

# Applying Logic and Discrete Mathematics to Philosophy of Nature: Precise Defining “Time”, “Matter”, and “Order” in Metaphysics and Thermodynamics

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## Abstract

The overall frame of the study is determined by applying a not-well-known solution of the problem of logical bridging the notorious gap between statements of being and statements of value to philosophical grounds of thermodynamics. The main hitherto not published significantly new nontrivial result presented in this article is a *formal logical inference* of a proper physical law of thermodynamics in logically-formalized-theory-Sigma from conjunction of a *formal-axiological analog* of that physical law in algebra of formal axiology and the assumption of a-priori-ness of knowledge. All the necessary means for constructing the mentioned formal logical inference, namely, a two-valued algebraic system of metaphysics as formal axiology, and a logically formalized axiomatic epistemology system called Sigma are defined precisely.

## Keywords

Logic and Discrete Mathematics Applied to Metaphysics,  
Direction of Time, Algebra of Metaphysics as Formal Axiology,  
A Priori Knowledge, Logically Formalized Axiomatic Epistemology,  
Logical Inference, Law of Thermodynamics

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## 1. Introduction

*The main issue* to be discussed in this article is an exemplification of *logical inference of statement of being from statement of value* within a formal axiomatic theory of knowledge under the assumption of knowledge a-priori-ness. In this paper, the statement of being is exemplified by a law of thermodynamics; the

statement of value is exemplified by a *formal-axiological analog* of the law of thermodynamics.

*A short review of relevant literature.* The nontrivial problem of *logical deriving statements of value from statements of being (and statements of being from statements of value)* has been raised originally in (Hume, 2000) and (Moore, 1903) with respect to philosophy of morals. In relation to *philosophy of science*, the discussion of *fact/value dichotomy* problem has produced an immense amount of literature; for instance, (Marchetti & Marchetti, 2017; Putnam, 2002; 2004; 2017; Lobovikov, 2020c). According to the positivism paradigm, being completely reduced to facts *science has nothing to do with values* (Carnap, 1931; Mach, 1914; 1960; 2006; Reichenbach, 1959; 1965; Schlick, 1974; 1979a; 1979b; Wittgenstein 1992), consequently, a proper axiological aspect of thermodynamics does not exist. However, in the relevant literature, there is a hypothesis (Lobovikov, 2012; 2017; 2019; 2020b) that, *in its essence, metaphysics is nothing but an abstract formal axiology*. If the unhabitual hypothesis is accepted, then metaphysics of nature (philosophical grounding physics) necessarily has a proper axiological aspect. Accepting this psychologically unexpected corollary from the extraordinary hypothesis under investigation (by the hypothetical-deductive method) makes a heavy problem (paradox) to be scrutinized carefully and solved below in the present paper. In (Lobovikov, 2020c), a rigorous formal proof (within a formal axiomatic theory  $\Sigma$ ) is constructed for such a theorem-scheme ( $A\alpha \supset ((t_i = + = t_k) \leftrightarrow ([t_i] \leftrightarrow [t_k]))$ ), which means (in the precisely defined interpretation) that under the condition of knowledge a-priori-ness, a statement of formal-axiological equivalence of evaluation-functions is logically equivalent to logic equivalence of corresponding statements of being.

But, in (Lobovikov, 2020c), this philosophically significant theorem-scheme is not exemplified; its rigorous formal proof is constructed independently from its possible interpretations. Therefore, to support the above-mentioned unhabitual hypothesis of metaphysics of nature as its formal axiology, there is a theoretical necessity to exemplify the above-mentioned philosophically significant theorem-scheme by a concrete material taken from physics. For implementing the exemplification, it has been decided to utilize the concrete material of thermodynamics. Thus, the reason and significance of choosing the topic of this paper are clarified.

Due to such clarifying, the overall logical structure (somewhat complicated one) of the applied investigation becomes more evident. Namely, for obtaining and examining the main scientifically new result of this paper, it is necessary to have precise definitions of basic notions of two-valued algebraic system of metaphysics as formal axiology, which are already published, for instance, in (Lobovikov, 2012; 2019; 2020b). These precise definitions are contents of the following paragraph 2. Including these already published contents into the paragraph 2 of the present paper is indispensable; otherwise, the significantly new nontrivial scientific result (represented in the paragraphs 3 and 7 of this article) should be not understandable and not examinable. The set of exact defini-

tions necessary and sufficient for perfect understanding and examining original contents of the paragraph 3 is submitted in the immediately following paragraph 2. The set of precise definitions necessary and sufficient for adequate understanding and examining original contents of the paragraphs 7 and 8 is given below in the paragraphs 2, 4, 5. As the significantly novel nontrivial 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 read and understand *formal deductive proofs* and to scrutinize them carefully at syntax level; 2) interpreting the formally proved theorems and discussing the interpretations. Now let us move to submitting the system of basic definitions.

## 2. A Two-Valued Algebraic System of Metaphysics as Formal Axiology

According to the contemporary view of algebra and logic, 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 or 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 (Lobovikov, 2009; 2012; 2019; 2020b). 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. 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  $\Delta$ . By definition, elements of  $\Delta$  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  $\Delta$ . However, if a value of the variable  $V$  is fixed, then valuations of concrete elements of  $\Delta$  are quite definite.

Algebraic operations defined on the set  $\Delta$  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 positive 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  $\Delta$ . 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 *valuation-functions determined by* (a finite integer of) *valuation-arguments* means talking of the following mappings (in the proper mathematical meaning of the word “mapping”):  $\{g, b\} \rightarrow \{g, b\}$ , if one talks of the valuation-functions determined by *one* valuation-argument;  $\{g, b\} \times \{g, b\} \rightarrow \{g, b\}$ , where “ $\times$ ” stands for the Cartesian product of sets, if one talks of the valuation-functions determined by *two* valuation-arguments;  $\{g, b\}^N \rightarrow \{g, b\}$ , if one talks of the valuation-functions determined by  $N$  valuation-arguments, where  $N$  is 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 the below-submitted **Table 1**.  $B_{1x}$ , “being, existence of (what, whom)  $x$ ”.  $N_{1x}$ , “nonbeing, nonexistence of (what, whom)  $x$ ”.  $F_{1x}$ , “finite (what, who)  $x$ ” or “finiteness of (what, whom)  $x$ ”.  $I_{1x}$ , “infinite (what, who)  $x$ ”, or “infiniteness of (what, whom)  $x$ ”.  $T_{1x}$ , “physical time of (what, whom)  $x$ ”.  $T_{2x}$ , “metaphysical time of (what, whom)  $x$ ”.  $T_{3x}$ , “absolute time of (what, whom)  $x$ ”.  $T_{4x}$ , “time (in general) of (what, whom)  $x$ ”.  $M_{1x}$ , “matter, material, materialness of (what, whom)  $x$ ”.  $M_{2x}$ , “movement, change, flow of (what, whom)  $x$ ”.  $D_{1x}$ , “diminishing (what, whom)  $x$ ”. The mentioned functions are defined by **Table 1**. (Attentively looking at this table, one can notice that in algebra of formal axiology, the functions  $T_{2x}$  and  $T_{4x}$  are mathematically identical. However, this psychologically odd fact does not make a real problem: although *formal-axiological meanings* of the symbols “ $T_{2x}$ ” and “ $T_{4x}$ ” (the evaluation-functions) do coincide, the *ontological meanings* of these symbols are not

completely identical: they can be different, namely, in general, time can be not metaphysical but physical one.)

*Glossary* for the following **Table 2**.  $R_{1x}$ , “relativity (relativeness) of (what, whom)  $x$ ”.  $O_{1x}$ , “order of (what, whom)  $x$ ”, or “ $x$ ’s order”, or “being ordered by (what, whom)  $x$ ”.  $O_{2x}$ , “order for (what, whom)  $x$ ”, or “ordered-ness of (what, whom)  $x$ ”, or “ $x$ ’s being ordered”.  $C_{1x}$ , “closed, isolated, protected (what, who)  $x$ ”, or “closedness, isolated-ness, protected-ness of (what, whom)  $x$ ”.  $S_{1x}$ , “*sensation* of (what, whom)  $x$  as an object, i.e.  $x$ ’s being an object of sensation”.  $M_{3x}$ , “*measurement* of (what, whom)  $x$  as an object, i.e.  $x$ ’s being an object of measurement”.  $P_{1x}$ , “possibility of (what, whom)  $x$ ”.  $I_{2x}$ , “impossibility of (what, whom)  $x$ ”.  $I_{3x}$ , “irreversibility of  $x$ ”.  $R_{2x}$ , “reversibility of  $x$ ”.  $V_{1x}$ , “ $x$ ’s *vector* (direction)”, or “*immanent direction (own vector) of*(what, whom)  $x$ ”. These functions are defined below by **Table 2**.

Now, let us move from the above-introduced evaluation-functions determined by one evaluation-argument to below-introduced evaluation-functions determined by two evaluation-arguments.

*Glossary* for **Table 3**, the symbol  $K^2xy$  stands for the two-placed evaluation-function “a *unity* (one-ness) of  $x$  and  $y$ ”, or “*joint being of*  $x$  and  $y$ ”, or “ $x$ ’s and  $y$ ’s *being together*”. The symbol  $E^2xy$ , “*equalizing (identifying values of)*  $x$  and  $y$ ”, or “*coincidence (identify)* of  $x$  and  $y$ ”.  $C^2xy$ , “ $y$ ’s *being in* (what, whom)  $x$ ”.  $C_1^2xy$ , “ $y$ ’s being an *immanent* (inner) *cause* of (what, whom)  $x$ ”.  $C_2^2xy$ , “ $y$ ’s being an *external* (transcendent) *cause* of/for  $x$ ”. The mentioned evaluation-functions determined by two arguments are defined by **Table 3**.

**Table 1.** The evaluation-functions determined by one argument.

x	$B_{1x}$	$N_{1x}$	$F_{1x}$	$I_{1x}$	$T_{1x}$	$T_{2x}$	$T_{3x}$	$T_{4x}$	$M_{1x}$	$M_{2x}$	$D_{1x}$
g	g	b	b	g	b	g	g	g	b	b	b
b	b	g	g	b	g	b	g	b	g	g	g

**Table 2.** The one-placed evaluation-functions.

x	$R_{1x}$	$O_{1x}$	$O_{2x}$	$C_{1x}$	$S_{1x}$	$M_{3x}$	$P_{1x}$	$I_{2x}$	$I_{3x}$	$R_{2x}$	$V_{1x}$
g	b	g	b	g	b	b	g	b	g	b	g
b	g	b	g	b	g	g	b	g	b	g	b

**Table 3.** The binary evaluation-functions.

x	y	$K^2xy$	$E^2xy$	$C^2xy$	$C_1^2xy$	$C_2^2xy$
g	g	g	g	g	g	b
g	b	b	b	b	b	b
b	g	b	b	g	g	g
b	b	b	g	g	g	b

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.

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

Definition DEF-2 of the notion “*formal-axiological law*”: in the algebra of formal *axiology*, any evaluation-function  $\Phi$  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  $\Phi$  acquires the value  $g(\textit{good})$  under any possible combination of the values of its evaluation-variables. In other words, the function  $\Phi$  is *formally-axiologically (or constantly) good* one, iff  $\Phi=+=g(\textit{good})$ .

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

Now, being equipped with the set of necessary and sufficient definitions of relevant functions and notions, let us begin generating a list of *formal-axiological equations of algebra* of metaphysics. First of all, let us start 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 a Formal Axiological Law Which Is Analogous to the Corresponding Law of Thermodynamics

The *finitism* in philosophical foundations of mathematics is well-known (Hilbert, 1990; 1996a; 1996b; 1996c; 1996d; 1996e). 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 (Lobovikov, 2009). In my opinion, an 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 (Lobovikov, 2012) 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 foundations of physics is exploited for the first time (hitherto the present article has not been published elsewhere).

Due to the precise definitions given above in the paragraph 2, the following list of formal-axiological equations can be generated by accurate computing relevant compositions of evaluation-functions.

1)  $T_4x=+=T_2x$ : time (in general) of  $x$  is formally-axiologically equivalent to metaphysical time of  $x$ .

2)  $T_2x=+=T_4B_1x$ : metaphysical time of (what, whom)  $x$  is time of being of (what, whom)  $x$ .

3)  $T_2x=+=B_1x$ : metaphysical time of (what, whom)  $x$  is equivalent to being of (what, whom)  $x$ .

4)  $T_2x=+=x$ : metaphysical time of (what, whom)  $x$  is equivalent to  $x$ .

5)  $T_2x=+=I_1B_1x$ : metaphysical time of  $x$  is equivalent to infinite being of  $x$ .

6)  $T_2x=+=I_1T_4x$ : metaphysical time of  $x$  is equivalent to infinite time of  $x$ .

7)  $T_1x=+=F_1B_1x$ : physical time of  $x$  is equivalent to finite being of  $x$ .

8)  $T_1x=+=B_1F_1x$ : physical time of  $x$  is equivalent to being of finite  $x$ .

9)  $T_1x=+=F_1T_4x$ : physical time of  $x$  is equivalent to finite time of  $x$ .

10)  $T_1x=+=N_1x$ : physical time of  $x$  is equivalent to nonbeing of  $x$ .

11)  $M_2x=+=N_1x$ : movement, change of  $x$  is equivalent to nonbeing of  $x$  (Parmenides, Zeno, Melissus). See (Guthrie, 1965).

12)  $M_1x=+=N_1x$ : matter of  $x$  is equivalent to nonbeing of  $x$  (Plato, Aristotle, Plotinus). See: (Guthrie, 1975; 1978; 1981; Plato, 1994; Aristotle, 1994; Plotinus, 1991; Augustine, 1994).

13)  $T_1x=+=M_1x$ : physical time of  $x$  is matter of  $x$ .

14)  $M_1x=+=M_2x$ : matter of  $x$  is movement, change, flow of  $x$ .

15)  $T_1x=+=M_2x$ : physical time of  $x$  is movement, change, flow of  $x$ .

16)  $T_1x=+=M_2T_4x$ : physical time of  $x$  is movement, change, flow of time of  $x$ .

17)  $B_1x=+=I_2N_1M_2T_1x$ : being of  $x$  implies impossibility of nonbeing of change (flow) of physical time of  $x$ .

18)  $B_1x=+=R_1M_2x$ : existence of  $x$  means *relativity of movement* of  $x$  (Galilei, 1994).

19)  $B_1x=+=R_1T_1x$ : being of  $x$  means *relativity of physical time* of  $x$  (Poincaré, 2013; Einstein, 1994; Einstein, Lorentz, Minkowski, & Weyl, 1952).

20)  $B_1x=+=P_1S_1M_2T_4x$ : being of  $x$  is equivalent to *possibility of sensation* of change (flow) of time of  $x$  (Mach, 1914; 1960; 2006).

21)  $B_1x=+=P_1M_3M_2T_4x$ : existence of  $x$  is equivalent to *possibility of measurement* of change (flow) of time of  $x$  (Mach, 1914; 1960; 2006).

22)  $B_1x=+=P_1S_1T_1x$ : existence of  $x$  is equivalent to *possibility of sensation* of physical time of  $x$  (Mach, 1914; 1960; 2006).

23)  $B_1x=+=R_1M_3x$ : being of  $x$  is equivalent to relativity of measurement of  $x$ .

24)  $B_1x=+=P_1M_3T_1x$ : existence of  $x$  is equivalent to possibility of measurement of physical time of  $x$  (Mach, 1914; 1960; 2006; Reichenbach, 1956; 1958; 1959;



1965).

25)  $B_1x=+=P_1M_3R_1T_4x$ : existence of  $x$  is equivalent to possibility of measurement of relative time of  $x$  (Mach, 1914; 1960; 2006; Reichenbach, 1956; 1958; 1959; 1965).

26)  $F_1x=+=M_1x$ : finiteness of  $x$  is equivalent to materialness of  $x$ .

27)  $M_1x=+=R_1M_3T_1x$ : materialness of  $x$  is equivalent to relativity of measurement of physical time of  $x$  (Poincaré, 2013; Einstein, 1994; Einstein, Lorentz, Minkowski, & Weyl, 1952).

28)  $F_1x=+=R_1M_3T_1x$ : finiteness of  $x$  is equivalent to relativity of measurement of physical time of  $x$ .

29)  $I_2M_3T_3x=+=g$ : impossibility of measurement of absolute time of  $x$  is a law of algebra of metaphysics. This is a formal-axiological model (analog) of the definitely negative positivist (empiricist) attitude to the idea of absolute time (Mach, 1914; 1960; 2006; Schlick, 1974; 1979a; 1979b; Reichenbach, 1956; 1958; 1959; 1965).

30)  $I_2S_1T_3x=+=g$ : impossibility of sensation of absolute time of  $x$  is a law of algebra of metaphysics. This is another formal-axiological model (analog) of the resolutely negative positivist attitude to “absolute time” (Mach, 1914; 1960; 2006; Schlick, 1974; 1979a; 1979b; Reichenbach, 1956; 1958; 1959; 1965).

31)  $I_3T_4x=+=I_2M_2V_1T_4x$ : irreversibility of time of  $x$  is impossibility of change of vector (direction) of time of  $x$ .

32)  $B_1x=+=I_3T_4x$ : being of  $x$  implies irreversibility of time of  $x$ .

33)  $B_1x=+=I_3T_2x$ : being of  $x$  implies irreversibility of metaphysical time of  $x$ .

34)  $B_1F_1x=+=I_3T_1x$ : being of finite  $x$  implies irreversibility of physical time of  $x$  (Reichenbach, 1956; 1958; 1959; 1965).

35)  $B_1x=+=R_2T_1x$ : being of  $x$  is formally-axiologically equivalent to reversibility of physical time of  $x$ .

36)  $T_2x=+=R_2T_1x$ : metaphysical time of  $x$  is equivalent to reversibility of physical time of  $x$ .

The last two equations expose the significant formal-axiological difference and even opposition between “physical time” and “metaphysical one”. As to the thermodynamics which is an intellectually respectable branch of contemporary physics based on facts and measurements, here it is relevant to consider also the following three formal-axiological equations.

37)  $T_4x=+=O_2M_1x$ : time of  $x$  is formally-axiologically equivalent to ordered-ness of matter of  $x$ .

38)  $V_1T_1x=+=D_1O_2Mx$ : vector (inner direction) of physical time of  $x$  is diminishing ordered-ness of matter of  $x$ .

39)  $T_1C_1x=+=T_4C_1F_1x=+=O_2M_1C_1F_1x$ : physical time of closed (isolated)  $x$  is formally-axiologically equivalent to ordered-ness of matter of closed (isolated) finite  $x$ .

40)  $D_1T_1C_1x=+=D_1T_4C_1F_1x=+=D_1O_2M_1C_1F_1x$ : diminishing physical time of closed (isolated)  $x$  is formally-axiologically equivalent to diminishing ordered-ness of matter of closed (isolated) finite  $x$ .



At first glance, the translation of this formal-axiological equation from the artificial language of two-valued algebra of metaphysics as formal axiology into the ambiguous natural language of humans looks like a human-natural-language formulation of the law of thermodynamics, but actually it is not a statement of *being* but a *formal-axiological* statement of *value* (while the laws of thermodynamics are statements of *being*).

Concerning original publications of the *formal-axiological* equivalences *modeling* corresponding laws of classical physics, see, for instance, (Lobovikov, 2012; 2015; 2016; 2017). At first glance, it seems that the mentioned original publications and the translations (into the natural language from the artificial one) of relevant equations submitted above in this paragraph of the article are nothing but well-known formulations of the corresponding laws of classical physics, namely, the law of conservation of energy, the so-called Newton's First Law of the classical theoretical mechanics, et al, hence, it seems that there is nothing new with respect to philosophical grounds of physics. However, in my opinion, it *only seems* so. The natural-language formulations of corresponding *formal-axiological* laws are really *similar* but their meanings are *not identical* to the meanings of natural-language formulations of laws of classical physics. In contrast to formulations of the laws of classical physics based on experience, formulations of the corresponding laws of *metaphysics* of nature in algebra of metaphysics (as formal axiology) have *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 studies "what is (or is not) necessarily" in nature. The metaphysics (as formal axiology) of nature studies "what is good (or bad) necessarily" in nature. According to Hume, Moore, et al, "is" and "is good" are logically independent: formal logical inferences between them are not justifiable. Generally speaking, it is really so, but I have a hypothesis that under some very rare extraordinary condition the so-called logically unbridgeable gap 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 examining the queer hypothesis before its possible rejection.

In the next part of the article, I am to submit a *formal deductive derivation* of the law of thermodynamics from: 1) the above considered *formal-axiological analog* of that law; and 2) *assumption of a-priori-ness of knowledge*, in a logically formalized axiomatic epistemology system  $\Sigma$  (Sigma). Originally, the formal axiomatic theory  $\Sigma$  was defined precisely in (Lobovikov, 2020a; 2020c). As below in this paper  $\Sigma$  is essentially used as an indispensable instrument of/for obtaining a significantly new hitherto not published nontrivial result, I have to repeat (recall) the exact definition of  $\Sigma$  in the immediately following paragraph

for making readers able to understand and examine the suggested *formal deductive derivation* of the law of thermodynamics in  $\Sigma$  from the above-indicated premises.

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

By definition, the logically formalized axiomatic epistemology system  $\Sigma$  contains all symbols (of the alphabet), expressions, formulae, axioms, and inference-rules of the formal axiomatic epistemology theory  $\Xi$  (Lobovikov, 2018) which is based on the classical propositional logic. But in  $\Sigma$  several significant aspects are added to the formal theory  $\Xi$ . In result of these additions the alphabet of  $\Sigma$ '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  $\Sigma$ ; they are called "*propositional letters*". *Not all small Latin letters are propositional ones* in the alphabet of  $\Sigma$ '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  $\Sigma$ 's object-language alphabet.

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

4) Technical symbols "(and)" ("round brackets") belong to  $\Sigma$ '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  $\Sigma$ '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  $\Sigma$ .

7) The capital Latin letters possessing number indexes –  $K^2, E^2, C^2, A_k^n, B_i^n, C_i^n, D_m^n, \dots$  belong to the object-language-alphabet of  $\Sigma$  (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  $\Sigma$ , 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  $\Sigma$ . Moreover, even at syntax level of  $\Sigma$ '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  $\Sigma$ " and in the below-given formulations of some axiom-schemes of  $\Sigma$ .

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

10) A symbol belongs to the alphabet of object-language of  $\Sigma$ , 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  $\Sigma$ , if and only if this succession contains such and only such symbols which belong to the above-defined alphabet of  $\Sigma$ 's object-language.

Now let us define precisely the general notion "*term of  $\Sigma$* ":

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

4) An expression in object-language of  $\Sigma$  is a term of  $\Sigma$ , 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  $\alpha$ ,  $\beta$ , and  $\gamma$  (belonging to meta-language) stand for *any* formulae of  $\Sigma$ . By means of this agreement the general notion "*formulae of  $\Sigma$* " is defined precisely as follows.

1) All the above-mentioned propositional letters are formulae of  $\Sigma$ .  
 2) If  $\alpha$  and  $\beta$  are formulae of  $\Sigma$ , then all such expressions of the object-language of  $\Sigma$ , which possess logic forms  $\neg\alpha$ ,  $(\alpha \supset \beta)$ ,  $(\alpha \leftrightarrow \beta)$ ,  $(\alpha \& \beta)$ ,  $(\alpha \vee \beta)$ , are formulae of  $\Sigma$  as well.

3) If  $t_i$  and  $t_k$  are terms of  $\Sigma$ , then  $(t_i =+ t_k)$  is a formula of  $\Sigma$ .

4) If  $t_i$  is a term of  $\Sigma$ , then  $[t_i]$  is a formula of  $\Sigma$ .

5) If  $\alpha$  is a formula of  $\Sigma$ , and meta-language-symbol  $\Psi$  stands for any element of the set of modality-symbols  $\{\square, K, A, E, S, T, F, P, Z, G, W, O, B, U, Y\}$ , then any object-language-expression of  $\Sigma$  possessing the form  $\Psi\alpha$ , is a formula of  $\Sigma$  as well. (Here, the meta-language-expression  $\Psi\alpha$  is not a formula of  $\Sigma$ , but a scheme of formulae of  $\Sigma$ .)

6) Successions of symbols (belonging to the alphabet of the object-language of  $\Sigma$ ) are formulae of  $\Sigma$ , 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  $\{\square, K, A, E, S, T, F, P, Z, G, W, O, B, U, Y\}$ . Symbol  $\square$  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  $\Sigma$  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  $\Sigma$ .

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:  $A\alpha \leftrightarrow (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg Sa \ \& \ \Box(\beta \leftrightarrow \Omega\beta)))$ .

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

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  $\Omega$  (belonging to the meta-language) stands for any element of the set  $\mathfrak{R} = \{\Box, K, T, F, P, Z, G, O, B, U, Y\}$ . 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 (Ivin 1970). 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 for the Formal Theory Sigma

Meanings of the symbols belonging to the alphabet of object-language of  $\Sigma$  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  $\Sigma$ , it is necessary to define a set  $\Delta$  (called “field of interpretation”) and an interpreter called “evaluator (evaluator)”  $\Theta$ .

In a standard *interpretation* of formal theory  $\Sigma$ , the set  $\Delta$  (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  $\Delta$ .

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

It is presumed here that *axiological evaluating* an element from the set  $\Delta$ , 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)  $\Theta$ . It is obvious that changing  $\Theta$  can result in changing valuations of elements of  $\Delta$ . But *laws of two-valued algebra of formal axiology* do not depend upon changes of  $\Theta$  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 evaluators. Thus, generally speaking,  $\Theta$  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  $\Sigma$  is *necessarily fixing* the value of  $\Theta$ ; changing the value of the variable  $\Theta$  is changing the concrete interpretation.

In a standard *interpretation* of formal theory  $\Sigma$ , *ontological constants* “e” and “n” mean, respectively, “exists” and “not-exists”. Thus, in a standard *interpretation* of formal theory  $\Sigma$ , one and only one element of the set  $\{\{g, e\}, \{g, n\}, \{b, e\}, \{b, n\}\}$  corresponds to every element of the set  $\Delta$ . The *ontological constants* “e” and “n” belong to the *meta-language*. (According to the above-given definition of  $\Sigma$ '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  $\Sigma$  are interpreted as *n-ary algebraic operations (n-placed evaluation-functions)* defined on the set  $\Delta$ . 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 **Table 1**, **Table 2**. For instantiating the general notion “*evaluation-function determined by two evaluation-arguments*” systematically exploited in two-valued algebra of metaphysics as formal axiology, see **Table 3**. (For correct understanding contents of this paper, it is worth emphasizing here that in the semantics of  $\Sigma$ , the symbols  $B_{1x}, N_{1x}, F_{1x}, M_{1x}, M_{2x}, T_{1x}, T_{2x}, T_{3x}, L_{2x}, D_{1x}, V_{1x}, K^2_{xy}, C^2_{xy}, C^1_{1xy}, C^2_{2xy}$  mean *not predicates but terms*. Being given a relevant interpretation, the expressions  $(t_i=+=t_k), (t_i=+=g), (t_i=+=b)$  are representations of *predicates* in  $\Sigma$ .)

If  $t_i$  is a term of  $\Sigma$ , then, being interpreted, formula  $[t_i]$  of  $\Sigma$  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.

Given a relevant interpretation, the formula  $(t_i=+=t_k)$  of  $\Sigma$  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 the 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 introduced and defined precisely the substantially new notions essentially involved into the discourse, let us move directly to the above-promised formal proof construction.

## 6. A Formal Proof of $(A\alpha \supset ((t_i = + = t_k) \leftrightarrow ([t_i] \leftrightarrow [t_k])))$ in the Formal Axiomatic Theory Sigma

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

- 1)  $A\alpha \leftrightarrow (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box(\beta \leftrightarrow \Omega\beta)))$  by axiom-scheme AX-3.
- 2)  $A\alpha \leftrightarrow (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_i] \leftrightarrow G[t_i])))$  from 1 by substituting: G for  $\Omega$ ;  $[t_i]$  for  $\beta$ .
- 3)  $A\alpha \supset (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_i] \leftrightarrow G[t_i])))$  from 2 by the rule of  $\leftrightarrow$  elimination.
- 4)  $A\alpha$  assumption.
- 5)  $K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_i] \leftrightarrow G[t_i]))$  from 3 and 4 by *modus ponens*.
- 6)  $\Box([t_i] \leftrightarrow G[t_i])$  from 5 by the rule of eliminating  $\&$ .
- 7)  $([t_i] \leftrightarrow G[t_i])$  from 4 and 6 by a rule of  $\Box$  elimination. (The  $\Box$  elimination rule is *derivative one*<sup>1</sup>.)
- 8)  $A\alpha \leftrightarrow (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_k] \leftrightarrow G[t_k])))$  from 1 by substituting: G for  $\Omega$ ;  $[t_k]$  for  $\beta$ .
- 9)  $A\alpha \supset (K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_k] \leftrightarrow G[t_k])))$  from 8 by the rule of eliminating  $\leftrightarrow$ .
- 10)  $K\alpha \ \& \ (\Box\alpha \ \& \ \Box\neg S\alpha \ \& \ \Box([t_k] \leftrightarrow G[t_k]))$  from 4 and 9 by *modus ponens*.
- 11)  $\Box([t_k] \leftrightarrow G[t_k])$  from 10 by the rule of eliminating  $\&$ .
- 12)  $([t_k] \leftrightarrow G[t_k])$  from 4 and 11 by the rule of  $\Box$  elimination.
- 13)  $(t_i = + = t_k) \leftrightarrow (G[t_i] \leftrightarrow G[t_k])$  axiom-scheme AX-7.
- 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)  $A\alpha, (t_i = + = t_k) \mid\!-\ ([t_i] \leftrightarrow [t_k])$  by the succession 1—19.
- 21)  $A\alpha \mid\!-\ (t_i = + = t_k) \supset ([t_i] \leftrightarrow [t_k])$  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  $\leftrightarrow$ .

<sup>1</sup>It is formulated as follows:  $A\alpha, \Box\beta \mid\!-\ \beta$ . This rule is not included into the above-given definition of  $\Sigma$ , but it is easily *derivable* in  $\Sigma$  by means of the axiom scheme AX-1 and *modus ponens*. (The rule  $\Box\beta \mid\!-\ \beta$  is not derivable in  $\Sigma$ , and also Gödel's necessitation rule is not derivable in  $\Sigma$ . Nevertheless, a limited or conditioned necessitation rule is derivable in  $\Sigma$ , namely,  $A\alpha, \beta \mid\!-\ \Box\beta$ .)



- 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)  $A\alpha, ([t_i] \leftrightarrow [t_k]) \mid - (t_i = + = t_k)$  by the succession 1—26.  
 28)  $A\alpha \mid - ([t_i] \leftrightarrow [t_k]) \supset (t_i = + = t_k)$  from 27 by the rule of  $\supset$  introduction.  
 29)  $A\alpha \mid - ((t_i = + = t_k) \leftrightarrow ([t_i] \leftrightarrow [t_k]))$  from 28 and 21 by the rule of  $\leftrightarrow$  introduction.  
 30)  $\mid - A\alpha \supset ((t_i = + = t_k) \leftrightarrow ([t_i] \leftrightarrow [t_k]))$  from 28 by the rule of  $\supset$  introduction.  
 Here you are<sup>2</sup>.

## 7. Logical Deriving the Law of Thermodynamics in $\Sigma$ from Conjunction of the Assumption of Knowledge A-Priori-Ness and the Formal-Axiological Analog of the Law of Thermodynamics

By means of the theorem-scheme proved above in paragraph 6 of the present article, from conjunction of 1) the *formal-axiological* equivalence 40) proved above in paragraph 3, and 2) the assumption that  $A\alpha$ , the *equivalence*  $([D_1T_4C_1F_1x] \leftrightarrow [D_1O_2M_1C_1F_1x])$  is formally derivable within the formal axiomatic theory  $\Sigma$ . Here it is worth highlighting that  $([D_1T_4C_1F_1x] \leftrightarrow [D_1O_2M_1C_1F_1x])$  is the equivalence of *statements of being*.

In other words, due to the indicated theorem-scheme, in relation to  $\Sigma$ , it is true that:  $\{A\alpha, (D_1T_4C_1F_1x = + = D_1O_2M_1C_1F_1x)\} \mid - ([D_1T_4C_1F_1x] \leftrightarrow [D_1O_2M_1C_1F_1x])$ , where the symbol “ $\{...\} \mid - \dots$ ” stands for “from  $\{...\}$  it is provable that  $\dots$ ”. This means that if knowledge is *a-priori* one, then ordered-ness (negentropy) of matter of closed (isolated) finite  $x$  is diminishing if and only if time of closed (isolated) finite  $x$  is diminishing.

According to the contemporary investigations in physics, there are some non-trivial problems and sophisticated puzzles concerning the law of thermodynamics (Atkinson, 2006; Callender, 1997; 2011; 2016; Earman, 1981; 2002; 2006; Hurley, 1986; Lieb, & Yngvason, 2000; Liu, 1994; Loewer, 2012; North, 2002; Price, 1996; 2004; Redhead, & Ridderbos, 1998; Sanford, 1984; Savitt, 1995; Suhler, & Callender, 2012) which problems and contradictions are to be solved somehow by proper physicists. But, in any way, the above-submitted mathematized philosophical discourse of metaphysical grounds of physics is worth taking into an account (even if the law in question is *not necessarily* universal one). If the law of thermodynamics is *contingently* necessary, i.e. *not absolutely* universal, then, according to the theory  $\Sigma$ , the law in question is not the great *pure-a-priori* law of nature but *empirical* (*not necessarily* necessary) one. However, let us live and see.

## 8. Compatibility of Physics and Theology of Time in the Two-Valued Algebraic System of Metaphysics

Thinking of time in metaphysics and philosophical theology had started in the

<sup>2</sup>I am grateful to Grigori Olkhovikov for his examining the proof and for suggesting an option of making it more short one.



ancient world. A representative example was St. Augustine (1994). And even in the early modern time I. Newton (1994; 2004) was involved in a systematical discourse of *absolute* space, *absolute* motion, and *absolute* time (along with his works on proper theology questions) in spite of his well-known slogan “physics, beware of metaphysics!” Notwithstanding this famous slogan, in fact, Newton’s physics was *too metaphysical* one. Many efforts were undertaken by his colleagues for converting Newton’s “natural *philosophy*” into the contemporary *science* system well-known under the name “classical physics independent from metaphysics”.

Now, let us undertake a somewhat risky attempt to continue Newton’s odd studies of a fancy combination of the natural theology with the mathematical principles of natural philosophy (1994). For implementing this attempt, let us introduce the evaluation-function “*God of* (what, whom)  $x$  in a *monotheistic* world religion”. Certainly, in plenty of barbaric *polytheistic* (or *not universal but particular*, local, ethnic) religions, the formal-axiological meanings of the expression “*God of* (what, whom)  $x$ ” are significantly different from the meaning of that expression in the present paper. A precise tabular definition of formal-axiological meaning of the word “God” in the not-universal barbaric religions is given, for instance, in (Lobovikov, 2019; 2020b). However, as the present paper is not devoted to religious studies as such, let us abstain from developing the comparative religious studies further. Otherwise, it is easy to deviate significantly from the principal target of the paper.

In the object-language of formal theory  $\Sigma$ , the evaluation-function “*God of* (what, whom)  $x$  in a *monotheistic* world religion” is represented by the symbol  $G_1x$ . In semantics of the formal theory  $\Sigma$ , i.e. in the above-defined algebraic system of metaphysics as formal axiology, the formal-axiological meaning of the symbol  $G_1x$  is defined as follows.

Definition DEF-4:  $G_1x = + = g$ .

This formal-axiological equation means that in a monotheistic world religion, *God is good for any  $x$* . Thus, *omni-goodness of God* is established by definition (DEF-4). In contrast to other evaluation-functions considered in this article, the definition of *constant* function  $G_1x$  is not tabular but analytical one. Corollary: from the definitions DEF-2 and DEF-4, it follows logically that “*God is a Law*” (of metaphysics) in the algebraic system under investigation. The metaphysical statement “*God is Necessarily Universal Law*” is perfectly suitable and important for content theology but in the present article, according to its main theme, the following corollaries connecting the above-said with “time of  $x$ ” attract attention first of all. Being focused on the different evaluation-functions called “time of  $x$ ”, let us continue the list of equations submitted above (in the paragraph 3) by adding equations connecting “time of  $x$ ” with “God of  $x$ ”.

- 1)  $T_3x = + = T_4G_1x$ : absolute time of  $x$  is time of God of  $x$ .
- 2)  $B_1x = + = C^2T_3xB_1x$ : being of  $x$  is ( $x$ ’s being in absolute time of  $x$ ).
- 3)  $C^2T_4yT_4G_1x = + = g$ : it is the *formal-axiological law of metaphysics* that time

of God of  $x$  exists in every time, i.e. in time of every  $y$ .

4)  $B_1y=+=C^2T_4G_1xT_4y$ : being of every  $y$  is equivalent to existence of time of  $y$  in time of God of  $x$ .

5)  $C_2^2G_1xG_1x=+=b$ : it is the *formal-axiological contradiction* that God of  $x$  is an *external* (transcendent) *cause* of/for Himself.

6)  $C_1^2G_1xG_1x=+=g$ : it is the *formal-axiological law of metaphysics* that God of  $x$  is an *immanent* (inner) *cause* of/for Himself.

7)  $C_1^2yG_1x=+=g$ : it is the *formal-axiological law of metaphysics* that God of  $x$  is an *immanent* (inner) *cause* of/for every  $y$ .

These formal-axiological statements about time in metaphysics and theology, being combined with corresponding factual statements about time in empirical physics, make no proper logical contradiction as the meanings of the word-homonym “time” used in constructing allegedly logical contradiction are qualitatively different. The significantly different meanings of the word-homonym “time” are precisely defined and systematically investigated above in this paper. Now, an allegedly logical conflict among physics, metaphysics and theology of time could happen only in result of a conceptual confusion in terms by negligence. Normally, the inconsistency among the three is not possible, hence, the unity of human consciousness is not in danger.

## 9. Conclusion

Both mathematized metaphysics and mathematized thermodynamics have special rooms in the consistent conceptual synthesis of the particular theories of time which synthesis is submitted in the present paper. Thus, in spite of the cultural prejudices, the two are quite compatible within one doctrine. In the two-valued algebraic system of metaphysics as formal axiology, metaphysics-of-time and thermodynamics-of-time are adequately modeled by mathematically different evaluation-functions called “time of (what, whom)  $x$ ”. Nevertheless, these mathematically different functions “time of  $x$ ” make up a consistent system within which under some quite definite condition, it is possible logically to move from one special room of the synthetic system to another. Applying discrete mathematics has made the compatibility of metaphysics and thermodynamics in one synthetic conception of time quite evident.

## Conflicts of Interest

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

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