary and sufficient definitions of evaluation-functions and formal-axiological notions relevant to the theme of present article, let us begin generating a list of such *formal-axiological equations* *of algebra* of metaphysics which (equations) are directly connected with the indicated theme. First of all, let us begin with introducing and discussing a finitism in philosophical foundations of empirical physics by analogy with the finitism in philosophical foundations of mathematics.

3. A Finitism in Philosophical Foundations of Empirical Physics and Such a Formal-Axiological Law of Metaphysics which is Significantly Analogous to Newton's First Law of Classical Mechanics

The *finitism* in philosophical foundations of mathematics is well-known [25]-[30]. A *formal-axiological* aspect of the finitism in philosophical grounding mathematics is highlighted as such and mathematically modeled by two-valued algebraic system of formal ethics as formal axiology in [19]. In my opinion, a significantly *analogous* finitism in philosophical foundations of physics in general (and a *formal-axiological* kind of it in particular) is reasonable as well, but it is not well-known and not well-recognized as such. Strictly speaking, the finitism in metaphysical (formal-axiological) foundations of physics has been considered in general and instantiated by the law of conservation of energy in [20] but yet it is almost unknown (probably, because the paper has been published in Russian language). In relation to thermodynamics, the *formal-axiological* aspect of finitism in philosophical grounding physics is recognized as such and mathematically modeled by two-valued algebraic system of formal axiology in [23]. In relation to Newton's first law of classical mechanics, the *formal-axiological* aspect of finitism in philosophical foundations of physics has been exploited, for instance, in [31].

However, the finitism in philosophical foundations of physics is not completely reduced to its *formal-axiological* aspect. There is a strong theoretical need formally-logically (deductively) to derive Newton's first law from its *formal-axiological* analog in some formal axiomatic system of metaphysics (probably, under some special epistemological assumption). Such formal-logical (deductive) deriving Newton's first law from its *formal-axiological* analog in a formal axiomatic system Σ (under the epistemological assumption of a-priori-ness of knowledge) is realized in the present article for the first time. Hitherto this article has not been published elsewhere. However, to make the mentioned new scientific result available (understandable and examinable) for readers, it is necessary to make the readers acquainted with the *formal-axiological* analog of Newton's first law of mechanics by constructing this analog. To make this acquaintance by constructing the formal-axiological analog, let us begin generating the following list of formal-axiological equations relevant to the theme of this paper by accurate computing compositions of evaluation-functions according to the precise definitions given above in the paragraph 2.

1) $S_6x=+=M_6P_4F_1P_1x$: space of x is a multitude (many-ness) of possible definite places (positions) of x.

2) P_1x=+=$F_1P_2S_6x$: place (position) of (what, whom) x is a definite part of space of x. This equation models (Leibniz and Clarke [32, p. 96]).

3) P_1x=+=F_2B_3x: place of x (i.e. place filled by x) is a form of body of x (Aristotle [1]).

4) P_1x=+=$W^2M_3F_2x$: place of x is a form of x without matter of x (Aristotle [1]).

5) P_1x=+=$W^2M_3xF_2B_3x$: place of x is a form of body of x without matter of x (Aristotle [1]).

6) V_2P_1x=+=$W^2B_3xF_3B_3x$: empty place of x (*i.e.* place void of x) is a form for body of x without body of x (Aristotle [1]).

7) $W^2P_1xB_3x$=+=b: body of x without place of x is a formal-axiological contradiction.

8) $W^2B_3xP_1x$=+=b: place of x without body of x is a formal-axiological contradiction.

9) B_3x=+=P_1x: body of x coincides with place of x (Descartes [4]), (Spinoza [33]).

10) B_3x=+=E_1x: body of x coincides with extension of x [4] [33].

11) $E^2B_3xH_1x$=+=b: identifying *body* of x and *flesh* of x is a formal-axiological contradiction.

12) H_1x=+=M_3B_3x: flesh of x is equivalent to material body of x.

13) M_3B_3x=+=F_1B_3x: material body of x is finite body of x.

14) $E^2B_3xM_3B_3x$=+=b: identifying *body* (*body-ness*) of x and *material* body of x is a formal-axiological contradiction.

15) $E^2B_1xM_3x$=+=b: identifying *being* of x and *matter* of x is a formal-axiological contradiction called materialism.

16) $E^2S_6xF_2M_3x$=+=b: identifying *space* of x with *form of matter* of x is a formal-axiological contradiction.

17) F_2x=+=O_1F_3x: *form of* x is an opposite of *form for* x.

18) S_6x=+=F_2x: *space* of x is *form* of x.

19) V_2S_6x=+=F_3x: *empty space* of x is *form for* x.

20) S_6x=+=F_3M_3x: *space* of x is *form for matter* of x.

21) $E^2S_6xF_3M_3x$=+=g: identifying *space* of x with *form for matter* of x is a formal-axiological law.

22) M_3B_3x=+=F_1P_1x: material body of x coincides with definite (finite) place of x.

23) M_3x=+=F_1E_1x: materialness of x means *finiteness of extension* of x.

24) M_3B_3x=+=F_1E_1x: material body of x is equivalent to definite extension (finite length) of x.

25) $N_1C^2S_6xP_1x$=+=b: nonbeing of place of x in space of x is a formal-axiological contradiction.

26) $C^2S_6xP_1x$=+=g: being of place of x in space of x is a formal-axiological law.

27) M_1x=+=C_1P_1x: motion (mechanical movement) of x is locomotion, *i.e.* a change of place (position), of x [1] [34].

28) M_1x=+=$C^2S_6xC_1P_1x$: mechanical movement of x is being of a change of place (position) of x in space of x.

29) S_6x=+=S_3x: space (in general) of x is formally-axiologically equivalent to metaphysical space of x.

30) S_3x=+=S_6B_1x: metaphysical space of (what, whom) x is space of being of x.

31) S_3x=+=B_1x: metaphysical space of (what, whom) x is equivalent to being of x.

32) S_3x=+=x: metaphysical space of (what, whom) x is equivalent to x.

33) $W_1\mathrm{B}_1x$=+= $W_1S_6B_1x$: struggle for life of x is struggle for life space of x.

34) P^2xx=+=$P^2S_6B_1xx$: self-conservation of x is conservation of space of being of x by x.

35) D^2xx=+=$D^2S_6B_1xx$: self-defense of x is defense of life space of x (or x's own territory) by x.

36) S_3x=+=I_1B_1x: metaphysical space of x is equivalent to infinite being of x.

37) S_3x=+=I_1S_6x: metaphysical space of x is equivalent to infinite space of x.

38) S_4x=+=F_1B_1x: physical space of x is equivalent to finite being of x.

39) S_4x=+=B_1F_1x: physical space of x is equivalent to being of finite x.

40) S_4x=+=F_1S_6x: physical space of x is finite space of x.

41) S_4x=+=S_6F_1x: physical space of x is space of finite x.

42) S_4x=+=N_1S_3x: physical space of x is formally-axiologically equivalent to nonbeing of metaphysical space of x.

43) S_4x=+=O_1S_3x: physical space of x is an opposite of metaphysical one of x.

The above-listed equations expose the significant formal-axiological difference and even opposition between "physical space" and "metaphysical one".

44) S_4x=+=N_1x: physical space of x is equivalent to nonbeing of x.

45) N_1x=+= V_2x: nonbeing of x means void (vacuity), emptiness of x.

46) S_4x=+= V_2S_6x: physical space of x is equivalent to vacuous space of x.

47) V_2S_6=+=M_3x: empty space of x is formally-axiologically equivalent to matter of x. Here it is worth emphasizing that "empty space of x (*i.e.* space *void of x*)" does not mean "space *void of everything*".

48) M^2xy=+= V^2xy: matter, material, materialness of x for y is formally-axiologically equivalent to vacuity of x for y.

49) S_4x=+=M_3x: physical space of x is matter of x.

50) B_2x=+=g: absolute being of x is a formal-axiological law of algebra of metaphysics.

51) N_2x=+=b: absolute nonbeing of x is a formal-axiological contradiction.

52) N_1N_2x=+=g: nonbeing of absolute nonbeing of x is a law of algebra of metaphysics; the law is a formal-axiological model of the Eleatic philosophy: Parmenides and Zeno of Elea; Melissus of Samos [35].

53) I_2N_2x=+=g: impossibility of absolute nonbeing of x is a law of algebra of metaphysics.

54) V_3x=+=N_2x: absolute vacuum of x is formally-axiologically equivalent to absolute nonbeing of x.

55) V_3x=+= V_3S_6x=+=b: absolute void (absolute vacuity of space) of x is a formal-axiological contradiction; this statement is a formal-axiological model of [4, pp. 229-230] and [33, p. 174].

56) N_1V_3x=+=$N_1V_3S_6x$=+=g: nonbeing of absolute vacuum (nonbeing of absolute vacuity of space) of x is a law of algebra of metaphysics; the law is a discrete mathematical model of formal-axiological interpretation of [1, pp. 292-297], [4, pp. 229-230], [33, p. 174].

57) I_2V_3x=+=$I_2V_3S_6x$=+=g: impossibility of absolute vacuum (impossibility of absolute vacuity of space) of x is a (formal-axiological) law of algebra of metaphysics. This equation models [4, pp. 229-230] and [33, p. 174].

58) B_1x=+=$R_2V_2S_6x$: existence of x means *relativity of vacuity of space of* x.

59) B_1x=+=R_2S_4x: being of x means *relativity of physical space* of x. This equation models G. W. Leibniz' standpoint in his well-known discussion with S. Clarke who has been a spokesman and friend of I. Newton. See Leibniz and Clarke [32, pp. 14, 15, 24, 65].

60) $C^2S_6xM_1x$=+=$C^2S_6xC_1P_1x$: being of *motion* (mechanical movement) of x in space of x is being of change of place (position) of x in space of x.

61) B_1x=+=R_2M_1x: existence of x means *relativity of motion* (mechanical movement) of x [2, pp. 186-188].

62) M_1x=+=C_1x=+=N_1x: motion (mechanical movement) of x is equivalent to change, flow of x and to nonbeing of x. This equation is a formal-axiological model of the Eleatic philosophy: Parmenides and Zeno of Elea; Melissus of Samos [35].

63) B_1x=+=$P_4S_7M_1x$: being of x is equivalent to *possibility of sensation* of mechanical movement of x (Mach [5] [8] [9]).

64) B_1x=+=$P_4M_5M_1x$: existence of x is equivalent to *possibility of measurement* of mechanical movement of x [5] [8] [9].

65) B_1x=+=$P_4S_7S_4x$: existence of x is equivalent to *possibility of sensation* of physical space of x [5] [8] [9].

66) B_1x=+=R_2M_5x: being of x is equivalent to relativity of measurement of x.

67) B_1x=+=$P_4M_5S_4x$: existence of x is equivalent to possibility of measurement of physical space of x [5] [8] [9].

68) B_1x=+=$P_4M_5R_2S_6x$: existence of x is equivalent to possibility of measurement of relative space of x [5] [8] [9].

69) F_1x=+=M_3x: finiteness of space of x is equivalent to materialness of x.

70) M_3x=+=$R_2M_5S_4x$: materialness of x is equivalent to relativity of measurement of physical space of x (Poincaré [36]), (Einstein [37]), (Einstein, Lorentz, Minkowski, and Weyl [38]).

71) M_3x=+=$R_2M_5F_1E_1x$: materialness of x is equivalent to relativity of measurement of finite length of x (Poincaré [36]), (Einstein [37]), (Einstein, Lorentz, Minkowski, and Weyl [38]).

72) F_1x=+=$R_2M_5S_4x$: finiteness of x is equivalent to relativity of measurement of physical space of x.

73) $S_5x=+=O_1V_3x$: absolute space of x is an opposite of/for absolute vacuum of x.

74) $C^2V_3xS_5x=+=g$: being of absolute space of x in absolute vacuum of x is a law of algebra of metaphysics.

75) $C^2V_3xy=+=g$: being of any y in absolute vacuum of x is a law of algebra of metaphysics.

76) $C^2yS_5x=+=g$: being of absolute space of x in any y is a law of algebra of metaphysics.

77) $B_1Z_1y=+=C^2S_5xy$: being of a thing y is being of the thing y in absolute space of x. This equation models [32, p. 75].

78) $B_1S_5x=+=C^2S_6xS_6x$: being of absolute space of x is being of space of x in itself.

79) $C^2S_6xS_6x=+=C^2Z_1xZ_1x$: being of space of x in itself is equivalent to being of thing x in itself.

80) $C^2Z_1xZ_1x=+=g$: being of thing x in itself is a law of metaphysics.

81) $C^2S_6xS_6x=+=g$: being of space of x in itself is a law of metaphysics.

82) $I_2M_5S_5x=+=g$: impossibility of measurement of absolute space of x is a law of algebra of metaphysics. The law is a formal-axiological analog of the definitely negative attitude of *empiricist*-minded physicists (Mach [5] [8] [9]), (Poincaré [36]), (Reihenbach [10] [11]), (Schlick [14] [15] [16]), (Sommerfeld [17]) to the idea of *absolute* space (Newton, [6] [39]), (Kant [40] [41] [42]).

83) $I_2S_7S_5x=+=g$: impossibility of sensation of absolute space of x is a law of algebra of metaphysics. The law is another formal-axiological analog (model) of the resolutely negative *empiricist* attitude to "*absolute* space" [5] [8] [9] [10] [11] [14] [15] [16] [17] [36]. Here it is relevant to place the following citation: "The English teach mechanics as an experimental science; on the Continent it is taught always more or less as a deductive and *a priori* science. The English are right, no doubt. … There is no absolute space, and we only conceive of a relative motion; and yet in most cases mechanical facts are enunciated as if there is an absolute space to which they can be referred (Poincaré [36, p. 26]).

84) $I_2C_1S_5x=+=g$: immovability and immutability (impossibility of change) of absolute space of x is a law of algebra of metaphysics. This equation is a model of Newton-and-Clarke standpoint [32, pp. 30, 31, 96, 98].

85) $I_2A_2S_5x=+=g$: impossibility of action on absolute space of x is a law of algebra of metaphysics.

86) $B_1x=+=C^2S_5yx$: being of x is its being in absolute space of y.

87) $B_1M_1M_4B_3y=+=C^2S_5xM_1M_4B_3y$: being of a movement of material body of y is being of the movement in absolute space of x.

88) $B_1S_5x=+=g$: existence of absolute space of x is a law of algebra of metaphysics.

Certainly, the concept of absolute space is *metaphysical* one. Therefore, the positivist-minded physicists ignore it on principle. However, the notion of absolute space is indispensable for constructing a perfect system of not absolutely empirical but *proper theoretical* philosophy of nature. With respect to proper philosophical grounds of physics the concept in question is still active one. "…

There are still senses in which space is considered absolute" [43, p. 101]. Even in modern theoretical physics, "… the absolute character of space is still held, although with modifications" [43, p. 101]. Thus, generally speaking, "… the concept of absolute space is not a discarded one" [43, p. 104]. If one plans to construct a consistent synthetic conceptual system uniting all possible meanings of the word "space", the one has to take "absolute space" seriously and find a special room for it in the synthetic conceptual system necessarily containing (and somehow consistently connecting) both proper metaphysical and proper scientific meanings of the term.

As to the proper *science* of classical mechanics which is an intellectually respectable "*particular or limited case*" of contemporary proper science of mechanics based on observations, experiments, facts and measurements, here it is relevant to consider also the following nontrivial formal-axiological equations.

89) $N_1A_2B_3x$=+=$N_1C_1F_1M_2S_2M_1B_3x$: nonbeing of action on body of x implies nonbeing of change of a finite magnitude (quantity) of quickness (speed) of x's body motion (Galilei [3, pp. 224, 238]), (Descartes [4, pp. 240-241]), (Spinoza [33, pp. 185-187]), (Newton [6, p. 14]). This is the historically first recognized aspect (prerequisite) of/for the law of classical mechanics.

90) $N_1A_2B_3x$=+=$C_3F_1S_2S_1M_1B_3x$: nonbeing of action on body of x is formally-axiologically equivalent to x's body's movement with a *constant finite speed in a straight line* (Descartes [4, pp. 240-242]), (Spinoza [33, p. 186]), (Newton [6, p. 14]). This equation represents the historically second stage (prerequisite) of/for approximating to contemporary formulation of the law of classical mechanics.

91) R_1x=+=N_1M_1x: rest of x is nonbeing of x's motion.

92) M_1x=+=N_1R_1x: motion of x is nonbeing of x's rest.

93) R_1x=+=O_1M_1x: rest of x is an opposite of/for x's motion (Descartes [4, p. 244]).

94) R_1x=+=$C_3F_1S_2S_1M_1B_3x$: rest of x is *formally-axiologically equivalent* to x's body's motion with a *constant finite speed in a straight line*. This is a *formal-axiological analog* (*model*) of (Newton [6]).

95) V_1x=+=$K^2S_2xD_1x$: velocity of x is formally-axiologically equivalent to joint being (conjunction) of speed (quickness) of x and own (immanent) vector of x. (This equation could be considered as an analytical definition of the *formal-axiological analog* of the notion "velocity of x" in classical physics.)

96) F_1V_1x=+=$K^2F_1S_2xF_1D_1x$: definite velocity of x is formally-axiologically equivalent to joint being of finite speed (quickness) of x and definite (fixed) immanent vector of x.

97) C_2x=+=$C_3F_1V_1M_1x$: dynamical closedness of x (perfect isolating x from external forces) is formally-axiologically equivalent to conservation (constant-ness, immutability) of definite velocity of movement of x. This equation (establishing a *law of conservation of definite velocity* of movement) is a *formal-axiological analog* of the first law of Newton's mechanics.

At first glance, it seems that the last entry (item) in the above-generated list of equations means nothing but the well-known Newton's First Law, hence, it seems that there is nothing significantly new with respect to proper physics and to its proper philosophical grounds as well. However, in my opinion, it *only seems* so. The translation of the indicated formal-axiological equation from the artificial language of algebra of metaphysics into the ambiguous natural language of humans looks like a human-natural-language formulation of the law of classical mechanics, but actually it is not a statement of *being* but a *formal-axiological* statement of *value* (while Newton's three laws of mechanics are statements of *being*).

The natural-language formulations of the two (Newton's First Law and the *formal-axiological analog* of it) are really *similar* but their meanings are *not identical*. In contrast to the natural-language formulation of Newton's First Law of mechanics, the natural-language formulation of the corresponding law of *metaphysics* of nature in algebra of metaphysics (as formal axiology) has *formal-axiological semantics* which is significantly different (and in some respect independent) from the logical semantics of descriptive-indicative statements of the experience-based physics. The classical theoretical physics has investigated "what is (or is not) necessarily" in nature. The metaphysics of nature (as formal axiology of it) investigates "what is good (or bad) *necessarily*" in nature. According to the so-called Hume's Guillotine and Moore's doctrine of naturalistic fallacies in ethics, elements of the couples < "is"; "is obligatory" > and < "is"; "is good" > are logically independent: formal logical inferences between elements of these couples are not well-grounded. With respect to some *habitual concrete* relation which statistically normal humans are used to, namely, concerning *proper empirical* knowledge, it is really so: the gap between "is" and "is good" is logically unbridgeable. But, in result of systematical investigating some *not-habitual* concrete relations, rare conditions, extraordinary circumstances and psychologically paradoxical arguments, I have arrived to a psychologically unexpected (surprising) hypothesis that under some very rare extraordinary condition, the notorious gap (allegedly called logically unbridgeable one) between "is" and "is good" (or "is" and "is obligatory") can be bridged logically. Certainly, this paradigm-breaking hypothesis can be false one to be rejected resolutely in spite of its being beautiful and intuitively attractive to its creator. Taking this possibility seriously, instead of usual philosophical wrangling and insulting the hypothesis creator, let us move tranquilly to the next part of the article for precise formulating, formal demonstrating, and rigorous scrutinizing the odd hypothesis before its possible rejection.

Below in this paper (within the framework of a logically formalized axiomatic epistemology system Σ), I am to submit a *formal deductive inference* of Newton's First Law of classical mechanics from conjunction of 1) the above-constructed *formal-axiological analog* of Newton's First Law and 2) the *assumption of a-priori-ness of knowledge*. Originally, the formal axiomatic theory Σ was defined precisely in [21] [44]. As below in this article the theory Σ is necessarily used as a means of/for obtaining a significantly new hitherto not published non-trivial result, I have to repeat (recall) the exact definition of Σ in the immediately following part of the paper for making readers able adequately to understand and rigorously to scrutinize the for-the-first-time-submitted *formal deductive derivation* of Newton's First Law of classical mechanics in Σ from the above-mentioned conjunction of premises.

4. A Precise Definition of Logically Formalized Axiomatic Epistemology System Sigma

By definition, the logically formalized axiomatic epistemology system Σ contains all symbols (of the alphabet), expressions, formulae, axioms, and inference-rules of the formal axiomatic epistemology theory Ξ [45] which is based on the classical propositional logic. But in Σ several significant aspects are added to the formal theory Ξ. In result of these additions the alphabet of Σ's object-language is defined as follows:

1) Small Latin letters q, p, d (and the same letters possessing lower number indexes) are symbols belonging to the alphabet of object-language of Σ; they are called "*propositional* letters". *Not all small Latin letters are propositional ones* in the alphabet of Σ's object-language, as, by this definition, small Latin letters belonging to the set {g, b, e, n, *x*, *y*, *z*, t} are excluded from the set of *propositional* letters.

2) Logic symbols $\neg$, $\supset$, $\leftrightarrow$, &, $\vee$ called "classical negation", "material implication", "equivalence", "conjunction", "not-excluding disjunction", respectively, are symbols belonging to Σ's object-language alphabet.

3) Elements of the set of modality-symbols {□, K, A, E, S, T, F, P, Z, G, W, O, B, U, Y} belong to Σ's object-language alphabet.

4) Technical symbols "(" and ")" ("round brackets") belong to Σ's object-language alphabet. The round brackets are exploited in this paper as usually in symbolic logic.

5) Small Latin letters *x*, *y*, *z* (and the same letters possessing lower number indexes) are symbols belonging to Σ's object-language-alphabet (they are called "*axiological variables*").

6) Small Latin letters "g" and "b" called *axiological constants* belong to the alphabet of object-language of Σ.

7) The capital Latin letters possessing number indexes—K^2, E^2, C^2, A^n_k, B^n_i, C^n_j, D^n_m, … belong to the object-language-alphabet of Σ (they are called "*axiological-value-functional symbols*"). The upper number index *n* informs that the indexed symbol is *n*-placed one. Nonbeing of the upper number index informs that the symbol is determined by one axiological variable. The value-functional symbols may have no lower number index. If lower number indexes are different, then the indexed functional symbols are different ones.

8) Symbols "[" and "]" ("square brackets") also belong to the object-language-

alphabet of Σ, but in this theory they are exploited in a very *unusual* way. Although, from the psychological viewpoint, square brackets and round ones look approximately identical and are used very often as synonyms, in the present article they have *qualitatively different* meanings (roles): exploiting round brackets is purely technical as usually in symbolic logic; square-bracketing has an *ontological* meaning which is to be defined below while dealing with *semantic* aspect of Σ. Moreover, even at syntax level of Σ's object-language, being not purely technical symbols, square brackets *play a very important role* in the below-given definition of the general notion "formula of Σ" and in the below-given formulations of some axiom-schemes of Σ.

9) An unusual artificial symbol "=+=" called "*formal-axiological equivalence*" belongs to the alphabet of object-language of Σ. The symbol "=+=" also *plays a very important role* in the below-given definition of the general notion "formula of Σ" and in the below-given formulations of some axiom-schemes of Σ.

10) A symbol belongs to the alphabet of object-language of Σ, if and only if this is so owing to the above-given items 1) - 9) of the present definition.

A finite succession of symbols is called an *expression* in the object-language of Σ, if and only if this succession contains such and only such symbols which belong to the above-defined alphabet of Σ's object-language.

Now let us define precisely the general notion "*term* of Σ":

1) the *axiological variables* (from the above-defined alphabet) are terms of Σ;

2) the *axiological constants* belonging to the alphabet of Σ, are terms of Σ;

3) If Φ_k^n is an *n-placed axiological-value-functional symbol* from the above-defined alphabet of Σ, and $t_i, \dots t_n$ are *terms* (of Σ), then $\Phi_k^n t_i, \dots t_n$ is a term (compound one) of Σ (here it is worth remarking that symbols $t_i, \dots t_n$ belong to the meta-language, as they stand for *any* terms of Σ; the analogous remark may be made in relation to the symbol Φ_k^n which also belongs to the meta-language);

4) An expression in object-language of Σ is a term of Σ, if and only if this is so owing to the above-given items 1) - 3) of the present definition.

Now let us make an agreement that in the present paper, small Greek letters α, β, and γ (belonging to meta-language) stand for *any* formulae of Σ. By means of this agreement the general notion "*formulae* of Σ" is defined precisely as follows.

1) All the above-mentioned propositional letters are formulae of Σ;

2) If α and β are formulae of Σ, then all such expressions of the object-language of Σ, which possess logic forms $\neg\alpha$, $(\alpha \supset \beta)$, $(\alpha \leftrightarrow \beta)$, $(\alpha \,\&\, \beta)$, $(\alpha \vee \beta)$, are formulae of Σ as well;

3) If t_i and t_k are terms of Σ, then $(t_i\text{=+=}t_k)$ is a formula of Σ;

4) If t_i is a term of Σ, then $[t_i]$ is a formula of Σ;

5) If α is a formula of Σ, and meta-language-symbol Ψ stands for any element of the set of modality-symbols {□, K, A, E, S, T, F, P, Z, G, W, O, B, U, Y}, then any object-language-expression of Σ possessing the form Ψα, is a formula of Σ as well. (Here, the meta-language-expression Ψα is not a formula of Σ, but a

scheme of formulae of Σ);

6) Successions of symbols (belonging to the alphabet of the object-language of Σ) are formulae of Σ, if and only if this is so owing to the above-given items 1) - 5) of the present definition.

Now let us introduce the elements of the above-mentioned set of modality-symbols {□, K, A, E, S, T, F, P, Z, G, W, O, B, U, Y}. Symbol □ stands for the alethic modality "necessary". Symbols K, A, E, S, T, F, P, Z, respectively, stand for modalities "agent *Knows* that…", "agent *A-priori knows* that…", "agent *Empirically* (*a-posteriori*) *knows* that…", "under some conditions in some space-and-time a person (immediately or by means of some tools) *Sensually perceives* (has *Sensual verification*) that…", "it is *True* that…", "person has *Faith* (or believes) that…", "it is *Provable* that…", "there is *an algorithm* (a machine could be constructed) *for deciding* that…".

Symbols G, W, O, B, U, Y, respectively, stand for modalities "it is (*morally*) *Good* that…", "it is (*morally*) *Wicked* that…", "it is *Obligatory* that …", "it is *Beautiful* that …", "it is *Useful* that …", "it is *pleasant* that …". Meanings of the mentioned symbols are defined (indirectly) by the following schemes of own (proper) axioms of epistemology system Σ which axioms are added to the axioms of classical propositional logic. Schemes of axioms and inference-rules of the classical propositional logic are applicable to all formulae of Σ.

Axiom scheme AX-1: $A\alpha \supset (\Box\beta \supset \beta)$.

Axiom scheme AX-2: $A\alpha \supset (\Box(\alpha \supset \beta) \supset (\Box\alpha \supset \Box\beta))$.

Axiom scheme AX-3: $A\alpha \leftrightarrow (K\alpha \,\&\, (\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box(\beta \leftrightarrow \Omega\beta)))$.

Axiom scheme AX-4: $E\alpha \leftrightarrow (K\alpha \,\&\, (\neg\Box\alpha \vee \neg\Box\neg S\alpha \vee \neg\Box(\beta \leftrightarrow \Omega\beta)))$.

Axiom scheme AX-5: $K\alpha \supset \neg\Box\neg\alpha$.

Axiom scheme AX-6: $(\Box\beta \,\&\, \Box\Box\beta) \supset \beta$.

Axiom scheme AX-7: $(t_i =+= t_k) \leftrightarrow (G[t_i] \leftrightarrow G[t_k])$.

Axiom scheme AX-8: $(t_i =+= g) \supset \Box G[t_i]$.

Axiom scheme AX-9: $(t_i =+= b) \supset \Box W[t_i]$.

Axiom scheme AX-10: $(G\alpha \supset \neg W\alpha)$.

Axiom scheme AX-11: $(W\alpha \supset \neg G\alpha)$.

In AX-3 and AX-4, the symbol Ω (belonging to the meta-language) stands for any element of the set $\mathfrak{R}$ = {□, K, T, F, P, Z, G, O, B, U, Y}. Let elements of $\mathfrak{R}$ be called "*perfection*-modalities" or simply "perfections".

The axiom-schemes AX-10 and AX-11 are not new in evaluation logic: one can find them in the famous monograph by Ivin [46]. But the axiom-schemes AX-7, AX-8, AX-9 are new ones representing not logic as such but formal axiology, *i.e.* abstract theory of forms of values in general ("formal logic" and "formal axiology" are not synonyms).

5. A Precise Definition of Semantics of/for the Formal Theory Σ

Meanings of the symbols belonging to the alphabet of object-language of Σ owing to the items 1 - 3 of the above-given definition of the alphabet are defined by the classical propositional logic.

For defining semantics of *specific* aspects of object-language of formal theory Σ, it is necessary to define a set Δ (called "field of interpretation") and an interpreter called "valuator (evaluator)" V.

In a standard *interpretation* of formal theory Σ, the set Δ (field of interpretation) is such a set, every element of which has: 1) one and only one *axiological value* from the set {good, bad}; 2) one and only one *ontological value* from the set {exists, not-exists}.

The *axiological variables* x, y, z range over (take their values from) the set Δ.

The *axiological constants* "g" and "b" mean, respectively, "good" and "bad".

It is presumed here that *axiological evaluating* an element from the set Δ, *i.e.* ascribing to this element an *axiological value* from the set {good, bad}, is performed by a quite definite (perfectly fixed) individual or collective valuator (evaluator) V. It is obvious that changing V can result in changing valuations of elements of Δ. But *laws of two-valued algebra of formal axiology* do not depend upon changes of V as, by definition, formal-axiological laws of this algebra are such and only such *constant evaluation-functions which obtain the value "good"* independently from any changes of valuators. Thus, generally speaking, V is a *variable* which takes its values from the set of all possible evaluators (individual or collective—it does not matter). Nevertheless, a *concrete interpretation* of formal theory Σ is *necessarily fixing* the value of V; changing the value of the variable V is changing the concrete interpretation.

In a standard *interpretation* of formal theory Σ, *ontological constants* "e" and "n" mean, respectively, "exists" and "not-exists". Thus, in a standard *interpretation* of formal theory Σ, one and only one element of the set {{g, e}, {g, n}, {b, e}, {b, n}} corresponds to every element of the set Δ. The *ontological constants* "e" and "n" belong to the *meta-language*. (According to the above-given definition of Σ's object-language-alphabet, "e" and "n" do not belong to the object-language.) But the *ontological constants are indirectly represented at the level of object-language by square-bracketing*: "t_i exists" is represented by $[t_i]$; "t_i not-exists" is represented by $\neg[t_i]$. Thus square-bracketing is a very important aspect of the system under investigation.

N-placed terms of Σ are interpreted as *n-ary algebraic operations* (*n-placed evaluation-functions*) defined on the set Δ. For instantiating the general notion "*one-placed evaluation-function*" or "*evaluation-function determined by one evaluation-argument*" systematically used in two-valued algebra of metaphysics as formal axiology, see the above-given **Tables 1-4**. For instantiating the general notion "*evaluation-function determined by two evaluation-arguments*" systematically exploited in two-valued algebra of metaphysics as formal axiology, see the above-given **Table 5** and **Table 6**. (For correct understanding contents of this paper, it is worth emphasizing here that in the semantics of Σ, the symbols U_1x, D_1x V_1x, S_1x, S_2x, S_3x, S_4x, S_5x, S_6x, S_7x, G_1x, H_1x, W^2xy, E^2xy, R^2xy, T^2xy,

P^2xy mean *not predicates but terms*. Being given an interpretation, the formulae (t_i=+=t_k), (t_i=+=g), (t_i=+=b) are representations of *predicates* in Σ.

If t_i is a term of Σ, then, being interpreted, formula [t_i] of Σ is an *either true or false proposition* "t_i exists". In a standard interpretation, formula [t_i] is true if and only if t_i has the *ontological value* "e (exists)" in that interpretation. The formula [t_i] is a false proposition in a standard interpretation, if and only if t_i has the *ontological value* "n (not-exists)" in that interpretation.

In a relevant interpretation, the formula (t_i=+=t_k) of Σ is translated into natural language by the proposition "t_i is *formally-axiologically equivalent* to t_k", which proposition is true if and only if (in that interpretation) the terms t_i and t_k have identical *axiological values* from the set {good, bad} under any possible combination of *axiological values* of their *axiological variables*.

Now, having given exact definitions of all the significantly novel notions necessarily exploited for making and demonstrating the principal scientific discovery represented for the first time in this article, we are to move directly to the above-promised formal proof construction.

6. A Formal Proof of $\left(A\alpha \supset \left(\left(t_i{=}{+}{=}t_k\right) \leftrightarrow \left(\left[t_i\right] \leftrightarrow \left[t_k\right]\right)\right)\right)$ in the Formal Axiomatic Theory Σ

The proof of theorem-scheme $\left(A\alpha \supset \left(\left(t_i{=}{+}{=}t_k\right) \leftrightarrow \left(\left[t_i\right] \leftrightarrow \left[t_k\right]\right)\right)\right)$ in Σ is the following succession of formulae schemes.

1) $A\alpha \leftrightarrow \left(K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\beta \leftrightarrow \Omega\beta\right)\right)\right)$ by axiom-scheme AX-3.

2) $A\alpha \leftrightarrow \left(K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_i\right] \leftrightarrow G\left[t_i\right]\right)\right)\right)$ from 1 by substituting: G for Ω; [t_i] for β.

3) $A\alpha \supset \left(K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_i\right] \leftrightarrow G\left[t_i\right]\right)\right)\right)$ from 2 by the rule of ↔ elimination.

4) Aα assumption.

5) $K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_i\right] \leftrightarrow G\left[t_i\right]\right)\right)$ from 3 and 4 by *modus ponens*.

6) $\Box\left(\left[t_i\right] \leftrightarrow G\left[t_i\right]\right)$ from 5 by the rule of eliminating &.

7) $\left(\left[t_i\right] \leftrightarrow G\left[t_i\right]\right)$ from 4 and 6 by a rule of □ elimination. (The □ elimination rule is a *derivative* rule[1].)

8) $A\alpha \leftrightarrow \left(K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_k\right] \leftrightarrow G\left[t_k\right]\right)\right)\right)$ from 1 by substituting: G for Ω; [t_k] for β.

9) $A\alpha \supset \left(K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_k\right] \leftrightarrow G\left[t_k\right]\right)\right)\right)$ from 8 by the rule of eliminating ↔.

10) $K\alpha \,\&\, \left(\Box\alpha \,\&\, \Box\neg S\alpha \,\&\, \Box\left(\left[t_k\right] \leftrightarrow G\left[t_k\right]\right)\right)$ from 4 and 9 by *modus ponens*.

11) $\Box\left(\left[t_k\right] \leftrightarrow G\left[t_k\right]\right)$ from 10 by the rule of eliminating &.

12) $\left(\left[t_k\right] \leftrightarrow G\left[t_k\right]\right)$ from 4 and 11 by the rule of □ elimination.

13) $\left(t_i{=}{+}{=}t_k\right) \leftrightarrow \left(G\left[t_i\right] \leftrightarrow G\left[t_k\right]\right)$ axiom-scheme AX-7.

[1]It is formulated as follows: Aα, $\Box\beta \vdash \beta$. This rule is not included into the above-given definition of Σ, but it is easily *derivable* in Σ by means of the axiom scheme AX-1 and *modus ponens*. (The rule $\Box\beta \vdash \beta$ is not derivable in Σ, and also Gödel's necessitation rule is not derivable in Σ. Nevertheless, a limited or conditioned necessitation rule is derivable in Σ, namely, Aα, $\beta \vdash \Box\beta$.)

14) $(t_i=+=t_k)\supset(G[t_i]\leftrightarrow G[t_k])$ from 13 by the rule of $\leftrightarrow$ elimination.

15) $(t_i=+=t_k)$ assumption.

16) $(G[t_i]\leftrightarrow G[t_k])$ from 14 and 15 by *modus ponens*.

17) $([t_i]\leftrightarrow G[t_k])$ from 7 and 16 by the rule of transitivity of $\leftrightarrow$.

18) $(G[t_k]\leftrightarrow[t_k])$ from 12 by the rule of commutativity of $\leftrightarrow$.

19) $([t_i]\leftrightarrow[t_k])$ from 17 and 18 by the rule of transitivity of $\leftrightarrow$.

20) $A\alpha,(t_i=+=t_k)\vdash([t_i]\leftrightarrow[t_k])$ by the succession 1 - 19.

21) $A\alpha\vdash(t_i=+=t_k)\supset([t_i]\leftrightarrow[t_k])$ from 20 by the rule of $\supset$ introduction.

22) $(G[t_i]\leftrightarrow G[t_k])\supset(t_i=+=t_k)$ from 13 by the rule of $\leftrightarrow$ elimination.

23) $([t_i]\leftrightarrow[t_k])$ assumption.

24) $(G[t_i]\leftrightarrow[t_i])$ from 7 by the rule of commutativity of $\leftrightarrow$.

25) $(G[t_i]\leftrightarrow G[t_k])$ from 24 and 17 by the rule of transitivity of $\leftrightarrow$.

26) $(t_i=+=t_k)$ from 22 and 25 by *modus ponens*.

27) $A\alpha,([t_i]\leftrightarrow[t_k])\vdash(t_i=+=t_k)$ by the succession 1 - 26.

28) $A\alpha\vdash([t_i]\leftrightarrow[t_k])\supset(t_i=+=t_k)$ from 27 by the rule of $\supset$ introduction.

29) $A\alpha\vdash((t_i=+=t_k)\leftrightarrow([t_i]\leftrightarrow[t_k]))$ from 28 and 21 by the rule of $\leftrightarrow$ introduction.

30) $\vdash A\alpha\supset((t_i=+=t_k)\leftrightarrow([t_i]\leftrightarrow[t_k]))$ from 28 by the rule of $\supset$ introduction.

Thus, the formal proof is accomplished[2]. Originally, this proof had been published in [21] and then repeated in [23].

7. Formal Inferring Newton's First Law of Mechanics in the Formal Theory Sigma from Conjunction of the Assumption of Knowledge A-Priori-Ness and the Formal-Axiological Analog of the Mentioned Law of Mechanics

By means of the theorem-scheme proved above in paragraph 6 of the present article, from conjunction of 1) the *formal-axiological* equivalence 97) proved above in paragraph 3, and 2) the assumption that Aα, the *equivalence* $([C_2x]\ \leftrightarrow\ [C_3F_1V_1M_1x])$ is formally derivable within the formal axiomatic theory Sigma. Here it is worth highlighting that $([C_2x]\ \leftrightarrow\ [C_3F_1V_1M_1x])$ is the equivalence of *statements of being*.

Thus, owing to the mentioned theorem-scheme, with respect to Sigma, it is true that: Aα, $(C_2x=+=C_3F_1V_1M_1x)\ \vdash\ ([C_2x]\ \leftrightarrow\ [C_3F_1V_1M_1x])$, where "… ⊢ …" means "from … it is logically derivable (in Sigma) that…". In other words, according to the above-said, if knowledge is *pure a-priori* one, then there is a formal proof in Σ for the first law of Newton's mechanics. Thus, within a system of *pure a priori* knowledge of nature-laws logically organized by the theory Σ, the famous *law of conservation of definite velocity* of movement is strictly provable; namely, conservation (constant-ness, immutability) of definite velocity of movement of *x* exists if and only if *x* is dynamically closed (perfectly isolated from external forces).

[2]I am grateful to Grigori Olkhovikov for his examining the proof and for suggesting an option of making it more short one.

8. A Formal-Axiological View of Philosophical Theology of Space (Exemplifying Computational Theology)

Notwithstanding the famous Newton's motto "physics, beware of metaphysics!", his physics has been assessed by some physicists as "*too metaphysical*" one. He has been criticized sharply by the positivists for his not complete separation and purification of physics from metaphysics. In particular, Newton's systematical using the *metaphysical* notion "force (power, violence)" has been criticized as *too anthropomorphic* one by H. Poincaré [36] and also by H. Hertz and D. Hilbert [47, p. 223]; it has been proclaimed that it is possible (and from the proper scientific theory viewpoint even desirable) systematically to eschew using the anthropomorphic concept "force (power)" in science of mechanics; in the Newtonian mathematical physics, there is still contained anthropomorphic residue of which it has to be cleaned. However, some of Newton's proper *metaphysical* statements (hidden fundamental philosophical assumptions) have been not recognized as proper *metaphysical* ones as they have been well-camouflaged. Newton's natural philosophy has been connected not only with metaphysics of nature but also with philosophical theology especially due to S. Clarke's and G. W. Leibniz' correspondence [32]. Therefore, here it is quite relevant to construct and investigate a discrete mathematical model of a formal-axiological aspect of philosophical theology of space in general and God's *ubiquity* (*omnipresence*) especially.

1) S_5x=+=B_2x: absolute space is absolute being.

2) G_1x=+=B_2x: God is absolute being.

3) S_5x=+=S_6G_1x: absolute space is space of God.

4) S_5x=+=P_1G_1x: absolute space is place of God.

5) S_5x=+=P_3G_1x: absolute space is a property of God.

6) A_1x=+=N_3P_3x: attribute of x is a necessary property of x.

7) S_5x=+=A_1G_1x: absolute space is an attribute of God.

8) $U^2G_1xA_1G_1x$=+=b: reducing God to His attribute is a formal-axiological contradiction.

9) $I_2U^2G_1xA_1G_1x$=+=g: impossibility of reduction of God to His attribute is a law of algebra of metaphysics.

10) $I_2U^2G_1xS_5x$=+=g: impossibility of reducing God to absolute space is a law of algebra of metaphysics.

11) $I^2G_1xA_1G_1x$=+=b: God's attribute independent of God is a formal-axiological contradiction.

12) $I_2I^2G_1xA_1G_1x$=+=g: impossibility of God's attribute independent of God is a law of metaphysics.

13) $I_2I^2G_1xS_5x$=+=g: impossibility of absolute space independent of God is a law of metaphysics.

14) B_1G_1x=+=g: existence of God is a law of algebra of metaphysics.

15) N_1G_1x=+=b: nonbeing of God is a formal-axiological contradiction.

16) $C^2S_5xG_1x$=+=g: existence of God in absolute space is a law of algebra of

metaphysics.

17) $Y^2S_5xG_1x$=+=g: God's being immanent cause of absolute space is a law of algebra of metaphysics. This equation models [32, p. 75].

18) $C^2P_1yG_1x$=+=g: existence of God in place of any y (*i.e.* God's *ubiquity*) is a law of algebra of metaphysics [22].

19) C^2yG_1x=+=g: existence of God in any y (*i.e.* God's *omnipresence*) is a law of algebra of metaphysics [22].

20) B_1y=+=C^2G_1xy: y's existence is equivalent to y's existence in God [22].

These equations of algebra of metaphysics are discrete mathematical models of corresponding aspects of natural theology in general, and of the concrete natural-theology views of Newton and his spokesman and disciple Clarke in particular [32]. Being combined with corresponding universal statements about space in theoretical physics, the above-listed formal-axiological equations modeling concepts of space in metaphysics and theology make no proper logical contradiction. This is so because, generally speaking, meanings of the word "space" used in physics, metaphysics, and theology are qualitatively different (although fundamentally interconnected somehow). In the present article, the different meanings of "space" are precisely defined and systematized in such a way that the proper logical contradiction among them is not possible; it could happen only in result of a conceptual confusion in terms by linguistic negligence.

9. Conclusion

According to the above-said, there is a harmony between the three: 1) proper laws-of-physics assumed as *pure a-priori* (necessarily universal) ones; 2) their *formal-axiological analogs* (which analogs are corresponding laws of metaphysics in the two-valued algebraic system of formal-axiology); 3) universal epistemology represented by the formal axiomatic theory Sigma.

Both the computational *metaphysics* as algebra of formal axiology and the mathematical physics (theoretical mechanics) as a proper *science* (based on sensations, observations, experiments, measurements, and facts) have special rooms in the consistent conceptual synthesis of the particular conceptions of space which synthesis is submitted in this article. In result of the investigation, I have arrived to the conclusion that, in spite of the philosophical prejudices, the two qualitatively different conceptions of space are compatible within one synthetic doctrine uniting the two on the basis of two-valued algebra of formal-axiology. In the algebraic system of metaphysics as formal axiology, metaphysics-of-space and physics-of-space are represented by mathematically different evaluation-functions called "space of x". These mathematically different evaluation-functions make up a consistent synthesizing system within which, under the extraordinary (very rare) condition of *a-priori*-ness of knowledge, one can move logically from one special room of the system to another. Thus, under the indicated strictly defined epistemological condition, the "logically unbridgeable gap" between metaphysics and physics is logically bridged in general, and the concrete example of such logical bridging is given (here I mean the exemplification related to Newton's First Law of mechanics).

This means that due to the given paper a *heuristically important precedent* has been made; such a universal principle has been formulated precisely, which could be exploited systematically in future research at the intersection of physics and metaphysics.

Being combined with [20] [31] the present article makes a theoretical foundation and indicates a new direction of/for interesting future investigations concerning hypothetical *formal-axiological analogs* of other great laws of physics, namely, Newton's Second and Third Laws of mechanics, Galilean universal principle of relativity of motion, and the great (not-falsifiable) laws of conservation as such *pure a-priori* (necessarily necessary, strictly universal) laws of nature, which, according to Kant [40] [41] [42], are *prescribed* to nature by human understanding.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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