Hilbert mathematics versus (or rather "without") Gödel mathematics: V. Ontomathematics!

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Abstract. The paper is the final, fifth part of a series of studies introducing the new conceptions of "Hilbert mathematics" and "ontomathematics". The specific subject of the present investigation is the proper philosophical sense of both, including philosophy of mathematics and philosophy of physics not less than the traditional "first philosophy" (as far as ontomathematics is a conservative generalization of ontology as well as of Heidegger's "fundamental ontology" though in a sense) and history of philosophy (deepening Heidegger's destruction of it from the pre-Socratics to the Pythagoreans). Husserl's phenomenology and Heidegger's derivative "fundamental ontology" as well as his later doctrine after the "turn" are the starting point of the research as established and well known approaches relative to the newly introduced conception of ontomathematics, even more so that Husserl himself started criticizing his "Philosophy of arithmetic" as too naturalistic and psychological turning to "Logical investigations" and the foundations of phenomenology. Heidegger's "Aletheia" is also interpreted ontomathematically: as a relation of locality and nonlocality, respectively as a motion from nonlocality to locality if both are physically considered. Aristotle's ontological revision of Plato's doctrine is "destructed" further from the pre-Socratics' "Logos" or Heideger's "Language" (after the "turn") to the Pythagoreans "Numbers" or "Arithmetics" as an inherent and fundamental philosophical doctrine. Then, a leap to contemporary physics elucidates the essence of ontomathematics overcoming the Cartesian abyss inherited from Plato's opposition of "ideas" versus "things", and now unifying physics and mathematics, particularly allowing for the "creation from nothing" instead of the quasi-scientific myth of the "Big Bang". Furthermore, ontomathematics needs another interpretation of arithmetic, propositional logic and set theory in the foundations of mathematics, where the latter two ones are both identified with Boolean algebra, and the former is considered to be a "half of Boolean algebra" in the exact meaning to be equated to it after doubling by a dual anti-isometric counterpart of Peano arithmetic. That unified algebraic realization of the foundations of mathematics is related to Hilbert mathematics in both "narrow and wide senses" where the latter is isomorphic to the qubit Hilbert space, thus underlying all the physical world by the newly introduced substance of quantum information being physically dimensionless and generalizing classical information measured in bits. The substance of information, whether classical or quantum, visualizes the way of the unification of physics and mathematics by merging their foundations in Hilbert arithmetic and Hilbert mathematics: thus how ontomathetics is a "first philosophy". The relation of ontomathematics to the Socratic "human problematics", furthermore being fundamental for Western philosophy in Modernity, is discussed. Ontomathematics implies its "substitution" by abstract information (or by "subjectless choice" relevant to it), thus "obliterating the human outline on the ocean beach sand" (by Michel Foucault's metaphor). A reflection back from the viewpoint of mathematic to Western philosophy as the philosophy of locality ends the study.

Keywords: Aletheia, arithmetics, Boolean algebra, epoché to reality, foundations of mathematics, fundamental ontology, Hilbert arithmetic, Hilbert mathematics, Husserl, Heidegger, information and quantum information, Language, locality and nonlocality, ontomathematics, phenomenology, propositional logic, Pythagoreanism, set theory

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I INSTEAD OF INTRODUCTION: HEIDEGGER'S DISTINCTION BETWEEN THE (ONTOLOGICAL) BEING AND THE (ONTIC) EXISTENT IN AN ONTOMATHEMATICAL INTERPRETATION

The final, fifth part of the study, devoted to the introduction and investigation of Hilbert mathematics, is concentrated on its philosophical essence and influence representable by the neologism of "ontomathematics" as well as by the slogan in the title: "Ontomathematics!". The starting point of that research will be Heidegger's "fundamental ontology" after his appeal for restoring the "question of the being" in the beginning of "Sein und Zeit", but reinterpreted as an immediate extension of Husserl's phenomenology in turn destructed or deconstructed to its origin in the transition from "Philosophy of Arithmetic" (1891) to "Logical Investigations" (1900/1901).[1] Thus, the usual reading of "Sein und Zeit" (1927) after "existentialism" will be thoroughly omitted or "bracketed" after a kind of epoché to the "human problem", dominated philosophy since Socrates till nowadays, and "existentialism" at issue, even more so that Heidegger himself rejected to be an "existentialist", in particular returning to the pre-Socratics, therefore inherently abandoning all "human" philosophy after Socrates.

Before starting the proper consideration of the distinction between the ontic and the ontological (respectively, the existent versus the being) after Heidegger, one needs a preliminary notice just about "human problematics" after him since it will be now reinterpreted or generalized as the hidden problem of locality and human experience including after Husserl and his "Lebenswelt". In his later works, Heidegger, for example, investigated the opposition of the human and the world after the etymological destruction of the German word "Gegenstand" (thing, entity) as "Gegen-stand", i.e., anything staying against the human, after which just that opposition constitute the human in a philosophical sense as a secondary concept originating rather from the opposition at issue than from the concept of the world itself.

So, if one endeavors to a kind of epoché to the "human problem" in philosophy, "that epoché" turns out to be analogical or even the same as Husserl's original one, to the world, and thus phenomenology, whether in Husserl's "first edition" or in Heidegger's "fundamental ontology", abandons inherently the "human problem". Indeed, Husserl's "phenomena" do not need the philosophical concept of human at all, moreover that the "human redundancy" is their essence and the way for them to be defined and legitimated.

One can continue back, into the origin of phenomenology after Husserl's rejection of "Philosophy of arithmetic" in favor of "Logical investigations", even more so that it refers directly to the design of ontomathematics. The former work considered (after the outlined above "back reflection" from his later papers) the subject of arithmetics, which can be notated as "numbers", to be "things" in the world like all perceptively accessible usual entities distinguishable from them only by involving another "perceptual sense", human mind. Speaking quite loosely, the mind accepts numbers so immediately as sight does the same as to any visible

[1] One should mean Husserl's implicit mathematical attitude and viewpoint penetrating his doctrine of phenomenology and discussed in many enough papers (e.g., Hartimo 2022; 2012; 2012a; Birne 2017; 2017a;Wiltsche 2017; Hartimo, Okada 2016; Isaac 2016; Tieszen 2012; Centrone 2010; Handdock 2006; 1997; 1987: Rollinger 2003; Vega 2003; Witherspoon 2002; Silva 2000; Picardi 1997; Snyder 1997; Tragesser 1984; Philip 1982; Stapleton 1982; Roger 1981; Willard 1980; Mahnke 1977; Meiland 1976; McCarthy 1972; Sokolowski 1968).

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external object. Obviously, that conception is rather opposite to his later doctrine known as "phenomenology", but nonetheless it might be granted as a synopsis of the standard modern opposition of humans versus things only additionally interpreted as to the subject of arithmetic.

That synopsis might be used by Husserl to formulate the antithetical viewpoint, moreover supplied by an ancient tradition originating still since Aristotle endeavoring to overcome the fundamental dichotomy of "things" versus "ideas" invented by "his friend Plato", once "truth is his better friend". More than two millennia later, Husserl repeated more or less Aristotle's revolutionary innovation after he had granted for the numbers to be "things" though perceptible by mind rather than by senses. He abandoned arithmetic in favor of logic, by the by, just as his contemporaries, Russell and Whitehead in relation to the particular problem about the foundations of mathematics in their famous "Principia mathematica".

Though Pythagoras and his school invented the idea of philosophy starting from arithmetic realized to be more or less sacral, that design was absolutely abandoned thereafter in favor of both Plato's or Aristotle's doctrines. So, Husserl followed also that ancient "oblivion" of arithmetic, choosing furthermore Aristotle's decision rather than that of Plato. Indeed, propositional logic is able thoroughly to neglect Plato's distinction since never mind what the propositional terms are: whether "things" or "ideas". So, logic[2] still since Aristotle has strictly observed that "epoché" articulated and being repeatedly emphasized more than two millennia later in Husserl's phenomenology.

Thus, arithmetic and logic, two "sisters in birth", had quite different destiny during many centuries. Logic maintained by Aristotle's authority and Euclid's reinterpretation of geometry, that science of how to measure earth and thus relative to today's physics, thoroughly by the only deductive and axiomatic method, was recognized by both philosophy and mathematics to underlie them. Alas, arithmetic, though being the "elder sister", was "left high and dry" as an elementary mathematical theory, so simple that first-year pupils in primary school might study and master it.

The state of affairs was partly changed only in the end of the 18th century and the 19th century when arithmetic was heralded as the "Queen of mathematics" (especially after Friedrich Gauss), John Bool created mathematical logic thus hinted at their forgotten kinship, and Cantor's set theory, the third and youngest sister, in the foundations of mathematics needed both others, but Kurt Gödel suggested proofs doubtful about the real "relationship" of arithmetic and set theory (1931), before that proving the "sisterhood" of set theory and propositional logic (1930).

Then, after logic has been now identified as *one*, though most fundamental mathematical theory, whether its remarkable property noticed still by Aristotle not to distinguish between "ideas" and "things" and thus being able to generate "ontology" in a philosophical sense is its *unique* feature differing it from all other mathematical theories (also called "first-order logics", or eventually of higher order, opposed to it as the single "zero-order logic"), or there exist others sharing the same extraordinary and philosophically very important "peculiarity". The former result of Gödel (1930) suggested though implicitly that at least set theory "suffers" from the

[2] "Logic" in a quite philosophical sense inherent for Hegel and the German philosophical tradition penetrates Heidegger's doctrine not less than Husserl's phenomenology where is an explicit and main subject of investigation (e.g. Segev 2007; Marder 2005; Winfree 2005; Käufer 2001; Rosenthal 1995; Cristin 1990; Fay 1990; 1977; 1974; 1974a; Mohanty 1988; Hartmann 1974; Gotesky 1938;

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same "blindness" to Plato's distinction, which will be later proclaimed by Husserl as the basis of his doctrine and notated as "epoché" to reality.

Thus, the fundamentality of set theory, for example postulated and demonstrated by the group of mathematicians published by the collective pseudonym of "Bourbaki" in a series of mathematical monographs, can be additionally supported. Indeed, set theory can be also realized as the class of equivalence of all mathematical theories (i.e., first-order logics), and then Gödel in 1930 proved (in his and many mathematicians' opinion, but *postulated* according to others) the equivalence of the single zero-order logic (classical propositional, "Boolean" logic) with the also single one class of all possible first-order logics (i.e., set theory), and his next paper in 1931 showed that the "elder sister" (arithmetic) cannot be consistently joint to the two "youngest sisters" (logic and set theory).

Indeed, the problematic "kinship" of arithmetic, so spectacularly explained by Gödel, is a crucial problem for establishing ontomathematics also usually interpreted as an ultimate fact refuting its possibility and supporting the standard Cartesian viewpoint to mathematics to be situated on that "shore of the abyss" opposed to both physics and the material, "bodily" world. Even granting that rather Cartesian interpretation, the previous result (1930) holds therefore hinting to an at least "set-theoretical ontomathematics", which (by the mediation of logic and Aristotle's ancient revolution) to be interpreted as ontology, and allows for its establishment though abandoning arithmetic or returning it in its post-Pythagorean "oblivion" (intentionally, though implicitly referring to Heidegger's "oblivion of the being" or at least, "oblivion of the question of the being).

By the way, that kind of ontomathematics, though only set-theoretical, might in turn elucidate Gödel's Platonism in philosophy of mathematics as well as in philosophy at all. Rather paradoxically, both papers (1930 and 1931) granted to be consistent (as their author reckoned, but which is not the single viewpoint to them) appeals to a reconciliation of Plato's and Aristotle's doctrines at least as to the area of mathematics at the cost of a repeated (and confirmed and restored) "exile of arithmetic".

That, not quite standard interpretation of Gödel's contributions is moved by the necessity for elucidating the relation of Husserl's phenomenology and his disciple Heidegger's "fundamental ontology"[3] to ontomathematics. Husserl avoided the psychological Platonism of "Philosophy of arithmetic" by jointing Aristotle's decision extrapolating and actualizing it in accordance with the modern history of Western philosophy, especially since Descartes[4], of course being absolutely inaccessible (as anachronistic) to Aristotle himself as well as to Plato. Husserl's basic education in mathematics assisted him crucially because mathematics (though implicitly) has utilized what Husserl later articulated as "phenomenology" in the proper domain of

[3] A huge amount of papers considers the relation of Husserl and Heidegger as well as that of their doctrines (e.g., McGuirk 2010; Overgaard 2010; 2004; 2003; Courtine 2009; Hickerson 2009; O'Murchadha 2008; Barua 2007; Luft 2005; Crowell 2002; 2001; 1990; Hopkins 2001; Moran 2000; Keller 1999; Neumann 1999; Palmer 1997; Øverenget 1996; Smith 1994; Dreyfus 1993; 1975; Kusch 1988; Lampert 1988; Murray 1988; Tapper 1986; Caputo 1984; 1977; Stapleton 1983; Pietersma 1979; Mohanty 1978; Morrison 1978; Merlan 1947)

[4] Husserl referred to Descartes in a few works (in more detail, e.g., Zhang 2019; Macdonald 2000; Attig 1980; Laporte 1963; Löwit 1957).

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philosophy, since at least Euclid's revolution to rewrite an empirical science such as geometry thoroughly deductively and axiomatically thus enumerating it as a mathematical theory.

The above statement might be exemplified or visualized by the relation of "eidetic" and "phenomenological" (identifiable furthermore as "transcendental") reductions after Husserl. "Eidetic reduction" is, in fact, a basic and traditional method for generating notions, their properties and relations in mathematics, starting from empirical entities, at least since Euclid's age, furthermore shared by many other non-mathematical sciences. A few features of the real object at issue are granted to be "definitive" and "unchangeable" after eidetic reduction thus constituting its "eidos" or "idea" in a more habituated Platonist manner of expression. In other words, and said rather mathematically, the eidos at issue is a certain class of equivalence of real objects after restricting definitive attributes to a finite set. That is: a potentially or actually infinite set of real objects is equivalently (at least as to mathematics) substituted by a finite tuple of statements including or referring to real entities, their properties and relations. As to propositional logic itself, it is able to neglect the distinction between finiteness (or "ideality") and infinity ("reality") since never mind what its terms mean as far as both ideal and real terms obey the same formal rules also called "logical laws".

Well, if ones transform that eidos, operated standardly in mathematics, now in the field of ("first") philosophy, it turns out to be Husserl's "phenomenon", relative but different enough from Kant's one, and rather unexpectedly interpreted also "psychologically" (in fact, reinterpreting his initial proper Platonist psychologism in "Philosophy of arithmetic" from the newly introduced viewpoint of "phenomenology"). Thus, phenomenology is able to reconcile Plato's and Aristotle's doctrines, containing also that later particular reconciliation proved by Gödel (1930) as to mathematics though it was thought by him in a rather Cartesian pattern.

Moreover, Husserl's decision is more general, furthermore for involving the finiteness of arithmetic in a consistent way, including even the Gödel dichotomy (1931) of incompleteness versus contradiction, since the "eidetic" (identifiable with "phenomenological") tuple of statements is inherently finite thus obeying arithmetic, nonetheless representing a potentially or actually infinite set of real objects as a class of equivalence, then identifying that tuple or class as a whole as a term for propositional logic therefore being able easily to explain its "epoché to reality". Indeed, any class of equivalence also transformed into a logical term is a relation of a finite tuple of statements (grantable to be an "eidos" or "idea") to a potentially or actually infinite real entity (i.e., "thing" or "object"). The conclusion might be that phenomenology is implicit ontomathematics non-articulated as such and, unfortunately, unreferred to mathematics, physics and science for its unarticulated method, a crucial deficiency (at least, as to the viewpoint advocated in the present study).

Then, which is his disciple Heidegger's contribution or "contribution" to phenomenology by "fundamental ontology" in "Sein und Zeit"? On the one hand, that is only a "contribution", or in Husserl's proper word, a "naturalization" of phenomenology. For example, one might try to describe "phenomenological (or transcendental) psychology" in terms of natural psychology, fortunately or unfortunately, understandable or misunderstandable as to art people in particular. Nonetheless, it is a real contribution, on the other hand, and especially important in the present context allowing for phenomenology by the mediation of fundamental ontology to be linked to physics and empirical science, here is how:

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That is Heidegger's distinction of fundamental ontology versus any regional or "ontic" ontologies, respectively, the being, or the "restored" by him "question of the being", versus the existent which can be also interpreted as the empirical or observable, so important for any natural science as physics. Anyway, Heidegger's proper solution in "Sein und Zeit" about the "problem of the being" is absolutely unusable in physics, tending to be rather a phenomenological and transcendental psychology only expressed in naturalizing, more or less arbitrary terms of usual psychology and human experience. As the title itself demonstrates, Heidegger appealed to some time relevant to the being unlike the standard time of physics, which is rather only "ontic".

Of course, the intended here reading of Heidegger's fundamental ontology would understand it as ontomathematics therefore deepening further the "destruction" or "dialectics of origin" as to philosophy from the pre-Socratics, for example Heraclitus, to Pythagoras and his school therefore absolutely removing Heidegger's proper realization as a kind of phenomenological transcendental psychology as yet "human, too human" and thus remaining within the framework Socrates's "human problem". By the by, the later "turn" of Heidegger himself to a fundamental "ontology of language" rather is a result to an analogical self-criticism to "Sein und Zeit". The conception of ontomathematics by itself excludes the "human problem" in an obvious and categorical way.

The physical and mathematical reading of Heidegger's "restored" problem of the being instead of that of the human being (as after Socrates) radicalizes it far beyond his own approach. Now, fundamental ontology is "destructed" to be mathematical and then, called "ontomathematics". It is able to generate a class of ontic, physical "regional ontologies", each of which is empirical and observable, thus one might say that all of them obeying Mach's principle in his original formulation requiring for science to restrict or even thoroughly to remove all pure, abstract constructs not referring directly to empirical facts, which, in particular, would be rather too limited the application of mathematics in physics. Consequently, one can conclude that Mach's proper intention radicalized Cartesianism thus being just opposite to here sketched "ontomathematics" to which Einstein himself endeavored in a naïve or unarticulated way, in turn rejected by Mach, too orthodoxic in his "empiriocriticism".

Anyway, Einstein's affinity to locality can be also understood as "Mach's principle" though generalized on the pathway to ontomathematics, but contradicting that nonlocality inherent for quantum mechanics, quite unacceptable as to him, which is obvious, for example, by his sardonic and pejorative phrase about "spooky actions at a distance". Also "Mach's principle", as it was formulated to general relativity (Einstein 1918), stating that only mass and energy are possible sources of gravitation, is within the same restriction of physics within locality though admitting pure mathematical concepts (however, inadmissible according to Mach's original principle) for the theoretical description of reality granted to be inherently local at least as to physics.

Just that more general understanding of empirical and experimental experience in natural science (especially physics) as locality after Einstein will be now utilized to be newly interpreted Heidegger's concept of "regional ontology" as the definition of the class of all regional ontologies to be local unlike the reinterpreted nonlocally (even in a physical sense) "fundamental ontology" being proper mathematical in the final analysis and thus, "ontomathematics". Then, physics (by means of special and general relativity) suggests a consistent, theoretical, and

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quantitative description of locality at all (sometimes called in philosophy "finitude"), i.e., the class of all regional ontologies, which is anyway discernibly distinguishable from "fundamental ontology" though they might be additionally postulated to be equivalent just the foundations of mathematics equate propositional logic as the single zero-order logic and set theory as the class of all first-order logics (for example, in that sense proved by Gödel in 1930).

So, the identification of locality and nonlocality in both physics and mathematics, on the one hand, with the pair of regional ontologies versus fundamental ontology, but not in the narrow and proper sense of Heidegger in "Sein und Zeit", on the other hand, allows for the interpretation of gravitation as a fundamental and creational "ontomathematical force" and thus, mathematical as well in particular[5]. "Time" after Heidegger should be related to the "ontological being" as a kind of a transcendental and psychological flow rather than to the ontic existence featured by the proper physical time. However, that "time" as a flow corresponding to the being cannot be defined at all in the suggested above much looser interpretation of Heidegger's "Zeit". So, the original transcendental and psychological flow shared by Heidegger's fundamental ontology and Husserl's phenomenology does not exist in the "absolutely liquid medium" of quantum information though now understood as ontomathematical, mathematical, and physical simultaneously and thus linking and even equating the two "shores" of Cartesian "abyss".

Then, and continuing the metaphor, there is "time" only on the one "shore", that of the physical, local, or ontic. As to both "shores" together, one might say that there exist "many times" (or "many universes", or rather many localities) or there does not exist any time as a single and unambiguous time. All of them are in a "quantum superposition" so that "Schrödinger's cat" is "alive" in the "time of the one universe", but "dead" as to the "time of another universe" and both universes can share any transcendental and psychological flow (whether following Husserl's original phenomenology or Heidegger's "naturalizing version" of fundamental ontology) only in a generalized sense, which interpreted mathematically is rather topological rather than metrical.

II TRUTH AS "ALETHEIA": DEEPENING HEIDEGGER'S "DIALECTICS OF THE ORIGIN" AS TO HISTORY OF PHILOSOPHY INTO THE PYTHAGOREANS, OR BACK TO THE HIDDEN BEGINNING OF PHILOSOPHY, "SUNK INTO OBLIVION"

One might say that "Heidegger II's" (i.e., after the "turn") philosophical worldview will be now discussed instead of "Heidegger I's" meant above, though in the same context of ontomathematics. The approach can be briefly concentrated on Heidegger's destruction of the history of philosophy investigating the origin of Western philosophy from Plato and Aristotle[6]

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[5] An idea developed in much more detail in: *Penchev 2023 November 2*.

[6] There exists a series of papers considering Heideger's reinterpretation of both Plato and Aristotle (e.g., Montgomery 2020; Chamberlain 2019; Gonzalez 2019; 2019a; 2018; 2009; 2006; Choi, Dattilo 2017; Lee 2016; Kockelman 2015; McNeill 2015; Adluri, Brogan 2013; Weidenfeld 2011; Jaran 2010; Keane 2010; Phillips 2009; Gonzalez 2008a; McGuirk 2008; Wolff 2008; Duro 2007; Brogan 2005; 1984; Bowler 2008; Hayes 2007; Kirkland 2007; Kress 2006; Chan 2005; Elden 2005; Wrathall 2004; Smith 2003; Baruchello 2001; Elliott 2000; Glazebrook 2000; Hanley 1999; McNeill 1999; Snyder 1997; Warnek 1997; Protevi 1994; Baur 1992; Bernasconi 1990; Makkreel 1990; Eiland 1989; Fóti 1985; Walz 1981; Sheehan 1977; Farrell 1975: White 1974; Richardson 1963).

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back to the pre-Socratics[7] in a sense similar to Hegel's reference of dialectics to Heraclitus's doctrine. The context of ontomathematics is what presupposes its deepening even further, to Pythagoras and its school, who lived in that epoch involved philosophy in human cognition.

In fact, there was no reason and there is no reason in the destruction itself into the origin of philosophy to stop its movement back, namely before the Pythagoreans: at the pre-Socratics or at Heraclitus in particular. Anyway, there exist causes, and they can thoroughly be interpreted by the huge influence of Socrates's "human problem" and thus by the mediation of all the tradition of Western philosophy especially in Modernity and its main question inherited by Cartesian dualism about "which the primary is" if one endeavors to monism. Indeed, humankind is effectively predefined by the Cartesian abyss as the only *arbiter* able to decide about the relation of entities situated on both shores such as Plato's "things" versus "ideas", Descartes's "body" versus "mind", or those "object" versus "subject" of German classical philosophy: thus being God's "vicar" on earth, and particularly deciding about the accordance of any theory, mathematical model, first-order logic, etc. to reality itself, ostensibly only being described or mirrorlike reflected in human cognition.

A preliminary note is that today's philosophy is rather a humanitarian science (for example classified among "Art and Humanity" rather in "Sciences" meaning mathematics, physics, chemistry, etc., first of all). In other words, philosophy nowadays has been more and more understood as some fiction invented by human imagination than reality by itself once they had been reliably divided by the Cartesian abyss in Modernity. So, no philosophical doctrine whether ancient, modern, or contemporary might influence any proper scientific theory more or less contradicting common sense's experience obeying the traditional and everyday prejudice permanently discredited as superstitions due to human ignorance. For example, philosophers-scientists such as Einstein, Bohr, etc. had been gradually replaced by the new *calculating* generation of physicists, after that famous "Shat up!" (sometimes rightly or wrongly attributed to Richard Feynman) rather than philosophizing as the former ones did.

The emancipation of science from religion continued further as *an emancipation from philosophy* heralded by Wittgenstein and Popper to be "metaphysics" in a bad sense, or dealing with meaningless "language-games" for what "one should be rather silent" following the famous concise seventh aphorism of "Tractatus Logico-Philosophicus", in fact and unexpectedly also recommending an analogical "Shut up!" like the same in the famous phrase ascribed to Feynman, himself belonging to the next generation of physicists after Einstein and Bohr. If one distinguishes philosophy from sciences as a doctrine or theory for the "forest" instead of those proper scientific theories for separate "trees", though quite various and different from each other, that famous "Shut up!" refers to the "forest" so that any suggestions about it should be enumerated among "Art and Humanity" as a "loose play of imagination" only disturbing and preventing the "serious" scientific study of different "trees" if philosophy, being inherently "metaphysics", were admitted.

Then, one can notice, that "Shut up!" in relation to philosophy has originated since the 20th century and its intellectual "milieu", being quite fremd and frustrated to the period of establishing modern science in the 17th century by scientists such as Descartes, Leibniz, Newton

[7] For example, Hackett 2013; Schürch 2007; Iyer 2005; Bambach 2003; Most 2002; Spanos 2001; Frings 1990; 1990a; Goff 1972; Vick 1971.

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who were not less philosophers or even theologians than mathematician, physicists, and scientists.

If Heidegger's "fundamental ontology", on the one hand, or Husserl's "philosophical and phenomenological psychology", on the other hand, are reflected from the viewpoint sketched just above, they might be understood also as attempts to be restored the ancient idea about the unity of humankind and reality, to which philosophy were related or referred in definition after its invention by the Pythagoreans more than two millennia ago. The corresponding "existentialism", though rejected by Heidegger himself as a misunderstanding of his doctrine, only interpreted too literally the unity at issue after the prejudice of humanity for the superiority of humankind, philosophically reflected as the "Self" by Modernity, often briefly notated as "humanism", at least in Heidegger's famous essay "on it"[8]. Indeed, and also by himself, "humanism" originated from Socrates's turn to the "man", rather pejoratively transformed into "Das Man" by Heidegger. Nonetheless, he, after his own turn, estimated "Sein und Zeit"'s "fundamental ontology" as "human, too human" thus inherently linked to the ancient problem involved in philosophy by Socrates and therefore rewriting the preceding philosophy of all pre-Socratics including the school of Pythagoras, presumably invented the word of "philosophy".

Anyway, he stopped at the pre-Socratics' "Logos" though reinterpreted "by destructing to the origin" rather phenomenologically, i.e., as an initial medium accessible by a kind of "philosophical and historical epoche" to Socrates's "human problem" and then, by a return back into the age before it to have appeared. One can continue the same return to the dawn of Philosophy at Pythagoras and his school, i.e., to their "Numbers", though partly desacralized, but a new kind of philosophically and theological "epoche", after (or historically, "before") the distinction of philosophy and theology might be ignored.

One might say that "Logos" or Heidegger's "Language" are also and already "too human", pregnant with that human problem, from which philosophy would be to be emancipated to become a "strenge Wissenshaft" though in a manner rather of Heidegger than of Husserl: by a destruction[9] to its origin, now continued to Pythagoras and his school. Indeed, those ancient "Numbers" should be generalized to "mathematical structures", at that not only arithmetical, but furthermore logical and set-theoretical, according to all the development of mathematics for more than two millennia, but staring at their unity, which will be the proper subject of investigation in *Section V*.

[8] Heidegger 1947; also: Rae 2014; 2010; Stolorow 2010; Soffer 1996; Soffer 1996;.

[9] Heidegger's "destruction" in both history of philosophy and philosophy of history (unifiable in a Hegegian manner, inherent also for Heidegger in an opposite "dialectics of origin") is discussed, for example, in: George 2015; Gonzalez 2008; Jollivet 2004; Fóti 1989; Dastur 1987; Henning 1982; Ijsseling 1982; Sheehan 1981; Lawler 1975.

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Heidegger's heredity will be used by still two of his concepts, "Aletheia"[10] and "Dasein"[11], however interpreting in a way allowing for them to be utilized as tools for the intended unification of mathematics, physics, and philosophy, maybe more or less speculatively restoring the alleged approach of the Pythagorean school into the absolutely contemporary idea of "quantum neo-Pythagoreanism" resulting further into "ontomathematics". So, "Aletheia", that famous and mysterious "coming from hiddeness into unhiddeness", intended to overcome the understanding of truth as an adequation originating from Aristotle or maybe still since Plato, now will be additionally interpreted both physically and mathematically: correspondingly, as "coming from locality into nonlocality" as well as "coming from both set theory and classical propositional logic into arithmetic".

Here, one can notice that the latter, proper mathematical interpretation riches up Heidegger's original concept of "Aletheia" by a kind of intentionality (or phenomenologically understood transcendentality) or by that of a direction converse (reverse) to that of transcendence. Indeed, one might question after Heidegger's "coming into unhiddeness" about the meaning or sense of an eventual and polar "returning into hiddenness" as well as about the symmetry of those "coming" and "returning". Abstractly, one might admit for them to be *absolutely symmetric*.

However, Gödel's dichotomy about the relation of arithmetic to set theory, "either incompleteness or contradiction", can be now generalized as an *asymmetr*y inherent for truth once it is already Heidegger's "Aletheia". Truth and reality cannot be any more thoroughly symmetric in a Platonic manner, but linked by a dichotomy analogical to the original one of Gödel: the relation of truth and reality is already initially featured by the complementarity of the incompleteness of truth to reality, on the one hand, or alternatively, their contradiction, on the other hand, in fact, meant by Hegel developing his philosophical dialectical logic for reality, ontologically understood as dialectics. As to the former option of incompleteness of truth to reality, it has be meant since Descartes's age in Western modern philosophy, and much more strictly in scientific methodology, since any theory claiming to be scientific (rather than metaphysical after Popper) is necessarily incomplete to reality thus allowing for its rejection further, for the subsequent scientific progress in the future.

Consequently, one can reveal the Gödel dichotomy, once it has been already generalized to Heidegger's "Aletheia", in the relation of philosophy of science (penetrated by scientific methodology and thus on the "shore" of the incompleteness of truth to reality) to proper metaphysics (e.g. the Hegelian or Marxist dialectics) as a Cartesian "abyss", on the one hand, but

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[10] There exist many enough papers about Heideger's "Aletheia" (e.g., Bennett 2018; Zuidervaart 2017; Orr 2014; Cummings 2013; McManus 2013; Dahlstrom 2012; 2001; Mackinlay 2010; Gonzalez 2008a; McGuirk 2008; Bonic 2005; Malpas 2004; Wrathall 2004; 2002; 1999; McGrath 2003; Overgaard 2002; Zuidervaart 2002; Graham 2000; Wrathall, Sugden 1999; Olafson 1998; Sikka 1998; Brognan 1997; 1990; Morris 1997; Tietz 1993; Harrison 1991; Caputo 1988; Cheng 1987; Ambrosio 1986; Dostal 1985; Fóti 1983; Okrent 1981; Wilshire 1977; Philippoussis 1976; Farrell 1975; White 1974; Hamrick 1971; Morrison 1969; Farber 1958; Turnbull 1957).

[11] Heidegger's "Dasein" is also widely discussed (e.g., Gelley 2017; McManus 2017; Jesuha 2016; Sturgess 2016; Stroh 2015; Zuckerman 2015; Moran 2014; Jaran 2010a; Ciocan 2008; Hayes 2007; Schmid 2004; Beistegui 2003; Salem-Wiseman 2003; Cerbone 2000; Mills 1997; Schüssler 1989; Hass 1988).

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on the other hand and not less relevantly, as that famous "Shut up and calculate!" ascribed to Richard Feynman or as "Sokal's hoax", both being preceded by the not less famous seventh aphorism of Wittgenstein's "Tractatus Logico-Philosophicus" or even by Kant's critique accomplished a Copernican revolution in philosophy in his opinion, versus philosophy as metaphysics endeavoring to "reality by itself".

In particular, the asymmetry of truth to reality in relation to Heidegger's "Aletheia" belongs to the same class of dichotomy, observed mathematically by Gödel, but known in philosophy a long time ago, at least since Kant's age. However, our "pain" is now its proper physical interpretation, namely that "coming from nonlocality into locality" in a way which tends to overcome Mach's principle in both interpretations of Einstein (1918) and Mach himself (1896).

So, a preliminary notice about "Mach's principle" is necessary. "Mach himself's principle" formulated for example in his popular lectures (1896) corresponded to his philosophical doctrine called "empiriocriticism" and meant a much more rigorous restriction of all theoretical concepts, especially scientific ones, to empirical or experimental experience in order to be avoided the transformation of science (or theoretical cognition) into a speculative doctrine relying on a new "scientific belief" belonging to the "new Church of science" rather than on really observable phenomena and facts. In other words, the original principle of Mach was directed against those too far going scientific and theoretical abstractions, which could be hardly inferred from human empirical or experimental experience. In particular, Mach reckoned even special and general relativity, though Einstein had proclaimed himself his disciple, for suffering from the same "vice" threatening to transform science into a "new Church".

As to Einstein's "Mach's principle", it was introduced in his paper (1918) to justify the additional member of the "cosmological constant" in the equation known nowadays as the Einstein field equation. It states that the only sources of gravitation are mass and energy. The connection to Mach's original principle seems to be too loose and unclear. In fact, it is really a corollary from the latter if one admits the reinterpretation of human experience as the necessary condition of locality in science and in physics in particular as well as that the postulate of not exceeding the speed of light in a vacuum should be now understood as the physically formulated axiom of locality as if directly originating from Mach's original principle at least in Einstein's opinion regardless of Mach's resistance to that too loose and maybe contradicting reinterpretation. One might say more or less figuratively, that Einstein's "Mach' principle" suffered just from that "vice", against which Mach sought to protect physics and science, by formulating his restricting principle and which can explain why Mach refuted their link alleged by Einstein.

One might complement "in brackets" that even Einstein's too loose formulation of "Mach's principle", though rejected by Mach himself, was unacceptable for quantum mechanics as rather binding. The discrete quantum leaps happening instantly could not obey the postulate of not exceeding the speed of light in a vacuum, however fundamental for special and general relativity. That contradiction between relativity and quantum mechanics was expressly articulated in the "triple article" of Einstein, Podolsky, and Rosen (1935), famous enough (not to be represented in detail) and usually cited as the "beginning of quantum information", but in a rather paradoxical sense claiming the "incompleteness of quantum mechanics", unlike quantum

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mechanics itself (advocated by Bohr, for example) stating its own completeness and thus, the necessary equivalence of quantum mechanics and quantum information.

The present context allows for that inherent nonlocality of quantum mechanics only articulated by the triple article or by quantum information nowadays to be immediately linked not only to the Gödel dichotomy in the foundations of mathematics already made in other papers (Penchev 2022 October 21), but also to Heidegger's "Aletheia" and the inherent incompleteness of truth to reality known in philosophy at least since Kant's age.

Indeed, the three authors suggested that quantum mechanics is incomplete but their hidden and thus inarticulate premise was that relativity was complete, for example, following Einstein's "Mach's principle" in his own understanding to be a direct corollary from Mach's original principle. In other words, quantum mechanics is really incomplete if the latter is granted, i.e., if one has in advance accepted that human experience is complete (as Mach's original principle might be paraphrased) and that this implies locality for physics inherently (e.g., as in Einstein's "Mach's Principle").

However, if one has in advance granted the opposite proposition, namely, that quantum mechanics is complete, for example, provable mathematically as in the theorems about the absence of hidden variables in quantum mechanics (Kochen, Specker 1967; Neumann 1932), theories of relativity turn out to be incomplete. Consequently, the completeness of relativity and completeness of quantum mechanics are complementary to each other: the completeness of either of both implies the incompleteness of the other one (and as well as vice versa).

Then, one might apply that observation to the relation of truth and reality (or particularly to Heidegger's "Aletheia"), immediately noticing that one can admit the completeness of either of both, but this implies the incompleteness of the other one. Both cannot be simultaneously complete, their completeness is complementary to each other, but nonetheless one is free to choose either of them as the starting point just as the experimenters in quantum mechanics cannot measure simultaneously conjugate quantities, but nevertheless they are free to choose either of any pair of conjugated to be measured.

However, the nonlocality of quantum mechanics interpreted as its incompleteness in the triple article at issue allows for any conjugated pair to be simultaneously measured. Thus, one needs locality (after Einstein, or respectively, empiricism after Mach himself) to be considered as a third and independent member of the relation of truth and reality as it is discussed above. This means that truth and reality (or more precisely, the completeness of either of both) are complementary to each other only under the necessary condition for empiricism (locality) to be granted in advance. On the contrary, they can be directly identified if locality (empiricism) has been abandoned: what is the option realized by ontomathematics, and rather unexpectedly, by theology as well[12], therefore explaining, for example, why the Pythagoreans sacralized the Numbers.

In fact, Heidegger's "Aletheia" means rather that identification of truth and reality at the cost of non-empiricism though it was above in the text interpreted one-foldingly: ostensibly as an alleged incompleteness of truth to reality. However, this was only a rhetorical skill, reception for inferring empiricism as a necessary condition. In fact, overcoming the "human problem" results

[12] That is not a proper subject of the present study, but more details will be mentioned further, according to the corresponding context.

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in the overcoming of empiricism, including in science and thus in physics. In other words, that "coming into unhiddeness" does not identify unhiddeness and locality (empiricism). This is only a prejudice (though quite inherent for modern science), at all not shared by Heidegger: on the contrary, he refuted it in many of his papers[13].

Furthermore, one can notice that still Kant's "Copernican revolution", from metaphysics to transcendentalism, meant an analogical overcoming of the same prejudice. Just the concept of transcendentality was what prevented the incompleteness of all "phenomena for us" to transcend reality by itself since they are transcendental, and transcendentality is not empirical. Thus, ontomathematics can be quite relevantly to be interpreted as a doctrine in the framework of transcendentalism not less than in that of phenomenology (whether Huserl's or Heidegger's).

The specific feature of the concept of ontomathematics consists in the understanding that both transcendentalism and phenomenology can be revealed in mathematics, especially in its foundations where they are elaborated in detail, rigorously and consistently, thus avoiding that usual ambiguity and vagueness of the philosophical doctrines (the overcoming of which was heralded by Husserl as a purpose in his "Philosophie als strenge Wissenschaft"). Furthermore, it allows for physics to be included into mathematics therefore unifying both with philosophy rather than only to each other.

In particular, that ontomathematical understanding of mathematics contributes to itself and to the resolution of its most fundamental problems (e.g., Penchev 2023 July 16). The present context allows for another or generalized elucidation of the Gödel dichotomy including an analogical one of set theory to arithmetic. Indeed, it sounds to be rather unexpected, paradoxical and even "false": set theory is either incomplete or contradictory to arithmetic not less than vice versa; thus, it needs an additional explanation.

Indeed, set theory is also incomplete to arithmetic once the Gödel dichotomy is interpreted to be a relation as above rather than a property only of arithmetic to set theory as his original paper (1931) meant. One can utilize Hilbert arithmetic in a wide sense for visualizing the meaning of that ostensibly paradoxical statement. Then, any unit of Hilbert arithmetic in a narrow sense corresponds to a qubit in Hilbert arithmetic in a wide sense, which in turn symbolizes or notates the actual infinity of set theory admitting a hierarchy of infinities, i.e., an arithmetic sequence of "alefs" so that any infinity of any "alef" allows for a next one therefore being incomplete to it. Analogically, any qubit of the qubit Hilbert space implies its successor by virtue of the "function successor" postulated by Peano arithmetic. The incompleteness of set theory to arithmetic in the sense sketched just above should be distinguished from the existence of inaccessible cardinal numbers meaning rather again the Gödel incompleteness of arithmetic to set theory though in the immediately next level, i.e. metalevel.

Considering the twofold relativity of "Aletheia", though also a concept introduced in "Sein und Zeit", one can penetrate into the one-sidedness of "Dasein". It means empiricism, or locality in the rigorous meaning of physics since special relativity, but not vice versa: and unlike "Aletheia". Rather loosely, one might say that the "existential" of Dasein admits the converse "Zeit und Sein", the initially intended, but never written second part, however "Aletheia" does not. So, "Zeit und Sein" was canceled by Heidegger's "Turn". "Zeit" correlates only with

[13] For example, *Heidegger 1938*.

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“Dasein”, but not with Sein[14]. Translated into the language of physics, this means that time (and thus energy, respectively mass) is only local. Nonetheless, they allow for the nonlocal physical action or quantum information to be depicted on their “screen” as gravitation: a representation being the proper subject of general relativity at least in an interpretation (Penchev 2023 November 2).

III DECONSTRUCTING AFTER DESTRUCTION: A NEW READING OF PYTHAGORAS, PLATO, ARISTOTLE AND THEIR INTERRELATIONS, OR ONTOMATHEMATICS FOR ONTOLOGY

Once Heidegger's destruction into the origin of philosophy is radicalized as above, i.e., returning still back, to the Pythagoreans and their “Numbers”, both sacral and philosophical in a syncretic, indistinguishable way, one can further reconstruct (or “deconstruct”, from a viewpoint belonging rather to Derrida), Plato, Aristotle, their interrelation and Socrates’s “human problem” in the final analysis otherwise and quite differently from the usual and standard realization of them.

A preliminary notice is necessary. Aristotle’s ontological revolution in philosophy (or revision to Plato) canceled Socrates’s human problem, in fact, rather than only Plato’s dichotomy of “things” and “ideas”. One might say that the choice in that dichotomy embodies the abstract “choice at all” inherently, but implicitly meant in the human problem: the human being can be defined philosophically as that being making choices. Or said otherwise, no choice: no “human problem”. So, Aristotle, erasing (by logic and philosophy as ontology) any choice “either things or ideas”, removed the “human problem”, as well. Logic, mathematics, and philosophy as ontology do not need the “human being”. However, natural science in Modernity restored the human being as the necessary arbiter of scientific hypotheses about whether they would correspond to reality or not. The Cartesian abyss between “mind” and “body” needed the human beings just because they could unify them and therefore, decide any conflict between them. So, modern science studying nature by itself returned from Aristotle back to Plato and thus it restored the “human problem”. However, natural science and physics by quantum mechanics reached those boundaries of knowledge, beyond which the human being turned out to be an “obstacle”, even the main obstacle for the further development of cognition. All the paradoxes of quantum mechanics can be reduced to the necessity for the human being to be removed somehow from the process of scientific research though being absolutely necessary for classical science and physics in particular.

The last statement seems to be somehow paradoxical since quantum mechanics is often blamed to be too “subjective”, depending on the “observer” or at least on the “experimenter's apparatus”, and thus abandoning the standard objectivity of classical physics and science. So, its alleged and seeming subjectivism needs some relevant explanation since the just opposite proposition is articulated in the previous paragraph: quantum mechanics overcomes (and even alone until now) the inherent subjectivity due to the Cartesian abyss joinable by the human being as the only possible arbiter (excluding God himself):

[14] Nonetheless, one might suggest a generalization of “Zeit” able to correlate symmetrically to “Sein”, but following rather Husserl than Heidegger, in much more detail in Section VIII.

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The reason for that objection to it consists in the inherently probabilistic predictions of quantum mechanics transformed only after experiments into absolutely exactly measured values of the quantities at issue: however, always accompanied by a kind of "uncertainty conservation" in virtue of which their corresponding conjugate counterparts "become" absolutely vague, uncertain. The former exact determination seems (but only seemingly) to require the human experimenter's participation unlike the case of classical science where the value of the quantity is granted to have existed in advance as if "by itself" ("an sich" after Kant's concept). So, if the existence would be identified with absolutely certain values, the experimenter (or even the observer) is who has created reality therefore ostensibly confirming or resurrecting Bishop George Berkeley's doctrine. That is the way for quantum mechanics to be groundlessly accused of subjectivism or irrationalism.

One might easily trace back that a few ostensibly obvious premises are borrowed from the pattern of classical science and physics and the corresponding scientific "common sense" for quantum mechanics to be blamed. In fact, quantum mechanics contradicts and breaks those narrow-minded principles of classical objectivity and rationality therefore calling for a conservative generalization beyond them. One can notice that the "observer's creation of quantum reality" in Berkeley's manner is thoroughly concentrated only onto locality (technically onto the one single quantity prepared to be measured of the pair of both conjugates) since that is the prejudice (even inarticulable and thus invisible and secretly acting) of classical objectivity and rationality. On the contrary, the newly introduced quantum objectivity and rationality need both members of the pair of conjugate quantities to be considered "simultaneously" regardless of their complementarity:

Then, one observes two opposite motions quantitatively following Heisenberg's uncertainty: the one "comes into the unhiddennes of both locality and complete certainty" while its complementary counterpart "goes out into the darkness and absolute hiddenness of both nonlocality and perfect uncertainty". Bohr's reference to Yin and Yang is quite relevant and reasonable. All classical science and physics since "Enlightenment" (which can be now reinterpreted by the neologism of "en-Yangenment") is concentrated only onto Yang so that Yin is thoroughly hidden, but nonetheless acting as Berkeley's subject able to create reality:

Once, the spectacles of that "en-Yangenment" have been put off, the seeming subjectivism and irrationality of quantum mechanics vanishes in thin air just as Berkeley's subject does properly substituted by Yin being the natural twin of Yang therefore hinting at still one metaphor and neologism of "en-Yinenment" (or "Endarkenment" after "dark matter" and "dark energy") caused by quantum mechanics. Particularly, the Socratic human problematics follows after Berkeley's "subject", therefore "erased on the beach sand" by the tide of Michel Foucault's "ocean".

As that is well known, the cited above article of Einstein, Podolsky, and Rosen had been intended for demonstrating that both conjugate quantities whatever they be can be "simultaneously" measured though by two experiments remote from each other in two space positions rather than only for proving the alleged incompleteness of quantum mechanics heralded literally and immediately. So, it can be also interpreted as a counter-argument versus the generalized objectivity and rationality of quantum mechanics claimed above and requiring both locality and nonlocality unlike the classical ones restricted to the former and intended to be

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rehabilitated by Einstein, Podolsky, and Rosen also in relation to the challenge of quantum mechanics.

Still Niels Bohr (1935) in his answer to the triple article paid attention to the inherent nonlocality of their Gedankenexperiment since if one would try to send the remote result by light signals according to Einstein's special relativity, they would be received after a finite interval by the other experimenter when the former results of the other conjugate quantity would be absolutely irrelevant. In other words, the former quantity would be again absolutely uncertain in the exact moment when the result of the measurement of the latter conjugate quantity is received by the former experimenter. However, the three authors had meant that objection, just for which they claimed incompleteness rather than that quantum mechanics is wrong.

Indeed, there exists a quite reasonable tenet, valid also nowadays, for *classical* quantum mechanics (i.e., without quantum information) to be incomplete even only by virtue of the above main argument of the three authors' paper. In fact, it admits the viewpoint of nonlocality claimed by quantum mechanics, once instantaneous, for a "zero time" quantum leaps have been recognized, therefore implicitly rejecting the postulate of non-exceeding the velocity of light in a vacuum regardless of whether it underlies both special and general relativity. However, that statement (though seeming absurd to Einstein who coined the pejorative and sardonic metaphor of "spooky actions at a distance") is not the starting point of a proof "reductio ad absurdum" which would state that quantum mechanics is absolutely false. Not at all: what the paper demonstrates mathematically and rigorously, though thus only theoretically, is the necessary existence of an extraordinary class of phenomena (now notated as "entanglement"). They were not observed experimentally in Einstein's age. So, he could quite reasonably admit that their absence joint to their existence proved to be necessarily implied by quantum mechanics can be included in a practical tenet against quantum mechanics once unobservable phenomena could be deduced from it.

Meaning that consideration, one may stare at the thought experiment suggested in the paper allowing for physical action to be inherently nonlocal. Then, two conjugate quantities, for example, both position and impetus, are simultaneously determined by virtue of nonlocality granted in advance so that the quantity of action as their product is also absolutely exactly certain in turn.

Then, the alleged incompleteness of quantum mechanics should be reduced to the fact that *classical* quantum mechanics did not mean the physical quantity conjugate to action. In fact, it should be physically dimensionless since its product after multiplying by action has necessarily the physical dimension of action once again. Nowadays and also thanks to the triple article articulating the problem just sketched, classical quantum mechanics is complemented by (the theory of entanglement and) quantum information (usually briefly notated as only "quantum information", and nonclassical quantum mechanics as "quantum mechanics and information"). The answer of the formulated particular question is: quantum information itself, really being physically dimensionless (indeed, any wave function is physically dimensionless), is the conjugate counterpart of action obviously being physically dimensionful just as action (or as the Planck constant as well).

Well, if the action after the three authors' thought experiment is absolutely unambiguously determined, its conjugate quantity of quantum information is, accordingly,

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absolutely uncertain. One might easily trace back that uncertainty in the definition of the thought experiment itself. Indeed, each of both entangled quantum entities in it determines a separable complex Hilbert space by the vector which its wave function represents, and quite different from the twin space defined by the wave function of the other entity. So, one may involve Heisenberg's uncertainty to the conjugate pair of action and quantum information. Since action is absolutely determined under the conditions of the thought experiment, correspondingly, quantum information, respectively, the wave function of the joint quantum system of both is absolutely uncertain therefore being able to be any point of the separable complex Hilbert space. Classical quantum mechanics is really incomplete once it has ignored quantum information, including by virtue of its restriction only to Hermitian operators and thus to unitarity and energy conservation. Indeed, the class of entanglement can be exhaustively described by all non-Hermitian operators, furthermore being inherently non-unitary and therefore violating energy conservation.

Any violation seems to be "scandalous": so, it needs a justification in detail, even more so that it implies not less scandalous "creatio ex nihilo", the subject of the next section. One may distinguish two main cases of those violations: (1) within the locality determined by a certain observer, thus energy and time, momentum and distance or both conjugate members of any pair of that kind are individualized; (2) beyond any locality so that only quantum information and physical action might be individualized rather than the standard set of cinematic or dynamic quantities meant implicitly by physics to be universal but quite groundlessly.

Classical quantum mechanics considers only the former case, in which energy conservation, Pauli's particle paradigm, Hermitianity or unitarity are valid and universalized to be absolutely valid for physics and reality at all. Nonclassical quantum mechanics (also called the "theory of quantum information") means both cases, therefore conservatively generalizing the former. However, a special term is wishful only for the latter case also in an "epoché" to whether the former or the latter case is what is meant.

It will be "information mechanics", after which the only admitted physical quantity is that of action, and the subject is its correspondence to information (i.e. both classical and quantum), on the hand, or the mutual transformation of the physical quantities of dynamics, e.g. energy, momentum, time, distance, etc,, being absolutely prohibited in the framework of classical quantum mechanics. In other words, information mechanics is intended to investigate the set-theoretical complement of the area in which energy conservation is valid to the much more extended field of quantum information conservation.

One can rather paradoxically notice that the former case of postulated locality is anyway commensurable and consistent with the above defined information mechanics in the domain of general relativity. Indeed, it admits violations of energy conservation due to the curvature of pseudo-Riemannian space (in fact, only globally: since locally, it is reduced to the "flat" Minkowsky space in any not-singulaar point of it). For the curvature at issue, energy has projection on time, momentum, and distance, each of which is described by the corresponding components of the Einstein field equation, therefore admitting in that sense (i.e. by virtue of varying the curvature and thus changing the magnitude of the meant projection) the mutual transformation of the enumerated dynamical quantities, however, being absolutely forbidden by classical quantum mechanics and particularly implying the accessibility of general relativity to it (the so-called "problem of quantum gravitation").

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As to “information mechanics” by itself, energy conservation as well as energy itself or any of almost all dynamical quantities (excluding action) do not make any sense at all. So, one might speak of their mutual transformation rather metaphorically or under the condition of depicting them on the “screen” of some locality, e.g., following Plato's parable of the “cave”. Then, quantum information conservation can be not less interpreted to be action conservation after postulating the Planck constant since the distinction of what is conserved and what is changed therefore constituting a Lie group in the first theorem of Emmy Noether (1918) is conventional, or even more precisely, relative to each other: if either of both quantities is granted to be conserved, the other one necessarily constitutes a Lie group[15].

That rather “physical deviation” in the present section is necessary for outlining the horizon of the intended reconstruction of the ancient history of philosophy since it is not an end in itself, but it would justify the reconstruction at issue as a new interpretation or reading of well known philosophical texts and their famous authors. So, the main distinction of ontomathematics introduced here from ontology originating from Aristotle’s revolution to Plato’s doctrine consists in its complement by their opposition along with that epoché, expressly articulated and especially emphasized by Husserl, in relation to Plato’s distinction of “things” and “ideas”. Its formal structure is that of a bit of information, however contradicting the standard prejudice for a bit of information to be understood as a single opposition, namely that of Plato’s “ideas” versus “things” as to the investigated case.

So, the present paragraph is intended to elucidate that incorrect realization of a bit of information at all, but first of all, to the distinction of ontology to ontomathematics to be the latter made clear. A Turing machine tape cell can illustrate the formal structure of a bit of information notating as usual the two cell state options to be “0” and “1”. The wrong prejudice to be overcome reduces a bit of information to the opposition of “0” versus “1”, respectively, to that of “ideas” versus “things”. In fact, it consists of two oppositions complementary to each other so that only the latter of them is “0” versus “1” (respectively, “things” versus “ideas”), but the preceding it former opposition being implicit and hidden one, is that of an “empty” cell (i.e. before recording either “0” or “1”) versus its state after record (regardless of “0” or “1”). So, ontology after Aristotle means the state after any record, notateted as an “empty cell”, in which whether a “thing” or its “idea” is recorded because a logical proposition is able not to distinguish them from each other.

So, Aristotle’s ontological revolution can be understood to be incomplete since it introduced only the one option of the former preceding, hidden and implicit alternative of the entire formal structure of a bit: namely, that articulated by Husserl more than two millennia later as “epoché” and put in the foundations of his “phenomenology”. Then, ontomathematics is to be introduced as the ultimate perfection of ontology, which needs the “epoché state” to be opposed to the state before it, a kind of “anti-epoché state”, visualizable by the metaphor of the state in “Edem” before the “initial sin” to have been “consumed”. It should not be misunderstood as

[15] By the way, one may continue the same approach to the usual, i.e. local and dynamical interpretation of the theorem at issue since the determination of what is conserved and what is changed is an additional prejudice without any mathematical basis: only too extravagant to our experience, for example a constant time to which energy would constitute a Lie group.

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“nostalgia for paradise lost” since the state of “paradise lost” is merely added to make otology complete to mathematics and then revealed once again in the coherent state before measurement, meant by quantum mechanics. So, ontomathematics only repeat a very hard course of thought, however already accomplished in an experimental (and thus empirical and local) science such as quantum mechanics forced by its own development to start studying nonlocality experimentally as the phenomena of entanglement, therefore rather paradoxically, in terms of locality as probability (density or not) distributions and their direct physical interactions (respectively, those of their characteristic functions, which all quantum “wave functions” are).

One can object the following: though any logical proposition does not distinguish whether its terms are “things” or “ideas”, it is either “false” or “true” determined just after Aristotle’s conception of truth by means of the correspondence of the proposition to reality, by which all propositions should be enumerated among the “ideas”, once one investigates its correspondence to “things” of reality. Furthermore, that kind of “epoché” (whether “things” or “ideas”) refers only to the terms of any proposition, but whether it is “true” or “false” relates to it as a whole.

For overcoming that objection, one needs a certain reinterpretation or reconstruction of Aristotle’s “theory of truth” also known nowadays as the correspondence theory of truth, obviously opposable to Heidegger’s “Aletheia” even only for that the former suggests human cognition establishing the correspondence at issue, but the latter should precede it referring directly to the “being” (regardless of any human and thus, of the “human problem” as well). The necessary reconstruction starts from the observation that only all the true propositions (and unlike all the false propositions) possesses the property featuring their terms not distinguishing “things” and “ideas” since any true proposition coincides with reality and allows for it, understood as an “idea”, not to be distinguished from its corresponding “thing” and thus to serve as a term for some meta-propositions. Reflecting back, the terms themselves of the initial proposition can be understood as potential propositions, but only *true,* and that should be expressly emphasized. So, one may see Aristotle’s “theory of truth” to be inherently ontological, thus similar to Heideger’s “Aletheia” and possibly wrongly understood as a “correspondence theory of truth” only in Modernity and after Descartes’s dualism.

Meaning the consideration in the last paragraph, one is to interpret philosophically the former, preceding, implicit and hidden opposition as that of “true” versus “false” relevant equally well to therms and to the propositions as whole, and the latter, explicit opposition in the formal structure of a bit of information as Plato’s one: that of “things” versus “ideas”, but now, after reconstructing or restoring Aristotle’s original doctrine, both of them can be realized equally well as terms or as propositions. Then, one sees that conception of “ontomathematics” rather to reconstructs or resurrects Aristotle’s original doctrine more or less misunderstood in Modernity.

However, ontomathematics has still one and much more important dimension (at least within the outlined contemporary physical horizon above), which can be called “ontoarithmetic” especially following the ancient Pythagorean tradition and now concentrating onto the reconstruction of Plato’s reading of it, ultimately resulted in his famous dichotomic conception of “things” versus “things” as generalizing the counting of things and then, determining their number as abstract numbers, the proper subject of arithmetic. Indeed, one can extend the correspondence of collections of enumerated things whatever they would be to their number to

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anything therefore suggesting a generalized number called idea for each item in the world. So, the process of counting is "bracketed" and reduced to its ultimate result consisting into a bijection of "things" and "ideas", respectively into a doubling of all things by their complementary counterparts called "ideas". That reconstruction of Plato's doctrine as originating from the Pythagorean "Numbers" can be directly and immediately realized as ontomathematics since now all those "ideas" can be thought as mathematical structures being the corresponding "things by themselves" (as for example after the theorems about the absence of hidden variables in quantum mechanics) rather than more or less adequate models of them, however always divided from the corresponding things by themselves on the opposite "shore" of the Cartesian "abyss".

IV JUMPING INTO TODAY'S TIME: PROS AND CONS "CREATIO EX NIHILO" IN PHYSICS

Ontomathematics allows for that scandalous "creation from nothing" being absolutely forbidden in classical quantum mechanics rather than only in classical physics. Moreover, all the quantum physics was edited and rewritten to fit that prohibition though it is absolute external, fremd and even inconsistent to quantum mechanics by itself therefore restricting it to today's very well known boundaries of "classical quantum mechanics" definable by its obedience to Pauli's particle paradigm, energy conservation, unitarity, "Hermitianity", the Standard model, etc. The pattern of reconstructing the ancient history of philosophy sketched in the previous section needs a particular reconstruction of history of quantum mechanics:

The initial history of quantum mechanics, conventionally until the thurties of the 20th century, was "innocent", yet residing the paradise before the "initial sin of cognition" to have been "consumed" after Neumann's theorem about the absence of hidden variables in quantum mechanics (1932), and even more, after the article of Einstein, Podolsky, and Rosen (1935), though both are only the "tips, the visible part of the iceberg" in the then intellectual milieu bifurcating between two mainstreams of its reflection ended later by the ultimate victory of classical quantum mechanics until the gradual establishment of entanglement and quantum information culminated in their official recognition by the 2022 Nobel Prize in physics. One might mark more or less figuratively that victory of classical quantum mechanics by the worldviews and scientific activity of two famous physicists, Wofgang Pauli and Richard Feynman. However, an elucidation of the triple link between the prohibition of any creation from nothing, classical quantum mechanics, and the establishment of modern science as empirical and experimental (and thus inherently local though implicitly and unarticulated) is preferred in the present study.

Indeed, natural science emancipated from the Church and the ancient scientific tradition by explicitly and expressly referring to observations (eventually by means of specially constructed devices such as Galileo Galilei's telescope[16]) and experiments as the ultimate arbiter

[16] Galilei and his telescope as the symbol of the modern, empirical, observational and experimental science in its relation to Husserl's philosophical viewpoint is discussed in a few papers (e.g. Ihde 2011; Natsoulas 1994; Soffer 1990; Cataldo 1987; Garrison 1986). One might add (maybe rather unexpectedly) a few papers about Heidegger's philosophical concept of "technics" (e.g. Conty 2013; Feenberg 2000) unifiable in the present context.

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for any theories and doctrines. Of course, those of the Church, Aristotelian science or geocentric system relied rather on authority, tradition, common sense and everyday experience. To be overcome, a revolutionary new source of cognition was necessary. Now, about half a millennium later, observations and experiments are absolutely legitime and even crucially prevailing, practically dominating scientific methods.

However today, after the debate about nonlocality in quantum mechanics, one may already articulate that they both are inherently and fundamentally local also in the exact meaning of locality introduced in special relativity (and then extended in general relativity) as not exceeding the speed of light in a vacuum. Of course any observations or experiments obey that postulate therefore being restricted within the light cone of locality, or the "imaginary domain of Minkowski space". So, the empiricism and experimentalism of contemporary natural science implies an implicit "localism" almost as a condition "sine qua non" for scientificity at all, the violation of which by quantum mechanics was sardonically emphasized by Einstein, coining the pejorative metaphor of "spooky actions at a distance" involved by it necessarily.

Then, one can easily trace the thread of that localism for anything claiming to be scientific to energy conservation, thus to the prohibition for "creatio ex nihilo" utilizing the exact definition of locality by the fundamental constant of the speed of light in a vacuum, and to which special or general relativity obey as well. The link is the following: only within any local "light" area, on the one hand, furthermore within the class of all possible local "light" areas (i.e. "reference frames") after special or general relativity, on the other hand, one can determine a well-ordering of all *future* temporal moments to the present (respectively and alternatively, another well-ordering of all *past* temporal moments to the present), and thus the physical quantity of time is unambiguously defined, but now one is to expressly emphasize: only within the local area at issue, or to the class of all possible local areas of the former. In other words, causality, mathematically equivalent to homeomorphism of the former and the latter (which is the physical sense and meaning of Poincaré's conjecture proved by Grigori Perelman), is not violated locally therefore allowing for a Lie group of time to be defined locally in a universal way, in turn implying energy conservation after the first theorem of Emmy Noether's paper (1918).

So, one has traced back how localism implies energy conservation, but rigorously speaking, only within the framework of special relativity. The eventual generalization to general relativity needs the assistance of Noether's second theorem in the same paper since gravitation "curving" differently (in general) Minkowski space in each point of pseudo-Riemannian space therefore parametrizes differently (in general) the Lie group of time and thus breaks its universality as well as energy conservation, anyway in the framework of the Hilbert - Einstein conservation of energy - momentum. In other words, the proper mathematical parametrization of the Lie group of time implying physically the violation of energy conservation can be also interpreted physically as the direct mutual transformation of time and energy being non-orthogonal to each other in general due to the curvature of pseudo-Riemannian space or to gravitation in the final analysis: the parameter can be linked to the nonzero scalar product of energy and time and thus physically interpreted. Then, one can complement the initial conclusion that localism implies energy conservation only under the condition of zero gravitation, or said

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otherwise, energy conservation implies localism but not vice versa since general relativity, though it violates energy conservation, remains absolutely local.

Now, one can trace back the link of localism and energy conservation also in quantum mechanics. Any quantum entity by itself (or "before measurement"), being in some coherent state, is nonlocal, however its measurement transforms it into a certain local image of it, but necessarily in a probabilistic way so that that its coherent nonlocal state is exhaustively represented by the probability (density or not) distribution of all possible local images of it (respectively, all possible measurements of it "by itself").

Then, if one has granted in advance Pauli's particle paradigm, thus energy conservation and unitarity, quantum mechanics is stronger restricted than by the initial "Copenhagen agnosticism". The former excludes in definition any violations of energy conservation in quantum mechanics and unlike the former, which preferred an agnostic position or an epoché to the problem whether energy conservation is or is not violated in quantum mechanics. Unfortunately, it is not violated after the radiation meant by the "BKS theory", which allowed for Pauli to impose his radically local viewpoint to all quantum phenomena. Nonetheless, energy conservation is not valid in another huge class of quantum phenomena, those of entanglement being inherently nonlocal.

So, one can immediately notice that there exist two huge classes of phenomena studied correspondingly by general relativity and quantum information violating energy conservation, each by itself, therefore hunting at the possible conjecture that those two fundamental theories are somehow linkable though being yet unknown how. Obviously, that eventual bridge between them would be a solution of the grandiose problem of quantum gravitation suddenly and unexpectedly explaining why all efforts of great physicists for about a century have been in vain. The quantum gravitation solution at issue is inconsistent with the Standard model originating from Pauli's particle paradigm and thus obeying energy conservation, unitarity and restricting only within Hermitian operators. The phenomena of entanglement violate all the three enumerated conditions. Thus, the theory of quantum information as far as it should study them has been limited to be an applied and rather technical discipline in order to "shut up and calculate" rather than it to discuss and think of the unavoidable fundamental corollaries once entanglement and quantum information are real. Particularly, that discussion would immediately wave the "Holy Faith" in the "Big Bang" due to allowing for the heretic "creation from nothing": on the contrary, being advocated by the present paper since "ontomathematics" implies it.

Then, after putting off the spectacles of Pauli's particle paradigm, quantum information understood fundamentally can be immediately identified with the cherished "quantum gravitation" though rather surprisingly: namely as the reverse Fourier counterpart of it, i.e., after applying reverse Fourier transform to it; as well as vice versa: if one transforms Einstein's gravitation (according to general relativity) "Fourierly", the result is to be the non-unitary, non-Hermitian theory of quantum-information "field" (which cannot be "quantum field" in a proper sense, though), the subject of which are all the phenomena of entanglement. Thus, the alleged link of quantum information and quantum gravitation turns out to be maximally close: they are the same as long two Fourier counterparts are the same, only represented in two alternate ways, furthermore being complementary in the exact meaning of quantum mechanics.

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Einstein's gravitation describes the same in spacetime, and thus locally what quantum information means to be beyond spacetime, consequently nonlocal.

Anyway, that "beyond spacetime" is rather figuratively or metaphorically said, vague, not clear enough and needing to be additionally elucidated. Quantum information suggests "leaplike" changes of probability (density or not) distributions, which might be called generalized "motions" in relation to usual mechanical ones as far the latter are both temporal and spatial processes. Thus, the physical quantity of action is immediately assigned to those generalized motions by virtue of the Planck constant, however neither space-time nor energy-momentum might be defined unambiguously and unlike any usual mechanical motion studied whether by classical mechanics, special or general relativity, or even by classical quantum mechanics.

Nonetheless, general relativity manages consistently to describe those inherently nonlocal and thus atemporal and aspatial, generalized informational "motions" in an absolute local spacetime way only at the cost for introducing gravitation to curve it differently (in general) as to any two points of it at a finite distance between them, i.e., globally. That success of general relativity to remain absolute local and simultaneously complete is now explained otherwise than Einstein's own reflection on his theory to obey "Mach's principle" including in a generalized sense to Mach's original doctrine: it is only a reverse Fourier counterpart of quantum information. Thus, nonlocality at all is interpreted to be a Fourier counterpart of locality in a "Hamiltonian way" though general relativity is thoroughly within the "Lagrangian framework".

Anyway, whether special or general relativity implies for spacetime to be inherently local, and so localism is universalized once spacetime is universal, a worldview perfectly advocated by Einstein by means of his theory of gravitation, who understood very well the close link of spacetime, localism, and Mach's "empiriocriticism". Nonetheless, the alternative viewpoint (which is twofold: either nonlocality complementary to locality in a Hamiltonian pattern, or nonlocality being universal, to which locality is incomplete in both Lagrangian and Gödel manner) though inconsistent to that of classical physics and science is internally consistent enough, but "scandalously" since it implies as a direct corollary the conjecture for "creation from nothing" omnipresently and omnitemporally rather than only in the unique singularity of the "Big Bang".

So, one can outline the conflict of two paradigms in physics reflecting on philosophy and mathematics as well. The most important features of the old, classical and dominating paradigm including classical quantum mechanics are: localism, universal spacetime, deterministic empiricism, causality, (at least local) energy conservation, the prohibition for "creatio ex nihilo" combined with the "Big Bang" theory.

The new nonlocal paradigm endeavoring to scientific revolutions to dethrone the former can be defined by the rejection of the enumerated definitive properties. It is inherently nonlocal, spacetime is an only local phenomenon, probabilistic empiricism, nonlocal and reverse causality, universal conservation of quantum information thus allowing for violations of energy conservation including locally, the admission of omnipresent and omnitemporal creation from nothing, the absolute rejection of the "Big Bang theory" as rather religious than scientific.

The meant mechanism of omnipresent and omnitemporal creation from nothing interprets it as "coming into local unhiddeness" from the temporally "preceding" (rather paradoxically, but only at a first glance) nonlocal entangled state of the holistic universe. If one wishes to describe

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all the history of that omnipresent and omnitemporal "creatio ex nihilo" on the universal spacetime screen as it postulated by classical physics, just the usual theory of the expanding universe due to the Big Bang would be the unambiguous result. Furthermore, the Big Bang theory is invariant to any spacetime locality of the universe, however that invariance cannot be proved locally, and only by involving nonlocality (Penchev 2023 November 2).

One may demonstrate that creation from nothing by means of the class of all quantum measurements and thus, by any element of it. Each quantum entity "by itself", i.e., "before measurement" is in a coherent, consequently entangled state. It can be interpreted as a nonlocal "nothing" in the exact meaning that any nonzero energy cannot be attached to it as far as energy can be defined only locally, but nonetheless, both quantities of quantum information and physical action can be unambiguously assigned to it, furthermore equated to each other by the mediation of the Planck constant. In other words, any quantum entity by itself is "only a changing probability", to which a certain amount of physical action is ascribed by virtue of the Planck constant rather than energy or time since both make sense only locally.

Then, its measurement attaches a certain spacetime, namely that of the apparatus furthermore shared by all other apparatuses, human beings, or whatever items belonging to the universe. Thus, that time assigned to the quantum entity at issue is chosen unambiguously by virtue of the obvious fact that its measurement takes place in our universe (rather than in any others), and accordingly its energy is also absolutely determined. If one repeats the measurement once again all quantities featuring it might be different except energy and time since both are meant relatively to our universe, which is the same in definition. That consideration is postulated by Pauli's particle paradigm, the Standard model, etc.

However, that consideration on the new background of nonlocality meant by the latter paradigm implies "creatio ex nihilo" and here is why. It is accomplished by the measurement since the separate existence of the investigated entity does not make enough sense and particularly its time and energy as if appearing as a result of the measurement itself. Of course, quantum measurement is only a class of examples of decoherence where that class is essentially defined by human free will featuring all experiments. Nonetheless, the availability of free will is not essential for all processes of decoherence as if gradually extracting our universe from the coherent state, to which it belongs along with all other possible universes (or "worlds" according to the "many-world interpretation of quantum mechanics").

So, that omnipresent and omnitemporal decoherence gradually extracting our universe from an atemporally preceding coherent state is in fact the "creation from nothing" thus also universal, however absolutely forbidden by classical physics and science even as ostensibly "anti-scientific" and substituted by the Big Bang theory, which is really anti-scientific. One might coin the metaphor of the "Stork" bringing the universe by the "beak" as a newborn baby as to the Big Bang just and only the omnipresent and omnitemporal way of its real conception is to remain hidden for the prejudice of classical science for energy conservation, figuratively said, veiling the permanent "sex" by which it appears actually. Just as the myth of the "Stork", that of the Big Bang has its reasons, but they are neither scientific nor the appearance of the universe by the Big. Bang is true. It is about time for science to become "for adults".

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V MORE IN TODAY'S TIME: A NEW READING OF THE THREE "WHALES" FOR THE FOUNDATIONS OF MATHEMATICS, OR PROPOSITIONAL LOGIC, ARITHMETIC, AND SET THEORY AS THE SAME

Another corollary from ontomathematics, due to the newly deduced completeness of mathematics, once it has been in advance reinterpreted as "ontomathematics" as here, consists in a new look at the foundations of mathematics, especially to its traditional "three whales": arithmetic, set theory, and classical propositional logic. Usually, they are understood to be three absolutely independent of each other mathematical theories, *de facto* involved in the foundations of mathematics alleged to be the three ostensibly simplest ones as well as according to the tradition and history of mathematics, including the main proper mathematical attempts to be justified by itself, namely, logicism, formalism, constructivism (intuitionism), finitism, the project "Bourbaki", etc., including Gödel's fundamental results (1930; 1931). However, any alternative approach, e.g., that undertaken by category theory, seems to be not less legitime.

Meaning the concept of ontomathematics, advocated here, all those approaches are doomed to fail, since all of them share the same modern prejudice to mathematics: to be divided from reality by the Cartesian abyss therefore being able only to create more or less incorrect models of the latter, which will be sooner or later rejected as wrong. Then, the cherished self-foundation of mathematics means for it to observe its boundaries limited by reality and the abyss at issue.

On the contrary, ontomathematics shares the negation of that postulate, after which any self-foundation of mathematics under the so enumerated restrictions is fundamentally impossible: in other words, the self-foundation of mathematics is only accessible by ontomathematics, consequently including reality within itself and therefore implying the option for certain models to coincide absolutely, thus turning out to be "reality by itself". Indeed, just that option is embodied by means of quantum mechanics as long it includes nonclassical quantum mechanics (quantum information) rather than being restricted only within classical quantum mechanics as Pauli's particle paradigm or the Standard model need.

That inclusion of reality within mathematics (therefore uniting them and transforming the latter into ontomathematics) involves the concept of Hilbert arithmetic in both narrow and wide senses "complementary" to each other from the viewpoint of quantum mechanics, but "dual" as to mathematics itself. Hilbert arithmetic in a wide sense is the qubit Hilbert space equivalent to the separable complex Hilbert space of classical quantum mechanical under a few purely technical admissions. Hilbert arithmetic in a narrow sense can be inferred from Hilbert arithmetic in a wide sense where all qubits of the latter are interpreted as "empty" and then equated to units in Peano arithmetic. In other words and more precisely said, any unit of Hilbert arithmetic in a narrow sense is the class of equivalence of all possible values of the qubit enumerated by the same number and belonging to the Hilbert arithmetic in a wide sense.

Then, one can find two dual anti-isometric Peano arithmetics in Hilbert arithmetic in a narrow sense. The one is equivalent to the standard Peano arithmetic, and its dual counterpart can be interpreted as starting from the "countable infinity" and the function successor is "n-1" rather than "n+1". Obviously, that nonstandard dual twin of Peano arithmetic originates from the dual qubit Hilbert space under the same condition for their units to be the corresponding classes of equivalences, i.e., "empty qubits".

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One can immediately notice that Hilbert arithmetic in a narrow sense conserves the property of completeness of Hilbert arithmetic in a wide sense proved as to the separable complex Hilbert space by means of the theorems of the absence of hidden variables in quantum mechanics (Kochen, Specker 1967; Neumann 1932). However, it is to be now interpreted as to the cherished completeness of mathematics impossible otherwise than ontomathematics, i.e., including reality within itself as physical reality meant by Hilbert arithmetic in a *wide* sense. One may add that "reality" is also represented in Hilbert arithmetic in a narrow sense as the dual anti-isometric Peano arithmetic and allowing for the restriction of the Gödel incompleteness to be avoided as to Hilbert arithmetic in narrow sense only by doubling the Gödel enumeration of all propositions so that all unresolvable propositions can be enumerated by the dual Peano arithmetic so that Hilbert arithmetic in a narrow sense does not contain any unresolvable statements therefore being mathematically complete just its complementary counterpart of Hilbert arithmetic in a wide sense is complete by virtue of the cited theorems, but rather in a physical sense though inherently inseparable from the proper mathematical sense in the newly framework of Hilbert arithmetic or Hilbert mathematics.

One can easily deduced that Hilbert arithmetic in a narrow sense is a Boolean algebra if the logical operation of negation is defined as passing to the same unit of the dual Peano arithmetic, and the operation of disjunction originates from the unification of both operations of addition (however anti-isometric to each other) each of which belongs to the one of both dual anti-isometric Peano arithmetics together constituting Hilbert arithmetic in a narrow sense. Accordingly, "conjunction" originates from the unification of both operations of multiplication, each of which belongs to the one of both dual anti-isometric Peano arithmetic.

If one has in advance proved that Hilbert arithmetic in a narrow sense, consisting of two dual anti-isometric Peano arithmetics, is a Boolean algebra, following, for example, the scheme sketched above, it may be immediately identified with propositional logic, for which is proved to be mathematically isomorphic with classical ("Aristotelian") propositional logic.

Now set theory, burdened after Cantor with a hierarchy of infinities, is to be reduced and identified with Boolean algebra, the only obstacle for which is just the hierarchy at issue of infinities, but anyway secondarily addable to Boolean algebra after considering of a compose structure joining Peano arithmetic to it. In fact, one may observe that the hierarchy of infinities is not rather utilized in all branches of mathematics out of set theory itself and thus not especially necessary for mathematics, but originating rather from Cantor's psychological peculiarities and then conserved as a "QWERTY effect" in the foundations of mathematics.

So, though Cantor's personal and subjective intention was to create set theory as a mathematical doctrine about infinity, which might eventually and especially later, in the 20th century to ground all the mathematics and mathematical theories, one can anyway ignore it following another branch of the traditions about the foundations of mathematics, expressly and explicitly articulated by Russell and Whitehead in "Principia mathematica" but traceable back still even to Aristotle. It identifies the seemingly different enough conceptions of "proposition" and "set", additionally not distinguishing between finiteness and infinity therefore canceling Cantor's own reflection on set theory as the mathematically relevant doctrine of infinity.

The identification at issue states that a set corresponds to any syntactically correct proposition as well vice versa: any set can be exhaustively described by a proposition. So, what

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set theory is really is rather a "theory of elements", to which the usual notation of "set theory" is misleading in fact. Indeed, propositional logic (and thus Boolean algebra) is able to describe thoroughly all sets, but it is hardly relatable to the concept of the number of elements (though "Principia mathematica" tried to deduce it from propositional logic). In other words, it is able to describe any element of any set as a conjunction of propositions (each of which means a property of the element in question), respectively as an intersection of sets.

However, Peano arithmetic, introducing the fundamental conception of "function successor" (or speaking loosely, that of "counting") and then the axiom of induction linking it to "proposition" (and thus, to "set") seems not to be directly (or said otherwise, analytically) deducible from logic. So, the ultimate conclusion from "logicism" is rather paradoxical: it can easily infer set theory from propositional logic even identifying them, but it fails to do this in relation to arithmetic.

If one stares at the reason for that failure, it should be concentrated on the axiom of choice and the fundamental trouble for it to be formulated logically. Indeed, it manages to link arithmetic to set theory by means of "choice", but the same link is too difficult to be translated into the proper language of propositional logic. Indeed, the "multiplication axiom" ostensibly substitutes the axiom of choice therefore translating it exactly in the framework of propositional logic alone, but only seemingly:

On the one hand, it needs the concept of "empty set", respectively "nonempty set", which in turn relies on "false proposition", respectively "true proposition" but without the "reference of a proposition" to avoid any relation to reality external to logic (and thus to mathematics after logicism). The false proposition within logic is only the tautologically false, i.e., contradictory proposition. Consequently, the multiplication axiom means as a result the following: any conjunction of propositions is not tautologically contradictory, i.e., a statement being obviously untrue. The cause of nonsense is just removing the concept of the "reference of a proposition", only for which the multiplication axiom makes sense, but that reference is inadmissible for the claim of logicism to ground mathematics on itself alone.

On the other hand, the multiplication axiom means, in fact, the statement reverse to the axiom of choice, stating that an element can be always chosen from any set (eventually restricting its cardinal number or not) rather than the statement that a (nonempty) set corresponds to any two or more elements of sets. The difference might be more clearly visualized by the choice defining a bit of information. In fact, that choice is twofold: it consists of two elementary binary oppositions complementary to each other[17]. On the contrary, the prejudice is that consists of a single one: if one utilizes the standard example of a Turing machine tape cell, that is the opposition of the two alternative writable or readable states usually notated as "0" and "1" (being relevant to arithmetic) or isomorphically as "true" and "false" (being relevant to propositional logic)[18]. However, it is preceded by an underlying opposition of the cell: either

[17] In detail, in: *Penchev 2021 July 8*.

[18] One is to notice that arithmetic and propositional logic share the same fundamental element of a Turing machine tape cell, or said otherwise, arithmetic and propositional logic (and thus, set theory as well) are two alternative ways of the meta-organization of the same "primordial" informational medium consisting only of bits, respectively, of elementary choices. Arithmetic means for them to be well-ordered, but propositional logic does not. Then, the logical viewpoint can be represented by two dual anti-isometric

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"empty" or recorded whether "0" or "1" in it. Obviously, the opposition of "0" versus "1" makes sense only to the "recorded state" of any cell.

Then, any choice is inherently *directed* since it means the ordered coherence "(1) before choice; (2) after choice". If the case is the explicit choice "1 versus 0", just the inherent direction of choice is meant as well as the axiom of choice. However, the multiplication axiom is to be related to the opposite direction of choice also visualizable by creating a quantum coherent superposition from two or more alternative states, on the one hand, or the implicit opposition of any choice, "before choice" versus "after choice", on the other hand.

Thus, the multiplication axiom is not able to produce arithmetic from logic, which is the intention of "Principia mathematica" or even whatever well-ordering starting from a coherent state. The cause of the failure is due to the fact that the multiplication axiom has implicitly presupposed them in advance by virtue of which it cannot infer them correctly. So, one may admit that set theory and propositional logic, though eventually identifiable as two interpretations of the same structure of Boolean algebra, are nonetheless discernibly distinguishable in relation to arithmetic which is directly inferable only form set theory rather than from logic, which is further the reason for logicism (though utilizing the multiplication axiom) to fail in the final analysis.

Indeed, propositional logic is a zero-order logic, and set theory is a universal theory of the class of all first-order logics, among which arithmetic can be interpreted as referring to the subclass of all *well-ordered* first-order logics. So, the Boolean equivalence of set theory and propositional logic is the simplest and most natural conjecture that zero-order logic is equivalent to the class of all first-order logics. However, it is an axiom in fact, thus improvable from propositional logic and set theory together. So, the Gödel (1930) completeness result needs an additional elucidation:

In fact, it states only that the newly introduced "equivalence axiom" of set theory (as the class of all first-order logics) and propositional logic (as the single zero-order logic) does not contradict the axioms of propositional logic or those of set theory rather than it can be deduced from them together. So, either itself or its negation can be *consistently* added to the tuple of axioms of both set theory and propositional logic therefore stating the equivalence of the sub-tuples to each other. Then, Hilbert arithmetic, or respectively, the corresponding philosophical conception of ontomathematics needs just that "equivalence axiom" unlike Gödel mathematics, being alternative to the former, confessing its negation.

Then, one may reinterpret the Gödel (1931) incompleteness result as an independent axiom whether equivalent, inferable or at least consistent with the negation of the equivalence axiom (by the way, chosen to be the starting point for introducing "Hilbert mathematics" in the first part of the present study: *Penchev 2022 October 21*). Consequently, Hilbert arithmetics and

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Peano arithmetics, the mutual anti-isometry of which excludes any universal well-ordering, nonetheless, absolutely relevant to each of both dual Peano arithmetics. Thus, HIlbert arithmetic in both wide and narrow senses is to be related to that primordial informational medium accordingly consisting of bits or qubits, and to which ontomathematics refers as well. For example, one can easily observe that the two fundamental kinds of "particles" in quantum physics, namely, bosons and fermions, correspond to the logical and arithmetical organizations of the primordial informational medium at issue as to the generalized case of it to consists of though the initial meaning of "arithmetical" or "logical" is properly mathematical rather than physical.

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thus Hilbert mathematics reject the Gödel incompleteness in order to be able to introduce "ontomathematics" after a relevant philosophical reflection onto the alternative completeness expressly articulating for it to contradict explicitly the Cartesian conjecture for that "mind - body abyss".

Thus, the gap at issue implies a rather extraordinary corollary: the equivalence axiom or its alternative exact or partial reformulations restricted only within the framework of mathematics are able to coexist with the Cartesian conjecture just by virtue of what it postulates: a derivative abyss between mathematics and philosophy implying also the option for the Gödel (1931) incompleteness result to be anyway consistently provable in mathematics once the Cartesian abyss has been in advance postulated just as Modernity had (or has) done.

Meaning the preliminary observation in the last paragraph, one can consider the abundance of exact or partial reformulations of the above equivalence axiom in mathematics, logic or mathematical logic. First of all, that is the principle stating that any set can be equivalently described by its characteristic property as well as vice versa: any proposition including self-contradictory implies a relevant set to which it is a characteristic property. Indeed, if one admits any nonempty mismatch between them, it is to be situated within the Cartesian abyss therefore justifying it constructively within mathematics. This means that there should exist (whether) at least one proposition to which no set corresponds or vice versa: at least one set inexpressible by any proposition. Obviously, one can hardly exemplify either of the two options. That principle can be granted to be a fundamental "ideologeme" confessed by logicism and then justifying its intention and efforts.

As to logic itself, the equivalence of intensionality and extensionality is relevant. In fact, it means the same as the above principle of logicism however observed from the viewpoint of logic: any proposition thus inherently intensional implies a certain extensional reference as well as vice versa. The same postulate can be easily reformulated by the relation of first- and zero-order logics therefore explaining and grounding all non-classical logics: if one considers any consistent tuple of axiom, the boundary between those relevant to a zero-order logic and those of a first-order logic is conventional, variable and thus arbitrarily changeable.

So, the standard list of the axioms of Aristotelian logic to be granted as the universal zero-order logic relies only on the tradition and can be eventually justified by the viewpoint of mathematical logic to it as Boolean algebra and the maximal symmetry of the corresponding lattice. Anyway, that maximal symmetry suggests that classical propositional logic is unique since no way for any lattice to be more symmetric than the Boolean lattice, or respectively, any non-classical zero logic is less universal, or figuratively said, "less zero" than Aristotelian logic. Thus, the boundary of it to all nonclassical zero order logics or any first-order logic is *absolute* since their tuples of axioms can be reached only by *adding* new and specific axioms featuring the nonclassical logic at issue (respectively, any first-order logic).

As a conclusion, the multiplication axiom fails also by virtue of the fact that the tuple of axioms of propositional logic needs an additional axiom stating that there exist first-order logics, respectively that *there exists* reality (or extensionality) since the pure intensionality of classical logic does not imply this. Formally, it would be sufficient to state that, to the list of logical axioms, one can add others as long they are consistent to the former ones, or said otherwise they

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are to define a true subset to that universal set, the characteristic property of which is the list at issue (a conjunction of all logical axioms).

Then, the equivalence postulate would determine the simplest case where reality or extensionality (once they have in advance granted to exist) only double intensionality already exhaustively defined by the tuple of logical axioms or respectively, to be Boolean algebra. In fact, that is an ancient solution invented yet by Plato and then perfected by Aristotle. Indeed, the "world of ideas" corresponds naturally to logical intensionality, then only doubled by the "world of things", which means that every "idea" is doubled by just one corresponding "thing", and namely: the former world is primary since the existence of the latter one needs an additional axiom and cannot be analytically deduced from the former (as Russell and Whitehead's logicism hoped in vain). Once that is the case, Aristotle's observation that propositional logic is valid in both "worlds" and thus it can be interpreted to be the universal "ontology" is an immediate corollary.

Ontomathematics implies, in particular the unification of philosophical principles and mathematical or logical axioms, respectively philosophical doctrines and mathematical or logical theories, being absolutely inaccessible even unacceptable for modern mathematics and philosophy permanently reflecting and reproducing the Cartesian abyss. Furthermore, physics is to be included in that "Great unification of cognition" confessed by ontomathematics, as that inclusion was already demonstrated above.

Meaning the ancient solution introduced yet by Plato and Aristotle, now only interpreted mathematically as ontomathematics implies, it can be further applied to the relation of set theory and arithmetic leaded by the intention to be avoided the Gödel dichotomy, or in particular, incompleteness. Indeed, set theory is above seen to be a theory of the class of all possible first-order logics once reality or extensionality has been postulated before that, and the equivalence axiom regulates its relation to intensionally to be the simplest case of doubling. Then, a subclass is naturally introducible, namely that of all possible *well-ordered* first-order logics and arithmetic (respectively Peano arithmetic) to be identified to the relevant mathematical theory of the latter, well-ordered class of all well-ordered first-order logics[19]. So, it is inherently incomplete to set theory interpreted to be the class of all possible first-order logics since the relevant complement of first-order logics which are not well ordered is obviously nonempty.

Then, one questions how the relation of the subclasses to each other can be suggested. Once again, the simplest solution is the doubling of arithmetic only admitting that all non-well-ordered first-order logics can be also well-ordered by a dual Peano arithmetic under the condition its well-ordering to be complementary, i.e., simultaneously impossible with the well-ordering meant by the former dual twin of Peano arithmetic. That condition is exemplified in Hilbert arithmetic where the dual counterpart of Peano arithmetic is anti-isometric.

An additional "bonus" of that solution is that the two doublings (that of set theory to propositional logic as well as that of both dual Peano arithmetics) allow for their identification, furthermore exactly corresponding to the main intention of ontomathematics to include reality within mathematics so that the class of all non-well-ordered first-order logics (though then

[19] For example, in: *Penchev 2023 November 2*.

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anyway ordered anti-isometrically by the dual Peano arithmetic) to be interpreted to that image of reality within mathematics just as ontomathematics needs.

One may check independently the identification at issue by the axiom of choice usually added to the tuple of axioms of set theory in order a certain well-ordering to correspond to any set, being non-well-ordered in general by itself, by virtue of its equivalence with the well-ordering "theorem". The axiom of choice means that any element of any set (or restricted to a certain cardinal number) can be chosen and thus individualized. Consequently, it states that the element at issue can be extracted from the initial set therefore dividing it into two parts: the part of the chosen element and the rest part of the initial set definable as the complement of the set consisting of the chosen element alone to the initial set. So, if one stares at the successive subsets of yet *unchosen* elements one can immediately notice that the explicit choice of each element orders anti-isometrically the sequence of subsets at issues. Consequently, the solution of Hilbert arithmetic by the two dual Peano arithmetics is equivalent to adding the axiom of choice to Peano arithmetic naturally doubling it and connecting so that the doubled Peano arithmetics by means of the axiom of choice should be equivalent with set theory since it is the class of all first-order logics then subdivided into two subclasses: that of all well-ordered ones and that of all non-well-ordered ones, observing that the axiom of choice orders both however anti-isometrically to each other and thus complementarily.

One may notice that the concepts of choice and dual doubling are relative to each other and fundamental for both mathematics and ontomathematics. They are also logically equivalent. Dual doubling implies the choice of either dual counterpart of both as well as vice versa: choice implies the definitive dual doubling of what is chosen by what is not chosen. Furthermore, the choice may be continued by another choice among what is chosen and thus any chain of choices is countable therefore admitting the concept of "number of choices" as a natural number. Then, one should introduce the concept of information still in ontomathematics and thus, in the foundations of mathematics, i.e., as one of the most fundamental notions applicable in both physics and mathematics and merging them by a natural bridge of theory of information understood to be fundamental rather than an applied and even only technical discipline as until now.

VI HILBERT ARITHMETIC, OR HILBERT MATHEMATICS AS ONTOMATHEMATICS

One may summarize the main features of Hilbert arithmetic as they are enumerated above now from the viewpoint of completeness of mathematics also provable internally for demonstrating that mathematics built on its basis (respectively, called "Hilbert mathematics") is complete, furthermore in a fundamental and philosophical sense, thus identifiable as "ontomathematics". Hilbert arithmetic contains a few internal symmetries philosophically realizing Husserl's "epoché" to reality as a symmetry, and all "phenomena" in his sense as definitively possessing the same symmetry. The reinterpretation of "epoché" as a symmetry allows for it to be related to mathematics and physics just as ontomathematics needs.

First of all, one distinguishes Hilbert arithmetic in a narrow sense from Hilbert arithmetic in a wide sense where the latter coincides with the qubit Hilbert space of quantum information being derivative from the separable complex Hilbert space of quantum mechanics in an

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elementary way. As far as quantum mechanics can be granted to be a universal basis of all physics and thus, of all claiming to be physical, i.e., material, Hilbert arithmetic in a wide sense underlies in a Pythagorean sense Plato's "world of things" now only called "ontomathematical". Plato's fundamental doubling of all "things" by their "ideas" corresponds to the doubling of Hilbert arithmetic in a wide sense by Hilbert arithmetic in a narrow sense as the most fundamental philosophical symmetry, in fact doubling all physical and material (i.e., all "things") by their unambiguously corresponding mathematical counterparts (i.e., all "ideas").

The nature of that most fundamental symmetry (also interpretable as Husserl's "epoché") is that of a class of equivalence, however seen in a generalized way. Any class of equivalence substituted the extension of the class (i.e., all "elements") by an "intensional" equivalent (i.e., the class itself). However, understood standardly, the class of equivalence is not a symmetry, by an hierarchy as the hierarchy of "types" in Russell's theory of types since any class is a higher type in relation to its elements. So, one needs a generalized reading of "class of equivalence", in particular, strictly forbidden in Russell's theory of types. This is the universal self-referentiality of the class so that any element is interpretable as the class itself.

Reflecting philosophically that generalization of "class of equivalence", one observers that it is reinterpreted "hermeneutically", but avoiding its trivialization to a "vicious logical circle" since the two directions of the two converse implications are complementary to each other therefore avoiding its reduction to a vicious circle of reasoning. One can check that after the so generalized "class of equivalence". The class of equivalence can be accepted as a whole for example, as a set or as its characteristic property able to describe all elements unambiguously. So, that direction is shared by both "hierarchic" and "hermeneutic" considerations, therefore clearly distinguishable after the next step (or "direction") obeying correspondingly the hierarchic "function successor" or the hermeneutic "complementary idempotency", thus interpreting the single whole of any class as the plurality of its elements reversely and acquiring an (as if) reflected wholeness (for example and following the same pattern, one might say that all quanta reflect the wholeness of the universe), furthermore exhaustively consisting of all of them. Speaking loosely, any class of equivalence is represented by any element of it, however "complementarily" or "hermeneutically".

Meaning the above consideration, one grants the constitution of any class of equivalence as the fundamental ontomathematical operation able to transform the physical into the mathematical as well as versa therefore being consistent only with the newly introduced "hermeneutic" reading of "class of equivalence". However, that hermeneutic reading, furthermore utilized as an equivalent of the hierarchical one in Hilbert arithmetic, even being definitive for it, corresponds to a relevant generalization of Hamiton's approach to mechanics and discussed in detail a little below.

As this is demonstrated above, Hilbert arithmetic unlike Peano arithmetic is complete to set theory just dually doubling the latter thus complementing it to Boolean algebra. Then, mathematics grounded on Hilbert arithmetic, naturally and respectively called Hilbert mathematics, is also complete, however at the cost to *include reality within itself*, thereby accomplishing the intention of Pythagoreanism only generalizing arithmetic to Hilbert one. Moreover, the inclusion of reality within itself is the only way for Hilbert mathematics to be complete thus necessarily breaking the Cartesian framework of cognition defined so that reality

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is inherently external to it: on the contrary, Hilbert mathematics realized as ontomathematics is that kind of cognition inconsistent and "impossible" according to the Cartesian fundamental and philosophical paradigm establishing the dualism of cognition, including mathematics, and reality.

The way of Hilbert mathematics as ontomathematics to overcome that philosophical dualism featuring Cartesianism is rather paradoxical since it involves the dualism in itself by a course of thought known a long time ago, but in relation to the rather particular case of two dual, but equivalent ways for mechanics to be formulated: Lgrangian (being historically the first one) and Hamiltonian (which considers velocity and acceleration as independent variables rather as the first and second time derivatives of distance or space coordinates).

For its emancipation and historically initially, quantum mechanics referred to the Hamiltonian approach naturally interpreting any quantum motions as instantaneous or happening out of time. However, it was later reformulated also in a Lgrangian manner, being often technically more relevant and convenient for resolving many problems, especially practical and applied. That turns out to be possible just by virtue of the equivalence of both Lagrangian and Gamilronian approaches to mechanics, which equivalency relies on the much more general equivalence after considering any derivatives in an abstract and mathematical sense as independent variables.

Indeed, also Cauchy's approach for the foundation of infinitesimal calculus, being historically the first as well, furthermore closer to Newton's "method of fluxions" than to Leibniz's "differentials" in turn restored as a possible and equivalent foundation only in the 20th century after Robinson's "nonstandard analysis", corresponds rather to Lgrangian mechanics. The alternative "nonstandard analysis" promoted by Robinson needs the "ultrafilter lemma", a weaker version of the axiom of choice, but sufficient for grounding the relevant nonstandard model implied (in general) by the Löwenheim - Skolem theorem in set theory and by the axiom of choice in the final analysis.

So, the contemporary justification of infinitesimal calculus if it follows Lagrange and Cauchy's pattern is closer to Cantor's original realization of set theory needing continuum with its set-theoretical power to be more powerful than that of any countable set in turn more powerful than that of any finite set or any natural number (as a cardinal number) accessible to Peano arithmetic. Alternatively, nonstandard analysis suggests a countable nonstandard model of continuum to substitute it in the foundation of integral and differential calculus. Moreover, that countable nonstandard model of continuum might be interpreted to be even finite after Skolem's "relativity of the notion of set" (1922) by the mediation of the set-theoretical "Dedekind finiteness".

Then, one may conclude that the idea for the Hamiltonian formulation, though initially applied particularly to mechanics can be generalized to the foundation of analysis, therefore allowing for the distinction of the classical approach versus Robinson's nonstandard one, but furthermore continuable to the foundations of mathematics: that is the proper contribution of Hilbert arithmetic accomplishing that generalized "Hamilonian reformulation" of the relation of arithmetic to set theory by complementing it by a dual Peano arithmetic to contain all nonstandard models, on the one hand, or all "Gödel numbers" of all "insoluble statements" (after him again) and unlike its "normal" counterpart (which contains the "Gödel numbers" of all *soluble* statements).

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That “Hamiltonian reformulation” of arithmetic and set theory as Hilbert arithmetic reflects also on the philosophical understanding of infinity usually and intuitively subordinate to finiteness (or “finitude”) to be “much more” than the latter: so being “much more”, that infinity is divided from finiteness by an “abyss”. Alternatively, Hilbert arithmetics interprets infinity to be not more than a *second and inherently dual finiteness*, therefore identical to it and indistinguishable from it just as two copies of the same Peano arithmetic only postulated to be dual to each other, respectively as to dimensions or two qualities, supplying a “binocular” viewpoint to all mathematical problems, for example those relating to the foundations of infinitesimal calculus or the nonlocality of quantum information to the locality of classical physics (including “classical quantum mechanics”).

Indeed, the infinitesimality of analysis whether “standard” or “nonstandard” meaning also their equivalence can be now related to the establishment of nonlocal quantum information therefore implying the necessity of an entanglement (thus nonlocal) theory of quantum gravity as a counterpart of gravitation being inherently local after Einstein’s general relativity.

VII ONTOMATHEMATICS FOR PHILOSOPHY, OR ONTOMATHEMATICS AS “FIRST PHILOSOPHY”

Philosophy always tries to describe the world uniformly regardless of whether it means Socrates’s “human problem” or not. Often, that philosophical unification notated to be the “first philosophy” means one or a few initial elements as “substance”. Seen analogically, as the first philosophy, ontomathematics suggests that Pyhagorean “Numbers” though modified and understood in a generalized contemporary way to be those initial elements of the world implying, by their nature, the mathematical, physical, and philosophical unity of the world. The relevant perfection of the Pythagorean “Numbers” can be schematized as follows:

They are de-sacralized, i.e. understood absolutely rationally, including to be thoroughly accessible for the human mind. Nonetheless, they can serve as the basis of an “ontomathematical theology” “als strenge Wissenschaft”. Historically and traditionally, what theology reckons for its subject, “God” is granted to be: whether non-existent (as to science) or at least separated from any possible subject of science (as far as science and religion contradict each other). Anyway, after the philosophical joining of physics and mathematics in ontomathematics, a scientific concept of “God” is more or less possible.

The Pythagorean numbers are understood rather as the most fundamental mathematical structures sufficient for the self-foundation of mathematics than any or all natural numbers studied by arithmetic also axiomatized by Peano arithmetic. Following Hilbert arithmetic, those structures are only three and linked formally and rigorously (which is elucidated in detail above): arithmetic, set theory, and propositional logic. Their connection can be naturally interpreted by classical and quantum information so that mathematics refers to the former, and physics, to the latter. Then the unity of information, whether classical or quantum, relying on the concept of choice is able to unify mathematics and physics, both relating to that fundamental choice.

The concept of information, especially quantum, involves “probability” and probability theory into the foundations of mathematics and thus, into ontomathematics as the first philosophy. What is physically existent is only the permanent change of probabilities preceding

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and generating the physical quantity: thus, those probabilistic changes are atemporal and and should be understood rather abstractly and mathematically.

Once those three most fundamental structures have been closely linked for the foundations of mathematics, their interrelations are to be rather described by means of unary and binary logical operations and their properties as idempotency, commutativity, associativity, and distributivity, therefore algebraically in the final analysis.

Furthermore, the separable complex Hilbert space, from which the qubit Hilbert space (also being identical with Hilbert arithmetic in a wide sense) is derivative is a generalization of Euclidean space, and its geometry generalizes Euclidean geometry. So, arithmetic and geometry are closely linked in Hilbert arithmetic as two dual aspects of the same, and further, in the foundations of mathematics by Hilbert space. The qubit Hilbert space itself can be considered as a Furier counterpart of Minkowski space, which is another geometrical space as well. It can be interpreted physically as Euclidean space in which a spherical wave propagates under the condition for not exceeding the speed of light in a vacuum and the equivalence of all inertial reference frames in the sense of special relativity.

Thus, one can conclude that three additional mathematical theories are involved in the foundations of mathematics by the mediation of Hilbert arithmetic in both narrow and wide senses: probability theory, algebra and geometry. Furthermore theory of information is reinterpreted to be a mathematical theory inherently relevant to its foundations rather than an applied mathematical, even only technical discipline. Nonetheless, the four enumerated mathematical disciplines being represented by certain corresponding mathematical theories are first-order logics, thus particular to set theory since it is equivalent to the class of all possible first-order logics. Geometry, probability theory, and theory of information refer directly to Hilbert arithmetic *in a wide sense* and thus they can be considered to be derivative from the unification of mathematics and physics in ontomathematics.

As to algebra, it is to be related immediately to Hilbert arithmetic in a narrow sense. It regulates the links of set theory, arithmetic, and propositional logic in the foundations of mathematics by identifying both propositional logic and set theory to be the same structure of Boolean algebra, furthermore adding to the same identification the pair of two dual Peano arithmetics therefore allowing for the theory of classical (i.e., binary and not quantum) information to be deduced only algebraically.

All the enumerated mathematical theories, once mathematics has been in advance granted to be the "first philosophy" as ontomathematics can be interpreted correspondingly, i.e., also philosophically. For example probability theory can be seen as a quantitative doctrine of possibility therefore being able to describe how *actuality appears from possibility*, which "precedes" the former from the viewpoint of ontomathematics (more precisely said, the philosophical categories of actuality and possibility can be considered as dual to each other mathematically or complementary to each other physically by the mediation of ontomathematics).

By reflecting philosophically, information is the single and universal substance of the world able to explain in an exact quantitative way how the non-material mathematical structure generate the material physical entities belonging to the empirically observable and experienced world following necessary ontomathematical laws such as the conservation of quantum

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information therefore not needing the "Big Bang" hypothesis, which is a quasi-scientific doctrine or an "ideology of hierarchy and its conservation" in the final analysis.

Space and time or spacetime after relativity are often considered to be universal philosophically categories therefore excluding all what is out of space, time, or spacetime from the physical or material world. On the contrary, ontomathematics restricts them only to locality, or respectively, to the "light universe" physically and absolutely irrelevant to the rest "dark universe", the energy and mass of which (i.e., "dark mass" and "dark energy") is approximately 20 times bigger than those of the former, which classical physics and science recognizing space, time, or spacetime as absolute conditions of the existence of all claiming to be physical or material, grants wrongly to be the whole universe. So, the acceptance of space, time, or spacetime to be universal restricts all possible cognition to locality therefore excluding the crucial "dark part" of the universe since it is nonlocal.

Speaking more loosely, one might say that almost all physical universe is out of space, time, or spacetime, and thus "out of science" as far as it requires an absolute repeatability of all results claiming to be scientific. On the contrary, the crucial part of all physical interactions are fundamentally random and what should be investigated is the permanent "game of probabilities" (which can also be also reflected philosophically as "possibilities"). Science obeying the condition of absolute repeatability of all scientific results is thus inherently limited to an insignificant part of the world featured by constancy and persistence, or particularly by energy conservation therefore wrongly forbidding any "creatio ex nihilo" as anti-scientific.

Nonetheless, the universe by itself appears "from nothing" omnipresently and omnitemporality just by virtue of the fact that the approximately 20 times bigger part of it is beyond spacetime and beyond human cognition at least the human cognition which obeys science as it has been so far. To reconcile the postulated constancy of the physical universe with the real and permanent generation of mass and energy "from nothing" (more precisely, from that game of probabilities and possibilities mentioned above) visible for example as the expansion of the universe, the myth of the "Big Bang" is invented: an only human fantasy as that of "God".

The present section sketches only cursorily the huge change in philosophy after ontomathematics as the "first philosophy", i.e., a revolutionary generalization of ontology into ontomathematics.

VIII ONTOMATHEMATICS AS HUSSERL'S PHENOMENOLOGY OR HEIDEGGER'S FUNDAMENTAL ONTOLOGY (INCLUDING "LANGUAGE" AS "SEIN")

Nonetheless, ontomathematics can be also interpreted in the tradition of Husserl's or Heidegger's ontology. As this is very well known, Husserl is a mathematician by education started his philosophical development by "Philosophie der Arithmetik. Psychologische und logische untersuchungen" (1891) where arithmetic as the basis of mathematics had been inferred in the Cartesian framework usual for modern philosophy, in which arithmetic would be to be discussed as a creation of human mind, i.e. psychologically. However, he overturned his philosophical credo in the next work in two volumes "Logische Untersuchungen" (1900-1901), in fact reinventing Aristotle's ancient solution in relation to Plato's dichotomy of "ideas" versus "things", now in the context of modernity as well as in his personal context marked by the mathematical education and the preceding research about philosophy of arithmetic.

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However, it did not reach the design of ontomathematics advocated in the present paper, though that development of his worldviews was possible, abstractly and theoretically. Indeed, quantum mechanics implicitly suggesting the idea of ontomathematics did not yet appear in his time as well as many other subsequent scientific and philosophical discoveries in the 20th and 21th centuries. Instead of that, he began the project of phenomenology, which can be also seen as an ontological rewriting of modern philosophy following Aristotle's revision of Plato's doctrine, since the main opposition of Cartesianism that of "body" versus "mind" is analogical to that of "things" versus "ideas", respectively Aristotle's solution would be relevant as well.

Indeed, Husserl's "epoché" to reality might be implicitly ascribed even to Aristotle as the essence of the ontological indistinguishability of "ideas" and "things" just as the words of any language do not separate them being able to refer to both equally well. Then, the description by propositional logic is invariant to them. Huserl's "phenomenon", achievable by "phenomenological reduction", means the logical essence of what is influenced by that phenomenological reduction whether a "thing" or an "idea". The same logical essence can be achieved also by Husserl's "eidetic reduction" representing the reduction of all elements belonging to a class of equivalence to the same class of equivalence itself.

One might question whether or as far Husserl himself identified phenomenological and eidetic reduction. The answer would require one to investigate many of his papers in detail, which is not possible in the limit of the present study. However, if one has done that, phenomenology can be interpreted as ontomathematics directly and immediately. What Husserl called "eidetic reduction" is the usual procedure for creating scientific notions not only in mathematics. However, they are explicitly understood as classes of equivalence only in mathematics. Husserl himself formulated "eidetic reduction" by statements influenced enough by his mathematical education.

One can think of both reductions as follows. Phenomenological reduction relied on Husserl's "epoché" is an explicit formulation of Aristotle's ancient project of ontology by means of propositional logic, only designated to modern philosophy, in which Plato's original dichotomy had been embodied in Cartesian dualism. So, the application of phenomenological reduction implies ontology called by Husserl "phenomenology" and thus reinterpreting the central Kantian concept of "phenomenon" ontologically and following immediately Aristotle in fact, even more so that Husserl himself introduced "transcendental reduction" and identified it with "phenomenological reduction"[20].

Eidetic reduction, rather inspired by his mathematical education, suggests alternatively "eidoses" as results due to its application, also identifiable as mathematical structures nowadays. If one unifies eidetic and phenomenological reductions and thus his concepts of "eidos" and "phenomenon", following also Husserl's original unification of "transcendental reduction" and "phenomenological reduction", his "phenomenon" can be in turn identified with "mathematical structure" in the sense of philosophy of mathematics or in the exact meaning of mathematics itself. Once "phenomenon" and "mathematical structure" has been unified, this implies the interpretation of phenomenology as ontomathematics, though that approach was rather implicit after Husserl himself.

[20] For example, in: *Husserl 1927*.

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Husserl's "turn" between "Philosophy of arithmetic" and "Logical investigations" had still one consequence in his philosophical worldview due to the inherent psychologism of "Philosophy of arithmetic", trying, speaking loosely, to infer arithmetic and thus mathematics from human psychology therefore reestablishing once again the human problem as the central one in philosophy at all. Then, the turn at issue can be also seen by virtue of "modus tollens" further embodied in Husserl's plan for phenomenological psychology, a philosophical psychology and thus intended to be a rigorous science just as phenomenology is to be that "Philosophie als strenge Wissenschaft".

In the same framework, the concept of the flow of consciousness was fundamentally introduced, which is characterized by its own internal time, quite different, even qualitatively, from the usual, physical one. The phenomenological and psychological time after Husserl is rather *topological*, a moving boundary of the present between the past and the future, and opposed to the physical *metrical* time, flowing monotonically and measured by clocks. So, the internal time is not another metrical time distinguishable by the external one only by its different metrics (for example, as two own times belonging to two reference frames in special or general relativity).

Then, following Husserl's pattern for internal time and a "rigorous" phenomenological psychology, one can generalize them to both ontomathematical counterpart of "internal time" and corresponding "ontomathematical psychology" thus referable to a new concept of "ontomathematical transcendental subject"[21]. That ontomathematical and psychological time is to mean the class of equivalence of all possible boundaries between locality and nonlocality thus independent of their metrics, and representable only topologically. In other words, any boundary of that kind correspond to the present, locality to the "past" or Husserl's "retention" [Retention], and nonlocality, to the "future" or his "protention" [Protention].

Obviously, that ontomathematical psychological time can be considered as an interpretation or equivalent of Husserl's original one where the "past" and "future" of the latter are correspondingly the "locality" and "nonlocality" of the former, respectively the present is the boundary between them, whether between the past and the future or between locality and nonlocality. Both considerations are topological. Then, the eventual transition to an external and physical time means the choice of a certain metrics among the class of equivalence of all possible metrics. The class of equivalence at issue is definitively topological, on the one hand, and relevant to "ontomathematical psychology" or to the ontomathematics "transcendental subject", on the other hand.

Thus both are to correspond to the fundamental mathematical structure of topological space, "temporalizing" it in a sense. Indeed, the relevant "topological time" is to be defined as the moving (i.e., "expanding") boundary between all infinitesimal neighborhoods of a given point of topological space and the finite ones about the same point. That topological time is not engaged with any certain metrics eventually ascribable to the topological space at issue additionally.

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[21] The conception of transcendentalism introduced by Kant is quite relevant to the doctrines of both Husserl and Heidegger is widely enough discussed (e.g., Shafiei, Mesgari 2020; Hart 2004; Gorner 2002; Schalow 1994; Heffernan 1989; Hanna 1984; Ghanotakis 1981; Kersten 1973; Kersten, F. (1973)Crosson 1962).

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The same concept of topological psychological time allows for reinterpreting the concept of "coherent state" (respectively, "quantum state before measurement") in a way admitting the attachment of time to it, but only topological rather than any metrical one. For example, any operator (thus inherently metrical) is rejected to the eventual quantity of quantum time (i.e., the own time of any quantum entity by itself) in classical quantum mechanics or within Pauli's "particle paradigm". Now, one can anyway introduce "time operator", however only topological, i.e, some homeomorphism visualizable as a certain "deformation" due to "entanglement" (also generalized not to be metrical, but only topological), rather than any metrical one including particularly any Hermitian one. Summarizing, the distinction is the following: classical quantum mechanics excludes any time operator; ontomathematical psychology excludes only any *metrical* time operator thus admitting certain topological time operators, i.e., homeomorphisms, due to entanglement in the final analysis.

The above example demonstrates that ontomathematical psychology, though generalizing Husserl's original design of phenomenological psychology, is quite and fundamentally different from any psychological doctrine in the framework of Modernity, which need the human being only to which any psychology is attachable therefore reestablishing Socrates's human problematics once again, now in psychology as a necessary condition for it. On the contrary and rather figuratively speaking, ontomathematical psychology, being inherent to "transcendental subject", might be called a "theory of God's psychology", just by virtue of which it is relevant to a physical discipline such as quantum mechanics.

As that is well-known, Martin Heidegger, Husserl's assistant, undertook an impressing project to describe that kind of "God's psychology" though "phenomenologically" rather than ontomathematically, in which the philosophical category of "Time" (understood after Husserl's phenomenological generalization of it) is fundamental therefore correlating to what it refers, called by Heidegger the "Being", furthermore heralded by him to be true subject of philosophy being in "oblivion" in Modernity, and only restored by his "Sein und Zeit". So, the standard conception of metrical time corresponds to a too limited area of the material and physical world only accessible to science, called by Heidegger the "existent" (or "existing"), just as the generalized phenomenological doctrine of "Time" (which is to be ontomathematically understood to be topological) corresponds to the restored "Being". the true subject of philosophy as well as that of his "fundamental ontology".

However, his project fails where he started to describe that restored subject of philosophy, "God's psychology" i.e., "fundamental ontology" since Heideger substituted it with human psychology, at that retrospective, at that only after Heidegger's own retrospection, thus being absolutely arbitrarily chosen and unreasonable otherwise than by virtue of Heidegger's unique genius comparable with those of the founders of great religions, such as Jesus or Muhammad. Consequently one is only to believe in his "fundamental ontology", just as in Christianity or Muslimanity, or respectively, in "Sein und Zeit" just as in the Bible or the Quran.

From the present viewpoint of ontomathematics, Heidegger's failure to describe adequately and objectively "God's psychology" is due to the likening to human psychology and then the replacement by Heidegger's own psychology, at that, by absolutely arbitrarily chosen retrospective fragments of it, the validity of which cannot be justified otherwise than by the "divine election" of Heidegger himself. In the final analysis, the cause can be revealed in his

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basic philosophical and theological education unlike Husserl's mathematical one. Speaking loosely and figuratively, Heidegger "entered philosophy" violating the prohibition "Let no one who does not know geometry enter here"[22], the putative inscription over the gate of Plato's academy, unlike Husserl himself, after whom phenomenology is rather easy to be interpreted ontomathematically as above.

Unfortunately, Heidegger's ignorance of mathematics was shared by almost all philosophers, by practically all humanitarian or artistic intellectuals for whom the knowledge of mathematics is even a vice or stigma, dishonoring those who are branded with them. So, Heidegger's "existentialism" (regardless of his refutations and protests) was widely propagated and disseminated by modifications among the Western (and not only) intellectuals unlike Husserl's original doctrine limited to the professional philosophers. Thus and rather paradoxically, the crucial deficiency of "Sein und Zeit" turned out to be his main advantage.

Heidegger himself rejected his initial philosophical worldview (declared in the work at issue as "fundamental ontology") after the so-called "turn" [die Kehre]. He gave up such radical generalizations at all, restricting himself rather only to criticism of Western philosophy in Modernity, partly substituting it by "Language", understood philosophically as a universal medium able to overcome the Cartesian dichotomy. Indeed, still Aristotelian logic appears and crystallizes from that medium conserving its fundamental property and advantage not to distinguish "things" from "ideas" and thus to correspond to what should precede ontology in an Aristotelian manner after "destruction", another philosophical method, newly introduced by Heideger.

The transition to "Language" can be characterized to be "a step in the right direction" from the viewpoint of ontomathematics. Indeed, the *language* of nature is sometimes granted to be the universal subject of mathematics. Of course, Heidegger himself did not make that next step which would correspond to the further destruction of the history of philosophy: from Heraclitus and all pre-Socratics to Pythagoras and his school. Heidegger's understanding of language, even in his interpretation as the philosophical category of "Language" remained rather humanitarian, i.e., "human, too human" regardless of his claim to overcome the limits of the Socratic "human problematics".

IX THE VANISHING "FIGURE DRAWN ON THE OCEAN BEACH SAND", OR HUMANKIND AFTER THE "LAST MAN"

After the "turn", Heidegger emphasized the relation of his doctrine to the Socratic "human problematics" in philosophy, which, figuratively speaking, should vanish after his "destruction" of the history of philosophy from Plato's or Aristotle's philosophy to the Presocratics. Michel Foucault ended his famous work "Les Mots et les Choses: Une archéologie des sciences humaines" (1966) with the picturesque and frequently cited metaphor elucidating

[22] Harries 2010. Nonetheless, there exist papers about Heidegger's viewpoint to mathematics or to natural sciences (e.g., Kochan 2017; Ma, Brakel 2014; Bagni 2010; Dea 2009; McManus 2007; 1999; Glazebrook 2000a: Roubach 1997; Kovacs 1990; Kockelmans 1985; Rouse 1985; Kolb 1983; Kisiel 1977) ; also in comparison with Husserl (e.g., Carson 2010; Videla 1994; Kockelmans 1989; Cahoone 1986; Kisiel 1973;

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quite clearly Heidegger's own position on "humanism" especially briefly and visually as a vanishing figure drawn on the ocean beach sand, which the next tide will obliterate.

Obviously, the conception of ontomathematics shares an analogical viewpoint to the "human problematics", partly reinterpreted in Modernity after Cartesianism where people are the only possible arbiters about whether "mind" and "body", a mental image and its material reference, a mathematical model and that area of reality to which it relates, etc. correspond to each other or not. The so-called correspondent theory of truth traceable back to Aristotle or maybe even to Plato establishes the same position for people. On the contrary, Heidegger's "Aletheia" does not need any more human beings to decide for it. Thus, Heidegger's viewpoint to the human problematics can be outlined in "Sein und Zeit" since he referred to Aletheia before the "turn" just as after it. Furthermore, the link between Aletheia and ontomathematics is made clear above.

One can stare at the formalization of people as arbiters. The essence of any arbiter is to decide, thus to make a choice between two or more alternatives. So, the conception of information in ontomathematics able to unify the physical world and mathematical models in a philosophical way and approach reduces people to a formal substance both mental (or mathematical) and material (or physical) underlying all and embedded in all. That "depersonalization" or "dehumanization" of choice, taken from people and transformed into the universal substance of information, can be revealed in the free will theorems (Conway, Kochen 2006, 2009), called so by their authors, who themselves explained their philosophical sense as follows. If one grants free will to the experimenter, i.e. a human or a group of humans, a few statements in quantum mechanics and special relativity implies for any quantum entity (for example, an electron) and thus, for all in the universe to share the same "valuable commodity of free will". One might conclude rather figuratively that the experimenter's free will implies that an electron also possesses free will once quantum mechanics and special relativity are true (the idea of the electron's free will was so disgusting as to Einstein that he wrote in a letter to Max Born that he would prefer to be a croupier in a gambling house or a shoemaker rather than a physicist if that is the case[23]). Applying *modus tollens*, if the electron's free will at issue is rejected, any experimenter or theorist such as Einstein himself does not possess free will as well.

Consequently, the "free will theorems" demonstrate in a formal and mathematical way that the validity of the substitution of human free will by an omnipresent and omnitemporal substance of information, which can be rather figuratively interpreted as a universal substance of free well shared by Einstein and the "electron" in question, follows from quantum mechanics and special relativity. Thus, the human figure outlined on the ocean beach sand will be really obliterated by the next tide of cognition (e.g., ontomathematics).

However, Foucault's metaphor ends his voluminous work (though in a single volume), the subtitle of which is: "Une archéologie des sciences humaines". Socratic human problematics has penetrated all the Western philosophy since Plato's age, and far not only: all the Western civilization after Christianithy and the myth of Jesus, the Godman sacrificed Himself and Who was sacrificed by God, His Father for the Salvation of humankind. So, its real constituting action has not to be restricted within the framework of the "Human Sciences", it penetrates Western

[23] Einstein 1926.

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civilization thoroughly, particularly, the natural science not less than the former. Thus, the obliteration of that "outline of a human figure on the ocean beach sand" is to be related directly to the sciences of nature, even to mathematics, as well and not less.

However, the "outline of a human figure" is not so discernible in natural sciences and mathematics. So, it should be made clearer initially, and only then to be "obliterated by the next tide of cognition", by ontomathematics properly. One is to demonstrate separately the "head", the "face", the "arms and hands", the "legs", the "carcass" of the "human outline" in the latter sciences not being so obvious as in the former case. First of all, the "human outline" at issue is local rather than nonlocal, "light" rather than "dark", "empirical and experimental" rather than "speculative and theoretical", "bodily, physical, and material" rather than "mental, spiritual, and ideal". The present context is to pay especially attention to "its outlines" in quantum mechanics: energy conservation, unitarity, Hermitian operators; Pauli's particle paradigm, and the Standard model; as well as in mathematics where it can be notated by the concept of "Gödel mathematics", already elucidated in much more detail and relations in the previous four parts of the present study.

Here is why the "human outline" in natural sciences and mathematics is inherently local. One might initially visualize rather loosely it as situated in-between the Cartesian abyss, being the only arbiter (excluding "God Himself") whether any two entities such that each of which belongs to the one of both shores of it corresponds to each other or not and thus possessing a unique monopoly right to mediate between them, or speaking metaphorically, to trade between "them", or to control both "geopolitically". On the contrary, if the two opposite shores are linked nonolocally, the human mediator between them turns out to be redundant, or figuratively, "obliterated by the next ocean tide". This means that the outline in question is tautologically local after the application of *modus tollens*.

"Mach's principle", both in original and in Einstein's formulation as to general relativity are other illustrations of the same figure in natural science and physics. Mach's empiriocriticism establishes empirical experience and experiments (both definitely related to human beings whether as observers or experimenters) as the ultimate limit of all theoretical conceptions and notions therefore excluding all too far reaching and remote abstractions as metaphysical speculations absolutely fremd to the true spirit of science, including those of his self-proclaimed "disciple" Einstein. Those ostensibly speculative scientific abstractions try to release and emancipate from the human arbiter's absolute domination, and Mach's rhetoric stigmatized their common "rebel". In fact, just analogical, empirically and experimentally "groundless" abstractions introduced by quantum mechanics, such as entanglement and quantum information, will provoke the "obliteration of the human figure", including as in the present study.

The confirmability by empirical experience and experiments includes their absolute repeatability borrowed from classical science, but contradicting the principles of quantum mechanics, especially its fundamental probabilisticality, in turn being a necessary condition for entanglement and quantum information. The demand of absolute repeatability at issue also belongs to the "human outline" in natural science. This means that any result whether by observations or experiments needs its human corroborated sanctions to be always unambiguous. Even a single negative result, for which a certain external cause or reason cannot be determined, falsifies and rejects it. Thus, all inherently probabilistic phenomena of entanglement are canceled

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by that requirement for absolute repeatability; as well as vice versa: the establishment of entanglement and quantum information (for example, by the 2022 Nobel Prize in physics) obliterates that "human figure" at least in quantum mechanics, in which the conjecture of it implies paradoxes such as "Wigner's friend" or the creation of reality by the experimenter.

That Nobel Prize took place just a century after Einstein's one, though awarded not for his grandiose discovery of general relativity. Einstein's formulation of "Mach's principle" (1918) states that only mass and energy may be the source of gravitation therefore anticipating in advance all troubles about quantum gravitation and even "dark mass" and "dark energy". As to the present context, it means that the source of gravitation is only local, particularly excluding entanglement as an eventual source of gravitation resulting locally into the "mysterious" dark mass and dark energy, at that crucially prevailing in the universe.

The previous few paragraphs do not claim to describe in detail the "human figure" in natural science, but only to demonstrate that it is crucial there just as in humanities and arts. The scientific "common sense" often blasphemed and stigmatized quantum mechanics for its alleged subjectivity to be ostensibly anti-scientific and does this sometimes even now. In fact, that subjectivity is only seeming and originates from the Cartesian postulate of the abyss, the only bridge over which human beings (besides "God Himself") such as observers and experimenters can be. On the contrary, quantum mechanics, and quantum information explicitly and especially, link its two shores directly, i.e., without the mediation of any human arbiter to decide about the correspondence between them in each given case.

However the dominating nowadays paradigm of classical quantum mechanics restores and establishes a modified human outline resisting the initial revolution by quantum mechanics recently embodied in the revolution of quantum information. The linked parts of the human figure in classical quantum mechanics are enumerated above: energy conservation, unitarity, Hermitian operators; Pauli's particle paradigm, and the Standard model. Their common essence consists in postulating that the quantum world is fundamentally similar to that of classical physics or all humans' everyday experience, in which Modernity needs the "human outline". Thus, if the quantum world is analogical in principle, it needs the human figure at issue and not less.

As to the relevant human frame in mathematics, all the previous parts of the present study described it coining the concept of "Gödel mathematics" meaning just mathematics in Modernity, in which human arbiters are only authorized to decide about any "mathematical model" utilized by a physical theory corresponds to "reality" or not. Thus, an additional description now, about how Gödel mathematics is "human" and how Hilbert mathematics "obliterates" its "human outline", is redundant.

X INSTEAD OF CONCLUSION: THE WESTERN PHILOSOPHY OF MODERNITY: AN ISLAND OF LOCALITY AMONG THE BOUNDLESS OCEAN OF ONTOMATHEMATICS

The horizon of ontomathematics implies particularly another interpretation and another reflection different from the claim of Western philosophy (especially that of Modernity) for universalism. On the contrary, situated within ontomathematics, it turns out to be an "island ideology" magnifying Modernity to be all: in fact, a quite particular viewpoint valid and limited

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to its boundaries proclaimed to be universal, even the only possible one. Furthermore, that "island ideology" is "humanistic" in a bad sense heralding that figure "outlined on the ocean beach sand" (sketched and "obliterated" in the last section) to be eternal and thus a necessary condition for cognition.

That island of Modernity and "Humanism" in the just mentioned bad sense is relatively insignificant compared with the boundless "ocean" of ontomathematics, among which and thanks of which it exists. Its magnitude is accordingly insignificant and might be quantitatively estimated by the ratio of the "light" universe to the "dark" one as 1/20 (or 5%) approximately. Thus, that quite tiny segment of land inhabited by humans is glorified to be all the universe, even more, the entire being reflected philosophically, only by virtue of the fact to be inhabited by humankind, or speaking metaphorically, to be the "homeland" of all humans.

Though the childhood of humankind cannot but be home, it will become sooner or later "adult" and will leave home to investigate that boundless ocean among which is the island where it's home is built. So, philosophy of Modernity, though rather implicitly, is a "homebody ideology" in the final analysis, therefore contradicting the human nature directed always beyond, out of the already mastered region, figuratively speaking, to the stars and space, to the "Cosmos" of the Ancient Greeks.

However, that visible "Cosmos", to which humankind's dreams were directed until now, turns out to be that relatively insignificant island, on which humankind's home is built and where it is born, the Earth and the universe observable from it. Maybe, there are other homes, in which "alien-kinds" live on the same island, and we will manage to connect them in the future. The newly discovered horizon of the ocean of nonlocality allows for another speech figure about messaging aliens utilizing the nonlocal communication of "instantaneous" teleportation beyond spacetime. We attempted to link with them "through the island" until now, thus obeying the postulate of not exceeding the speed of light in a vacuum though knowing that our messages would travel many years, centuries, and millennia until they might reach to whom they are addressed.

So, those periods of time make nonsense of our undertakings such as "CETI" to connect the eventual "brothers-and-sisters-in-reason", however we have wrongly granted that the messages "through the island" are only possible since our cognition of nature has been too primitive. Though the alleged or cherished aliens would be "islanders" just as ourselves, the messages through the ocean of nonlocality could be much more perspective and even utilized a long time ago by the more advanced alien island civilizations teleporting messages or maybe nonlocally trading between each other since millennia, timidly expecting for humankind to become "adult" enough to apply for being a participant in the nonlocal "Universe Trade Organization".

Theoretically, there does not exist any prohibition for "nonlocal aliens", "brothers-and-sisters-in-reason" as well, differing from all "islanders" only by their habitat, the nonlocal "ocean". In fact, the "body" as an obligatory carrier of any "mind" is a necessary condition only for the "island" of locality, where the former is absolutely separated from the latter and Cartesianism makes sense, though it is quite meaningless to the ocean of nonlocality (as the present study demonstrates, in particular) ot to its eventual reasonable habitants, "nonlocal aliens". They might be seen from the islanders' viewpoint as "Pure Reason", i.e., as

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“mind” without any “body” as its carrier in general, or able to create whatever material “body” if need be (for example, to reside on the “island” as a certain local body).

On the pole of philosophical reflection featuring the present text, Kant’s doctrine of transcendentalism is also relevant only “on the island”, and the description of the nonlocal ocean as “Pure Reason” cannot be any more likened to an arbitrary metaphysics or to a loose play of human imagination and fantasy. It obeys rigorous laws though generalized to those relevant to the “island of locality” (for example, being probabilistic rather than deterministic, admitting “religious miracles” just as quantum mechanics allows for “tunnel transitions” under certain conditions).

So, a new perspective might be spotted on the horizon of ontomathematics: that of “scientific theology” or “theology as a rigorous science”. Indeed, Kant’s “Pure Reason” can be interpreted as a philosophical euphemism of “God”: and if science may study that “Pure Reason”, that would be “scientific theology” in fact. Religion and thus theology can only postulate “God”, and “Belief in God” is a necessary condition for both, distinguishing them from science, for example situated beyond Popper’s “demarcation line” between metaphysics and science. Though science can also postulate certain statements, there is no need for “belief” in them since the postulates imply checkable corollaries or conclusions able to be “falsifiable” (after Popper), and rejecting eventually the postulates themselves by virtue of “modus tollens”. On the contrary, the theologian conclusions or doctrines need belief not less than the initial postulates, not being testable.

Scientific theology of “Pure Reason” would suggest experimentally verifiable or refutable statements, though inherently probabilistic, but just as such an exact and experimental science of quantum mechanics really does. In other words, the experimental research of the nonlocal “Pure Reason” would be similar to that of nonlocal correlations, particularly investigating physically the “creation from nothing” substituting the quasi-scientific myth of the “Big Bang”.

Summarizing, the abandonment of “the islanders’ ideology of locality, in fact penetrating all the Western culture and civilization reveals newly vast perspectives consistent to the horizon of ontomathematics. Those enumerated above quite cursorily sketch them only to demonstrate their availability, omitting thoroughly their consideration in detail as well as many others, even not mentioned at all (e.g., those of “mathematical psychology”, “quantum parapsychology”, the nonlocal “mind-body “ theory, etc., etc.).

However, the contemporary total organization of society (even pluralistically consisting of many hierarchies incommensurable to each other) does not correspond to ontomathetics needing rather a liquid social medium (a rough illustration of which might be today’s “social media”) thus relevant to nonlocality rather than to any local hierarchies. So, one might expect for forthcoming social revolutions though “velvet” rather than “blood” as in the past, but nonetheless necessary for the establishment and domination of that global homogenous social medium over any local hierarchies.

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