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On an Axiomatic Foundation for a Theory of Everything

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Whether a unified theory of everything (TOE) is possible or not is a philosophical question and yes or no can be chosen in a two-valued logic system. Currently the two schools are in conflict with each other. Based on the relativity of simultaneity axiom proposed in this paper, the present author suggests to use a midway philosophy to replace the present materialist philosophy for modern sciences; then this conflict together with many other conflicts among different theories such as classical mechanics (CM), general relativity (GR), and quantum mechanics (QM) can be solved and a unified theory of everything for the world we can observe can be constructed. In this paper, the axiomatic foundation for a TOE is proposed which contains six fundamental axioms. Various problems related to these foundational issues are discussed. It is hoped that the present paper might show a new promise and a new direction for TOE which would be helpful for the further development of modern sciences.

Keywords: axiom, mind-body problem, the demarcation problem, cause-effect law, theory of everything (TOE)

Introduction

A theory of everything (TOE) is a hypothetical single, all-encompassing, coherent theoretical framework of physics that fully explains and links together all natural and social aspects of the world we can observe. Constructing a TOE is a pursuit of many philosophers and scientists including Aristotle, Newton, Laplace, Einstein, but it still remains one of the major unsolved problems in physics (Overbye, 2020). It may be worth pointing out that in this definition I have modified specifically by confining the system scope to the world we can observe which is just a small part of the whole universe. Furthermore, both natural and social aspects of the world are included.

Whether a unified TOE is possible or not is a philosophical question. In a two-valued logic system, people can either choose yes or no. From the ancient times up to the born of quantum mechanics, most of the people select yes because they believed that the universe is operated with laws and our human beings can reveal these laws. These are the famous epistemological problems in philosophy. Albert Einstein is a good example of this belief (Whitaker, 2006). This belief led to the exploration of the universe and in order to explain the observed phenomena and predict the future events about the physical phenomena in the universe, many concepts have been defined and later many theories have been developed. In ancient times, people treated the universe as a whole; there was no division of subject areas. So very often, a scientist was also a philosopher or a religionist such as Lao Zi (571-471 BC), Confucius (551-479 BC), Siddhārtha Gautama (563-483 BC), Aristotle (384-322 BC). This approach to view the whole universe as an entity is later defined as a holistic approach from a system

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perspective (Bertalanffy, 1968). The occurrence of these greater philosophers can be regarded as the first peak time of scientific exploration and the period of ancient history from about the 8th to the 3rd century BCE was often called the Axial age. They applied a holistic approach to construct different theories to explain all the phenomena in the universe, and Daoism, Buddhism and Greek Philosophy are typical examples of such TOE theories (Capra, 1975).

Later, people introduced a reductionist approach to study the so-called objective problems and left the subjective life issues to religionists. The reductionist approach divides a mechanical system into several subsystems and studies the subsystems quantitatively by introducing many measurement methods together with logical analysis methods. It was first divided into religion and philosophy; the former studies the life of human beings while the latter studies the natural objects in the universe except human beings. The main achievement of the former was the Christianity and this theory can explain quite a lot of phenomena after civilization but attributed all the unknowns to the concept of God. For the latter, an experimental approach was introduced to test the theory and Galileo Galilei was one of the big contributors (Dugas, 1957). After that, people further divided philosophy into philosophy and science. All those theories that can be tested with experiments or observations are called science while the rest is called philosophy. People who adopted the reductionist approach believed that the explanation of a complex system can always be made in terms of their individual, constituent parts, and their interactions. Since human beings live in the universe, there are some overlapping areas among philosophers, scientists, and religionists. There was a long war between philosophers/scientists and religionists from 5th century to 16th century. Galileo observed the universe through the telescope and found it was different from what was told in Christian religion. Through a list of great scientists' efforts, scientists finally won the war and Newtonian mechanics was born (Newton, 1846). This can be regarded as the second peak time of scientific exploration and people gradually accept that sciences are superior to the Christianity. Newtonian mechanics was further developed into classical mechanics (CM) by many scientists, such as Euler, Lagrange, Hampton (Dugas, 1957). Classical mechanics was so powerful and at that time, some scientists optimistically thought that classical mechanics might be the final theory for the universe. On Friday, April 27, 1900, the British physicist Lord Kelvin gave a speech entitled "Nineteenth-Century Clouds Over the Dynamical Theory of Heat and Light" which began "The beauty and clearness of the dynamical theory, which asserts heat and light to be modes of motion, is at present obscured by two clouds" (Kelvin, 1931, p. 1). Classical mechanics can be regarded as the second generation of TOEs in the human history. However, these two small clouds resulted in the separate developments of general relativity (GR) (Einstein, 1916) and quantum mechanics (QM) (Bohr, 1913). This can be regarded as the third peak time of science development. These two theories are based on two different and conflicting philosophical foundations and are also different from the philosophical foundations of classical mechanics. While GR was still based on a causal-effect law, but QM gave up this law and it was assumed that the nature of micro world is random. Heisenberg derived an uncertainty principle to emphasize this point (Heisenberg, 1927; 1930). Einstein was very unhappy with this interpretation of quantum phenomena and a long debate was carried out between Einstein and Bohr (Whitaker, 2006). However, from this development process, we realized our limitation to know the external world, no matter macro or micro worlds. Due to this limitation, uncertainty will always exist for a complex system, whether these uncertainties can be reducible or not divided scientists into two schools: deterministic vs. probabilistic.

Later people applied the principles of classical mechanics to study life and various subjects in life sciences have been developed. In the 1920s to 1950s, people realized that for organisms, the whole is greater than the parts and a purely reductionist approach seems to be inadequate, and it must be combined with a holistic approach. Thus, the general systems theory (GST) was developed (Bertalanffy, 1968). Von Bertalanffy's objective was to bring together under one heading the organismic science that he had observed in his work as a biologist. His desire was to use the word "system" to describe those principles which are common to systems in general. In GST, he writes:

> …there exist models, principles, and laws that apply to generalized systems or their subclasses, irrespective of their kind, the nature of their component elements, and the relationships or "forces" between them. It seems legitimate to ask for a theory, not of systems of a special kind, but of universal principles applying to systems in general. (Bertalanffy, 1972, p. 41)

Currently most people in the scientific community intend to believe that it is impossible to construct a TOE (e.g., Jaki, 1966; Schmidhuber, 1997; Dyson, 2006; Hawking, 2006; Feferman, 2006; Robertson, 2007; Weinberg, 2011) while few people intend to believe it is possible and make the claim that they have constructed a TOE (De Aquino, 2012; Shen, 2013; Gong, 2016; Lee, 2019; Cui & Kang, 2020). Of course, none of these TOEs have been accepted by the scientific community.

In order to answer whether it is possible to construct a TOE, many other fundamental questions should be addressed such as: What is a theory? How to judge a theory to be scientific? What are the potential consequences for the different selections of axioms? It is the author's belief that by removing the philosophical contradictions among CM, GR, and QM through generalizing GST, a theory of everything (TOE) can be developed. The purpose of this paper is to discuss these fundamental issues related to the axiomatic foundation for a TOE.

Definition of Science and the Demarcation Problem

Currently we are living in an era of scientific rule (Walach, 2019); one's research proposal is hardly to be funded from society if he is accused to do pseudoscience. However, a universally agreed criterion to demarcate science from pseudoscience does not exist (Blachowicz, 2009; Johansson, 2016). This criterion problem is the famous demarcation problem after Karl Popper (1963). In order to build the criterion, the first thing we need to do is to provide a definition for science. Unfortunately, there is no universally agreed definition. By searching the definition of science in the Google engine, one can find many different definitions at Dictionary.com, at Merriam-webster.com, in Cambridge dictionary, in Collins dictionary and even those from science council and Wikipedia. I am not happy with any of these existing definitions and I think each existing definition only covers part of the scope. By a combination of all the meanings in the existing definitions, I offer the following definition for science:

Science is a set of clearly defined and logically consistent knowledge about the structure and behavior of the natural and social systems obtained by watching, measuring, and doing experiments in the form of testable explanations and predictions about the system we can observe within the world we are living.

In this definition, I particularly emphasize that science can only study the system we can observe which is of finite nature both in time and space. The concepts must be clearly defined, and axioms and laws must be logically consistent. Thus, I automatically give up the possibility for a TOE for the whole universe which is out of human beings' observation and untestable.

How to judge a theory to be scientific or not, people have also attempted to build some criteria. Currently, there are two criteria. One is the falsification criterion proposed by modern philosopher of science Karl Popper (1963) and the other is replicability (or repeatability) as a demarcation criterion of science from pseudoscience. Braude (2018) provided a detailed discussion in an “Editorial” and his conclusion is that repeatability cannot be used as the criterion. Ellis (2014) has dedicated one section (Section 6.3) to present his criterion to be a scientific theory using a systematic approach. The criterion covered four categories of satisfactory structure, intrinsic explanatory power, extrinsic explanatory power, observational and experimental support. Each category includes several aspects. I think that his criterion is too complicated and many of the items are hardly operational, for example, the criteria for satisfactory, simplicity, beauty, connectedness to the rest of science and the extendability. In how to present a scientific theory, Maudlin (2018) thinks that a canonical presentation of a physical theory shall specify six aspects: (1) the fundamental physical ontology; (2) the spatio-temporal structure; (3) the mathematical items; (4) the nomology; (5) mathematical fictions; (6) derivative ontology. I quite agree with his opinions but these seem to be too detailed as a criterion. Therefore, in conjunction with Ellis criteria, Maudlin’s requirements, and my own definition of science, I re-formulate my dynamic criterion for a scientific theory based on a general system theory approach:

(1) Clear definitions: including the object to be studied, the scope of the study, the important concepts, the undefined concepts. Undefined concepts are those concepts which are taken for granted in the dictionaries. In the definitions of the object and scope for a system, the ontology behind is involved and it should be specified clearly for the easy understanding of the theory (Maudlin, 2018).

(2) Logically consistent: Every scientific theory has at least four components: axioms, laws, logical analysis methods, and phenomena. All axioms are inducted from finite observations. All laws can be derived through the logical deduction from axioms.

(3) Unfalsified yet: including no counterexample or paradox is found to be against the axioms and laws; the undefined concepts are reasonable; the logical deduction process for every law is correct.

In my criterion, I specifically give up the completeness required by Einstein (Einstein, Podolsky, & Rosen, 1935). It is my belief that no theory can be claimed to be complete since the system itself is of open nature and our understanding to the system gradually deepens.

Different from Popper’s opinion that there exist some absolute non-falsifiable statements, I declare that every statement is relatively falsifiable. For example, although one may not be able to find a counterexample to falsify an axiom, he may be able to derive one paradox from this axiom if this axiom really contains some problem. Today someone has not found the counterexample does not mean tomorrow he will not be able to find. That is the nature of science. Thus, my criterion of demarcation to draw a sharp line between those theories that are scientific and those that are unscientific is dynamic. If our human beings have not falsified the axioms of a theory, it is still a scientific theory; otherwise if we have found a counterexample or a paradox of a theory, then it is unscientific. But if the application range is refined to the scope where the counterexample or the paradox can be removed, it is still a scientific theory. Newtonian mechanics is a typical example and, in the future, many modern scientific theories such as GR and QM may also be subjected to this type of revision. It is my belief that science is adequate to falsify an unscientific statement but inadequate to prove a statement to be a truth if we define truth to be universally correct. In that sense, Popper’s falsification criterion can be used to demarcate science from pseudoscience. Otherwise, it is logically inconsistent. If one can judge a statement to be falsifiable, it will have two results: One is true and the other is false. If we still retain the false within science, it conflicts with the mission of science. Of course, any individual claim to make the ultimate judgement of falsification is certainly an over-claim. He has no tool to make that judgement. Repeat of 1,000 times does not guarantee that the 1,001th time will repeat again. Up to now, there has not been found a counterexample against the axiom; it does not guarantee that there will be no counterexamples against the axiom in the future. So, every axiom and law used in a scientific theory is only of relative or temporary correctness and it should not be regarded as a universal truth. If someone takes an axiom or a law to be a truth, it is his belief rather than the scientific evidence. The attitude itself is not very scientific since scientific spirit encourages people to question every axiom or law.

A theory can be presented in many different formats such as Confucius Theory, Daoism, Buddhism, Christianity but the axiomatic approach was adopted in modern science. Archimedes was possibly the first philosopher to have described nature with axioms (or principles) and then deduce new results from them through logical analysis methods. Thus, every scientific theory has at least four components: axioms, laws, logical analysis methods, and natural phenomena. Axioms are fundamental assumptions called hypotheses and most frequently through logical induction from the observed natural phenomena. Hypotheses do not need to be proved, but if a counterexample is found against one hypothesis or a paradox is derived if one accepts this hypothesis, this hypothesis is proved to be wrong. The laws can be derived from the logical deduction from axioms. Gödel (1931) has proved that at least one hypothesis cannot be proved within the theoretical framework. Thus, selection of the fundamental axioms (hypotheses or postulates) is the starting point of a scientist to construct a scientific theory. This selection is the reflection of his philosophical belief and different selections can create different scientific theories. Co-existence of orthodox quantum mechanics and Bohmian mechanics for explaining the quantum phenomena is a typical example of this selection.

Why Do I Select Yes for TOE

After the acceptance of the Heisenberg uncertainty principle (Heisenberg, 1927; 1930) and the orthodox quantum mechanics, most of scientists have selected no for TOE (Jaki, 1966; Schmidhuber, 1997; Dyson, 2006; Hawking, 2006; Feferman, 2006; Robertson, 2007; Weinberg, 2011). However, my opinion is that while a TOE for the whole universe is really impossible since it is out of the observation of our human beings, whether a TOE for the world we can observe exists or not is a philosophical problem and it depends on the choice of scientists. If all scientists select impossibility and give up the study, the TOE will never be born. However, if some scientists select to believe the possibility of TOE and make continuous efforts to construct the TOE, it is possible to be created. The development process of every scientific theory has followed that path. Any claim about the impossibility of future events is fundamentally an over claim, and it could be right or wrong. It is beneficial for the development of science if one selects yes while it prevents the scientific development if all the people select no. Furthermore, I have the following reasons to support my belief on yes for TOE.

(1) System is a very general concept and every problem we encounter can be modeled as a system. According to Bertalanffy (1968), a system is a group of interacting or interrelated entities that form a unified whole. A system is delineated by its spatial and temporal boundaries, surrounded and influenced by its environment, described by its structure and purpose, and expressed in its functioning. A schematic representation of a general system is shown in Figure 1.

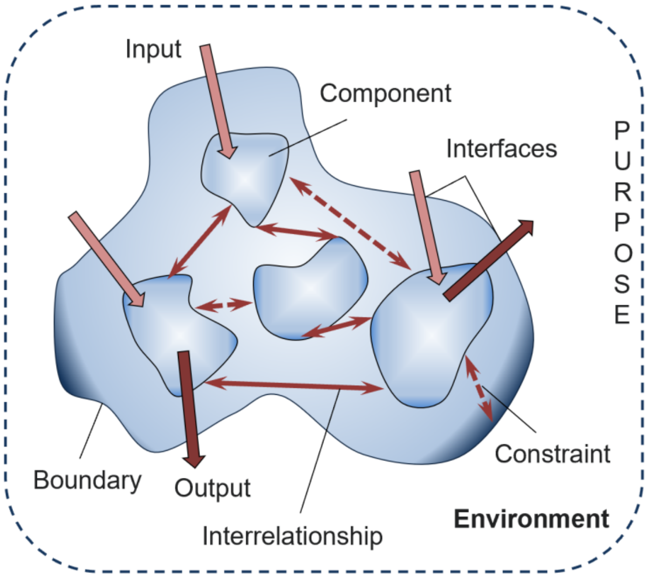

Figure 1. A schematic representation of a system.

(2) The universe is a whole entity; all the objects within the universe have interactions with each other. For example, each observable object will have mass and according to Newton's law of universal gravitation, every particle attracts other particles in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers. If the particle has other properties such as charge, then other types of forces exist among these particles.

(3) Theory is a construct of human beings. For a given system, the general system theory (GST) can always be employed to construct a mathematical model for the system. Currently we have classical mechanics for macro systems, quantum mechanics for micro systems, and relativistic mechanics for cosmic systems. The only problem existed is that the three theories are based on different axioms and there are some contradictions among these axioms.

(4) Unification has made progresses. After the occurrence of Einstein-Bohr debate (Whitaker, 2006), many progresses in the unification direction have been achieved. String theory (Zwiebach, 2004) and M-theory (Duff, 1996) are two examples which have been accepted by the mainstream of scientific community as the potential candidates of TOE while others are just their own claims (De Aquino, 2012; Shen, 2013; Gong, 2016; Lee, 2019; Cui & Kang, 2020).

(5) The consequence of yes is better than no. Firstly, as pointed out earlier, select yes is more beneficial for the development of science. Secondly, if many theories are used to handle different systems, the contradictions and paradoxes existed among these theories cannot be resolved. Thirdly, in order to completely resolve the "tool" problem of science that science is a tool and it could have good and bad effects (Mao, 2019), we need to construct a TOE by unifying religion, philosophy, and science. This is possible within the dualist mind-body model which will be explained in the next section. Without the cause-effect law for human behaviour, the altruism has no philosophical foundation, and this is the root of many social problems (Mathew et al., 2016). Thus, the main task of science is to reveal this cause-effect law for everything in the world we are living, especially the cause-effect law for human behaviour.

Fundamental Axioms Required to Develop a General System Theory

The Relativity of Simultaneity Axiom

From the definitions of science and systems, we can find the phenomenon that in order to define a concept, we need to rely on other concepts. We do not accept such a definition that A is A, but we accept the definition format that A is B with some characteristics. To describe the characteristics, some other concepts have to be referred. So, we can conclude that if we want to describe something, we at least need to use a pair of concepts (two-valued logic), and sometimes more concepts (multi-valued logic). For example, in order to have the concept of existence which is defined as something we can observe, touch, feel, or even imagine, then nonexistence should be defined and it can be called either emptiness, or vacuum, or nothingness etc. For the observable objects, we can divide them into human beings and non-human beings known as nature. Before Einstein, people often thought that nature is independent of human beings. As a matter of the fact, nothing is independent of human beings, even dependence and independence are defined by us. Every concept is defined by human beings, and its properties are measured and interpreted by human beings. Therefore, knowledge is subjective if we regard nature to be objective. In quantum mechanics, this subjective nature of knowledge is more obvious from the famous “measurement problem” (Oriols & Mompart, 2019). From this observation, we can induce the following axiom:

TOE-A1: The relativity of simultaneity axiom: There is no such thing as a perspective-independent existence. Every described existence is a relative existence since the concept of existence depends on other concepts, at least its opposite or complement.

By opposite or complement we mean that for a given space Ω, if we divide it into two sets A and B, A and B are mutually exclusive; then B is the opposite or complement of A. This can be denoted as $B = \neg A$ or A^c. This is the most fundamental law for our new general system theory or TOE for the world. If we check the existing theories, one may find that most of the scientific theories violate this axiom since they are based on materialism.

When checking the consistency of concept definitions, there will always be a self-circulation in the dictionaries, while in a particular science, this problem is hidden because of the dependence on the dictionary. Self-circulation for some unimportant concepts may not be a problem but self-circulation for some important concepts could lead to paradoxes in sciences (Clark, 2007). So, in each scientific theory, which concepts are taken for granted and which concepts are specifically defined must be clearly stated in order for communication. Currently, this problem becomes very severe and for many daily used concepts such as matter, field, consciousness, energy, mind, information, entropy, universe, world, are understood very differently by different persons. For example, what is the difference between matter and energy? Is energy a more fundamental existence than matter or energy is just a property of matter? In my previous paper, I treat energy as a fundamental existence similar as dark matter and dark energy used in the Big Bang cosmological model (Cui & Kang, 2020), but now I more intend to believe that energy is just a property of matter. The universe only exists matter and non-matter. Matter can be divided into visible matter and invisible matter. The invisible matter can be called dark matter, and the energy contained in the dark matter can be called dark energy similar as the energy contained in the visible matter.

The Important Pairs of Concepts for the General System Theory

Based on the relativity of simultaneity axiom, we always need to use at least a pair of concepts to describe the structure and behaviour of a system. For example, if we need to define changes, then we need to have the concept of rest. If we need to describe the detailed changes, then we need to define time-space framework. The following pairs of concepts are redefined and regarded as the important concepts.

Universe/world. In the past, we have used universe and world to describe the spacetime of a system, and we did not make specific distinction between these two concepts. From the definition of a system, we need to have two spacetimes for a system; one is the spacetime for the system itself and the other is the spacetime for the outside environment of the system. Let us introduce the following two definitions:

Definition 1. Universe is defined as the largest spacetime that our human beings can imagine while world is defined as the largest spacetime our human beings can observe.

Based on this definition together with our observations, we can know that the universe is of infinite nature both in time and space while the world is of finite nature both in time and space. As is well-known now, infinitely large (∞) and infinitely small (ε) have been created in mathematics by our human beings. The relation between universe and world can be illustrated in Figure 2. This can be regarded as our second axiom:

TOE-A2: The infinite universe and finite world axiom: The universe is defined as the largest system that our human beings can imagine and it is of infinite nature both in time and space. The world is defined as the largest spacetime our human beings can observe and it is of finite nature both in time and space.

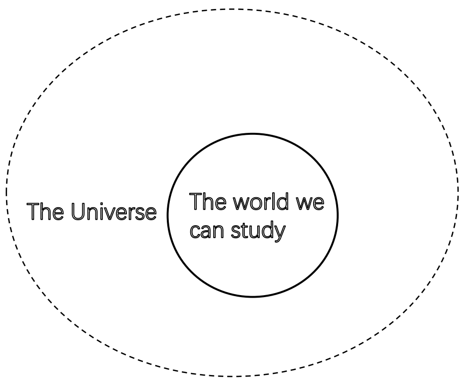

Figure 2. A schematic representation of the concepts of universe and world.

In terms of the concept of universe, at present, the most prevailing cosmological model is the Big Bang theory (Uzan, 2015). The Big Bang hypothesis states that all of the current and past matter in the universe came into existence at the same time, roughly 15 billion years ago. At this time, all matter was compacted into a very small ball with infinite density and intense heat called a Singularity. Suddenly, the Singularity began expanding, and the universe as we know it began. It is obvious that this hypothesis cannot be tested. Furthermore, this model has encountered many problems (Burago, 2017). From my point of view, with a sudden start of the universe, the origination problem can never be explained satisfactorily. If we assume the universe to be infinite, this origination problem can be avoided. With the existence of the universe, then we can explain the origin of the world we are living. The world is operated cyclically according to the process of formation, the steady state, deterioration and explosion to emptiness. There may be no Singularity for the world operation. Therefore, with the infinite universe and finite world axiom to replace the Big Bang hypothesis, all the observed phenomena which can be explained by the Big Bang theory can also be explained in the new model, and many existing paradoxical problems may be solved. This axiom may be able to unify the infinite universe model (Borchardt, 2017), cyclic universe model (Steinhardt & Turok, 2002), and even many-worlds model (DeWitt & Neill, 1973). Of course, more detailed research is needed to fully explore the advantages of this axiom over Big Bang hypothesis and to unify these different cosmological models.

The confusion and misuse of the concepts of finite and infinite is the source of most of paradoxes such as the famous Zeno's paradoxes (Clark, 2007). Modern development of differential and integral calculus provides a way to handle this problem, but we must be very careful to its application range. Das (2013) analyzed several published proofs of the Heisenberg's uncertainty principle and pointed out that this uncertainty principle is a consequence of Fourier transform (FT) based on the infinity assumption. If we want to stick to the criterion for science to be testable, it must be limited to the scope of our observation, both macroscopically and microscopically. Although the observation scope is enlarged as our technical equipment, such as telescope and microscope, are progressed, its finite nature of spacetime will never change. Thus, knowledge can only be about the world we can observe rather than the universe, but I have never seen any paper to clarify this point. Currently both world and universe represent spacetime and no specific difference is emphasized except in Buddhist philosophy in which the universe is composed of infinite number of worlds (Laumakis, 2008). From a systemic point of view, the rest universe outside the observable world is the environment of the world, and it will certainly have influence on the world's behaviour, see Figure 2. Since the environment is outside the scope of our human beings' observation, fundamentally speaking, its influence on the world behaviour can never be known. However, for some particular properties of a given system within the world, one can assume the influence to be small and negligible. By trial and error, if we found the theory thus established can explain quite a lot of observed phenomena, and can predict some future phenomena and verify some predictions to be true, then a new scientific theory about the system is established and this theory can be added to our knowledge database. Thus, knowledge about a system is a relative truth based on the fact that we have ignored some influences from the universe.

Based on the definition of science and the criterion to demarcate science from pseudoscience, the spacetime for a scientific theory must be confined within the world in order to derive testable knowledge. Thus, our ability to know the whole universe is limited while our knowledge to a particular system within the world can always be deepened. This can be called the limited ability axiom. Furthermore, since the universe is a whole, everything outside the system in the universe may have influences on the objects of the system, and these influences are fundamentally agnostic. Therefore, knowledge to a particular system is relative knowledge while we have implicitly assumed that the influences from the rest of the universe are negligible. Similarly, for a pair of concepts, we can claim to know one concept if we temporarily attribute uncertainty to its opposite or complementary. This can be called the general uncertainty principle (GUP). This GUP can be derived from TOE-A2 and TOE-A3.

TOE-A3: The limited ability axiom: The ability of a human being to know the universe is limited due to the infinite nature of the universe and finite nature of a human being such as its life span.

TOE-T1: General uncertainty principle (GUP): If a human being wants to know something clearly, he needs to attribute all the uncertainty to something else such as the complement of that thing.

Proof: Every object is within the universe and the rest of the universe have actions on the object. From TOE-A3, we know that, fundamentally speaking, we cannot know the performance of the object we concern. However, by attributing the uncertainty to something else, we could claim that we know some performance of the object. This is also what has been stated by TOE-A1 that certainty about something (knowledge) is related to uncertainty about other things.

For example, if we want to know the finite system within the world we are living, we must attribute all the uncertainty to the infinite system (the universe). If we want to study the origin of the world, we have to assume the existence of the universe before the world. Other pairs of concepts are matter/field, field/mind, mind/meditation, meditation/world, word/universe. So ultimately, the universe has to be assumed unknown, and there exists irreducible uncertainty while the uncertainties for a given system in the world can be reduced. This principle could resolve the philosophical debate between Einstein and Bohr (Cui, 2019). Different from Copenhagen interpretation of quantum mechanics who selects agnosticism for micro worlds and knowability for macro worlds, I select agnosticism for the universe because it is out of our scope of observation and knowability for any systems within the world we can observe, including micro worlds (Cui & Kang, 2020). Heisenberg's uncertainty principle (Heisenberg, 1927; 1930) can be viewed as a special case of this general uncertainty principle which depends on the measurement method. If one changes the measurement method for positions, then more accurate measurement values may be possible. Both velocities and momentum are the derived variables, and they depend on the measurement accuracy of positions. Bohr's complementarity principle can also be covered by this GUP.

Time/space. Now we are accustomed to describing any phenomenon in a space-time framework. Thus, we need to define what is time and what is space. This is also a very big problem now. In classical mechanics (Thornton & Marion, 2003), spacetime is any mathematical model which fuses the three dimensions of space and one dimension of time into a single four-dimensional manifold. Spacetime diagrams can be used to visualize relativistic effects, such as why different observers perceive differently in where and when events occur. Until the 20th century, it was assumed that the 3-dimensional geometry of the universe (its spatial expression in terms of coordinates, distances, and directions) was independent of one-dimensional time. However, in 1905, Albert Einstein proposed two counter-intuitive postulates in order to develop his theory of special relativity (Einstein, 1916):

- The laws of physics are invariant (i.e., identical) in all inertial systems (i.e., non-accelerating frames of reference).
- The speed of light in a vacuum is the same for all observers, regardless of the motion of the light source.

Due to these two postulates, time dilation and space contraction problems occur (Millette, 2017). From my point of view, these two problems can be avoided if we do not introduce these two postulates. Both of the postulates are not testable since there never exists an absolute inertial system and absolute vacuum. Our human beings are living on earth, and we are moving by the earth's movement like we are taking an airplane, but we could never know the absolute movement of the earth. Currently, we do not know dark matter and dark energy. How can we know that it is a vacuum for a given space? In my opinion, there is no need to adopt these two counter-intuitive postulates in order to explain the observed phenomena; we can explain these phenomena by attributing the uncertainty to the concept of non-matter such as spirits, souls, or minds which will be explained in later sections. So, I still keep the same definitions of time and space as that in classical mechanics. A quote of Kant can describe their accurate definitions.

Definition 2. "Space and time are the framework within which the mind is constrained to construct its experience of reality" (Kant, 2002).

For our human beings, we can only measure or make observation in 4-dimensional spacetime; thus any theory which relies on the introduction of spacetime higher than 4-dimensional is untestable and violates the fundamental requirement of science. Obviously, Einstein has successfully developed his special theory of relativity based on these two axioms. What I want to emphasize here is that if we do not use these two counter-intuitive or untestable axioms, we might also be possible to develop another theory to explain the phenomena Einstein wanted to explain. This is what we want to discuss in this paper.

Matter/mind. What we have observed in the world we are living are cosmic stars (through eyes plus telescopes), macro objects of living creatures and lifeless objects on earth (through eyes only), and micro particles such as molecules, atoms, protons, neutrons, electrons (through eyes plus microscopes). If we define matter to be an object of finite mass and finite volume in the space, according to TOE-A1, the existence of matter implies the co-existence of non-matter. Let us introduce the following definition:

Definition 3. Any object or particle of mass is called matter, while the thing which enables a body of matter to possess the ability of active movement is called mind.

Then a body with mind is called a living creature while a body without mind is called lifeless object. A life can generate active force to make it move while a lifeless object can only move under the forces acted by other objects. I suggest to attribute all the consciousness phenomena and the information generation ability to the function of mind-body interaction. I do not suggest to study the properties of mind now since it is non-matter and impossible to be observed but we can study the properties of living bodies which are the interactions of mind with body.

From this definition, mass is the fundamental property of matter while the active force is the fundamental property of mind-body interaction. Of course, passive forces due to mass and charge also exist.

Since the occurrence of Einstein's theory of special relativity (Einstein, 1916), the concepts of mass and energy and their relations have been greatly confused, and speed-dependent mass or relativistic mass was taught in many textbooks (Adler, 1987; Okun, 1989a; 1989b; Wong & Yap, 2005). Hecht (2009) explored in great detail the evolution of Einstein's understanding of mass and energy, and his conclusion was that "Early on, Einstein embraced the idea of a speed-dependent mass but changed his mind in 1906 and thereafter carefully avoided that notion entirely. He shunned, and explicitly rejected, what later came to be known as relativistic mass" (p. 709). Based on these references (Adler, 1987; Okun, 1989a; 1989b; Hecht, 2009), I still adopt the conventional definition given in Newtonian mechanics for mass and mass possesses the following six important properties (Okun, 1989a; 1989b):

(1) Mass is a measure of the amount of matter.

(2) The mass of a composite body is equal to the mass of the bodies that constitute it (mass conservation law).

(3) The mass of an isolated system of bodies is conserved—it does not change with time (mass conservation law).

(4) The mass of a body does not change on the transition from one system of coordinates to another; in particular, the mass is the same in different inertial systems of coordinates.

(5) The mass of a body is a measure of its inertness (inertia).

(6) The masses of bodies are the sources of their gravitational attraction to each other.

All the quantities of mass, velocity, momentum, energy are properties of matter. Matter can be regarded as a reserve of energy and it can contain many types of energy, such as the rest energy E_0, potential energy E_p, kinetic energy E_k, electromagnetic energy E_b, and one type of energy can be converted into another type of energy. In any chemical reactions or physical transformations, the system should follow the three conservation laws: mass, momentum, and energy. It is the use of these three laws to calculate the trajectory of particles in a system.

Thus, my concept of matter is that any matter has mass, volume, density, and it can have positions, and it will move under the action of a force either internally or externally. Energy is just a property of matter similar as mass, momentum, and others. Mass is invariant.

> It is not good to introduce the concept of the mass $M = \gamma m_0$ of a body for which no clear definition can be given. It is better to introduce no other mass than "the rest mass" m. Instead of introducing M, it is better to mention the expression for the momentum and energy of a body in motion. (From Einstein, in a 1948 letter to Lincoln Barnett cited in Leong and Chin, 2005, p. 62)

It is also my opinion that photon has a mass (Tu, Luo, & Gillies, 2005) and the zero mass result is derived by adopting the Lorentz transformation. Gift (2018) has shown that the Lorentz transformations contain an inconsistency where light speed determined using the transformations in two different approaches yield two different answers. This can be overcome by using the Selleri transformations (Selleri, 1997; 2004). The difference is that in Lorentz Transformations, the speed of light is c while in Selleri Transformations, the speed of light is $c/(1-\beta)$. There is therefore no inconsistency in the Selleri transformations as occurs in the Lorentz transformations and Selleri (2011) has shown that these revised transformations predict the confirmed relativistic effects associated with the Lorentz transformations. Gift (2015) therefore advocated that the Selleri transformations were the correct space-time transformations of modern physics. I do not make the same judgment as Gift but agrees that the zero-mass of the photon is caused by using Lorentz Transformations and it is not necessary the physical reality.

Aether/mind. In order to explain all the observed phenomena about lifeless objects and lives, we need to answer the famous mind-body problem (Skirry, 2016). Currently, there is no explanation why a life can actively move while a lifeless object cannot. It is well-known that Newton's first law states that "an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force". Some people interpret this law as "a system cannot bootstrap itself into motion with purely internal forces—to achieve a net force and an acceleration, it must interact with an object external to itself" (a sentence found from Google search but without formal reference). However, it is obvious that this sentence is certainly not true for a living object like a man. Man can start to move by himself. From above observations, we can find that in general, three Newton's laws are only suitable for lifeless objects but not living objects.

The mind-body problem is a debate concerning the relationship between thought and consciousness in the human mind, and the brain as part of the physical body. It is distinct from the question of how mind and body function chemically and physiologically, as that question presupposes an interactionist account of mind-body relations (Skirry, 2016). This question arises when mind and body are considered as distinct, based on the premise that the mind and the body are fundamentally different in nature. The problem was first addressed by René Descartes in the 17th century, resulting in Cartesian dualism, and by pre-Aristotelian philosophers (Young, 1996; Robinson, 2011), in Avicennian philosophy (Lagerlund, 2010), and in earlier Asian traditions. A variety of approaches have been proposed. They are either dualist or monist. Dualism maintains a rigid distinction between the realms of mind and matter while monism maintains that there is only one unifying reality, substance, or essence, in terms of which everything can be explained. By examining carefully, modern sciences such as general relativity and quantum mechanics have already moved from monism of matter only to dualism of matter and energy. For some others, information is assumed to be a fundamental existence in addition to the matter (Draganescu, 1990; Gaiseanu, 2020).

I answered this problem based on the relativity of simultaneity axiom; it is neither purely monism nor purely dualism but a combination of monism and dualism. If we stick to the monism, it can only be described by either emptiness or existence, both of them in a special meaning. For the emptiness, it cannot be seen but it can generate everything; for the meaning of existence, it can generate everything but it cannot be seen by us. If we want to describe the existence in a deeper level, it is a relative existence and at least two concepts have to be used, such as matter/non-matter, thus it is a dualism. The non-matter can be defined as energy or information or soul or other names, but since energy and information have other meanings, it is better to be called mind in order to match the famous mind-body problem. Energy is a property of matter while information can be thought to be generated by mind. From quantum mechanics, we know that matter exists in the form of quanta and let us call the assembly of unobservable quanta as aether, while observable quanta as particles. Then, aether and minds are the two fundamental existences of everything in the world we can observe. They are explicitly given by the following definition:

Definition 4. The essence of matter is defined as aether which represents ensemble of unobservable quanta. The essence of a life is defined as a mind.

It is well-known that the concept of aether has been abandoned in Einstein's theory of relativity (Einstein, 1916), but this is costed by the mis-use of the concepts of energy and field etc. By re-interpreting quanta as matter and energy is a property of matter, then the fundamental existences in the universe are reduced to two: aether and minds. According to TOE-A1, both concepts should co-exist and only with both concepts we can explain how everything in the world is created without introducing the concept of GOD. TOE-A1 can solve the "creator" problem (Sarfati, 1998). Let us introduce the following axiom which is also derived from observation through logical induction.

TOE-A4: The particle generation and annihilation axiom: Lives can accumulate aether into particles and decompose particle into aether.

Lives can be divided into microorganisms and macro lives such as plants, animals, and human beings. The ability of doing this accumulation and decomposition is certainly different from one life to another. With TOE-A4, the origination of the world is explained based on the existence of aether and minds. This can avoid the creator problem in the materialism and the "creating an object from nothing" problem in the idealism. However, both aether and minds are out of observation and they can only be understood as two concepts for attributing uncertainty according to the current scientific research methods. In terms of the properties or characteristics of aether, minds and unobservable quanta, instead of selecting agnostic attitude to them, I recommend an open-minded attitude that they may be able to be studied through other methods such as meditation (Laumakis, 2008). Currently we just take them as a convenience to replace the role of God to explain things since all our knowledge is a relative knowledge and we have to rely on some fundamental concepts to explain things.

Probabilistic/deterministic. Whether the world operates deterministically or probabilistically, and whether the operation laws of the world is knowable or unknowable, Einstein and Bohr have debated these two questions for more than 40 years (Whitaker, 2006). I find Bohr's agnosticism a paradox in its own way. If he believed that the operation of the micro world is random in nature and the nature of the micro world is unknowable, then he should stop to carry out research to seek the statistical operation law of the micro world. The law of statistics is also a law of operation. In addition, just because he did not know himself at that time, there was no need to make the claim that other people did not know, and it cannot be known by others in the future. Furthermore, if he thought only the operation of the macro world is deterministic, then he needed to define a clear boundary between macro world and micro world. I think it would be difficult for him to justify why there is a sudden jump at this boundary if he really creates an artificial boundary between the two worlds.

According to TOE-A1, deterministic and probabilistic are our division of the methods and they co-exist. Philosophically, we should believe that (1) any system in the world, including macro and micro systems, always operates with laws, and (2) these laws can always be revealed by our human beings. These laws can be called causal-effect laws. The fundamental task of our scientific research is to reveal these causal-effect laws. Practically, most of the systems are complex and up to now we have not obtained all the information needed in order to reveal these laws. Thus, all the laws revealed by us now may not represent the final truth. Uncertainty due to the lack of information in the form of data and knowledge often exists for practical systems. In presenting the truth value for a statement under incomplete information, the accuracy-correctness balance axiom will be followed:

TOE-A5: The accuracy-correctness balance axiom: Accuracy and correctness are in conflict in the sense that the more accurate the representation of a statement, the higher the information content but the less likely it is to be correct (Cui & Blockley, 1990).

Thus, the purpose of scientific research is to maximize the accuracy under the condition of correctness. Without the correctness, accuracy is not meaningful. For example, if we measure someone’s height by just using the naked eyes, we can only say “Smith is a tall person” or “Smith’s height is between 1.7 m to 1.8 m”. If we use a meter to measure the height, the accuracy could be much higher, say, “Smith’s height is 1.78 ± 0.1 m. The theory of probability (Venkatesh, 2012) is a mathematical tool to handle the situation when the uncertainty exists. For example, when we toss a coin, since the difficulty in controlling the initial conditions, the results of either head or tail cannot be predicted accurately. But in the future, if a mechanism is designed to strictly control and measure the initial conditions of the coin toss, the result may be predicted accurately by classical mechanics. The same is true for the quantum trajectory (Minev, 2018; Minev et al., 2019).

The Unification of Two Extreme Philosophical Opinions by the Midway

In constructing a scientific theory, the proposer needs to answer philosophical problems related to ontology, epistemology, and methodology. In the past, most of scientists select monist philosophy and this makes one fighting with the other between the two extreme opinions and only one is allowed to survive but the survived one always encounters some contradictions or paradoxes. However, the actual situation is that both of them occur at the same time and creating one concept needs to define its complement or opposite at the same time. Thus, this philosophy can be regarded as the midway philosophy while both materialism and idealism are regarded as two extreme philosophies (Laumakis, 2008). This midway philosophy can unify the two extremes and can act as a philosophical foundation for a general system theory.

In the ontology (philosophy of existence and identity), we are neither monism nor dualism in a traditional sense and we are either monism or dualism in a new sense. If we call it monism, we can either call it emptiness or existence, but this emptiness or existence should be in a special meaning. We can call it existence if we have also defined a state of non-existence. If we want to describe what we have observed about the existence, we can divide them into living creatures or lifeless objects or many other names. The essence of matter is defined as aether while the essence of a life is defined as a mind. Then, with these two fundamental existences of aether and minds, all the existences in the world can be explained.

In the epistemology which concerns the operation of the world and limitations of knowledge, the two schools of agnosticism and knowability are unified. Basically we select agnosticism to the universe while knowability to the world. We believe that the world is operated under the causal-effect law. This can be expressed in the following axiom:

TOE-A6: The causal-effect axiom: Every object in the world including living creatures is governed by the causal-effect law. That is, each effect should have causes and each cause will have effects.

Based on this axiom, the main task of scientific research to a system in the world is to reveal this causal-effect law for the system and in presenting the law; either deterministic mathematics or probabilistic mathematics can be employed depending on the information available. This follows TOE-A5 which is a unification of methodology in philosophy. With these six axioms, a general system theory can be established and they are able to explain some special phenomena which led to the development of general relativity and quantum mechanics. In the following section, several examples are given just for demonstrating purpose.

Explanations to Some Important Problems

Wave-Particle Duality

The wave-particle duality is a new concept introduced in quantum mechanics to explain the phenomena observed in the double-slit experiment. The long story can be briefly explained as follows.

Democritus (5th century BC) was the first person to propose the particle theory for light and he postulated that all things in the universe, including light, are composed of indivisible sub-components. Euclid (4th-3rd century BC) gives treatises on light propagation and states the principle of shortest trajectory of light, including multiple reflections on mirrors, including spherical, while Plutarch (1st-2nd century AD) describes multiple reflections on spherical mirrors discussing the creation of larger or smaller images, real or imaginary, including the case of chirality of the images. At the beginning of the 11th century, the Arabic scientist Ibn al-Haytham wrote the first comprehensive *Book of Optics* describing reflection, refraction, and the operation of a pinhole lens via rays of light traveling from the point of emission to the eye. He asserted that these rays were composed of particles of light. In 1630, René Descartes popularized and accredited the opposing wave description in his treatise on light, *The World (Descartes),* showing that the behavior of light could be re-created by modeling wave-like disturbances in a universal medium i.e., luminiferous aether. So Descartes was the first person to propose wave theory for light. Beginning in 1670 and progressing over three decades, Isaac Newton developed and championed his corpuscular theory, arguing that the perfectly straight lines of reflection demonstrated light’s particle nature, only particles could travel in such straight lines. He explained refraction by positing that particles of light accelerated laterally upon entering a denser medium. This consolidated the particle theory. Around the same time, Newton’s contemporaries Robert Hooke and Christiaan Huygens, and later Augustin-Jean Fresnel, mathematically refined the wave viewpoint, showing that if light traveled at different speeds in different media, refraction could be easily explained as the medium-dependent propagation of light waves. The resulting Huygens-Fresnel principle was extremely successful at reproducing light’s behavior. The wave view did not immediately displace the ray and particle view, but began to dominate scientific thinking about light in the mid-19th century, since it could explain polarization phenomena that the alternatives could not. James Clerk Maxwell discovered that he could apply his previously discovered Maxwell’s equations, along with a slight modification to describe self-propagating waves of oscillating electric and magnetic fields. It quickly became apparent that visible light, ultraviolet light, and infrared light were all electromagnetic waves of differing frequency.

From the above history, it seems we must use sometimes the wave theory and sometimes the particle theory, while at times we may use either. We are faced with a new kind of difficulty that we have two contradictory pictures of reality; separately neither of them fully explains the phenomena of light, but together they do. In 1801, Thomas Young performed a double-slit experiment. A beam of electrons with low intensity (so that electrons are injected one by one) impinges upon an opaque surface with two slits removed on it. A detector screen, on the other side of the surface, detects the position of electrons. Even though the detector screen responds to particles, the pattern of detected particles shows the interference fringes characteristic of waves. The system exhibits, thus, the behavior of both waves (interference patterns) and particles (dots on the screen) at the same time. From this experiment, many scientists hold that all quantum particles exhibit a wave nature. In order to explain the physics behind quantum systems, the concepts of waves and particles should be merged in some way. Two different routes appeared (Oriols & Mompart, 2019):

(1) Wave or particle?: The concept of a trajectory was, consciously or unconsciously, abandoned by most of the young scientists (Heisenberg, Pauli, Dirac, Jordan, …). They started a new route, the "wave or particle?" route, where depending on the experimental situation, one has to choose between a wave or a particle behavior. Electrons are associated basically to probability (amplitude) waves. The particle nature of the electron appears when we measure the position of the electron. In Bohr's words, an object cannot be both a wave and a particle at the same time; it must be either one or the other, depending upon the situation. This approach, mainly supported by Bohr, is one of the pillars of the Copenhagen, or orthodox, interpretation of quantum mechanics.

(2) Wave and particle: Louis de Broglie, on the other hand, presented an explanation of quantum phenomena where the wave and particle concepts merge at the atomic scale, by assuming that a pilot-wave solution of Schrödinger's wave Equation guides the electron trajectory. This is what we call the Bohmian route. One object cannot be a wave and a particle at the same time, but two or more can.

From my point of view, the "wave and particle" route is much clearer and in consistent with the classical mechanics principles while for the "wave or particle?" route, new hardly-understood concepts of wave-collapse and measurement problems need to be relied. More preferences for the second route are presented in Bohmian mechanics (Oriols & Mompart, 2019).

Measurement Problem

The measurement problem in orthodox quantum mechanics is the problem of how (or whether) wave function collapse occurs. The inability to observe such a collapse directly has given rise to different interpretations of quantum mechanics and poses a key set of questions that each interpretation must answer.

In the orthodox quantum mechanics, the state of a quantum system at a given time is described by a complex wave function, also referred to as state vector in a complex vector space called Hilbert space. The wave function evolves deterministically according to the Schrödinger equation as a linear superposition of different states. However, actual measurements always find the physical system in a definite state. Any future evolution of the wave function is based on the state in which the system was discovered when the measurement was made, meaning that the measurement "did something" to the system that is not obviously a consequence of Schrödinger evolution. The measurement problem is describing what that "something" is, how a superposition of many possible values becomes a single measured value. To express matters differently, the Schrödinger wave equation determines the wave function at any later time. If observers and their measuring apparatus are themselves described by a deterministic wave function, why can't we predict precise results for measurements, but only probabilities? As a general question: How can one establish a correspondence between quantum and classical reality?

The measurement problem can be formulated as the impossibility for a physical quantum theory (in empirical agreement with experiments) to simultaneously satisfy the following three assumptions (Maudlin, 1995).

(1) The wave function always evolves deterministically according to the linear and unitary Schrödinger equation.

(2) A measurement always finds the physical system in a localized state, not in a superposition of macroscopically distinguishable states.

(3) The wave function is a complete description of a quantum system.

A theory that includes all three assumptions is not empirically compatible with the experimental results. Different physical theories are developed depending on which assumption is ignored (Herbert, 1984). The measurement problem appears because none of the proposed solutions fully satisfies the whole scientific community.

The Copenhagen interpretation is the oldest and probably still the most widely held interpretation of quantum mechanics. It argues that the unitary and linear evolution of the Schrödinger equation is not always valid (such solutions ignore the (1) assumption). When a measurement is performed, the linear Schrödinger equation should be substituted by a nonlinear collapse law. The typical orthodox prediction of some experimental property of the quantum system is described through the use of a proper operator $\hat{G}$ whose eigenvalues give the possible outcomes of the measurement. When we measure a particular eigenvalue, the initial wave function is transformed into an eigenfunction of the operator. This is the so-called von Neumann (or projective) measurement. Thus, the time evolution of the wave function of a quantum system is governed by two (quite) different laws:

(1) The first dynamical evolution is given by the Schrödinger equation. This dynamical law is deterministic in the sense that the final wave function of the quantum system is perfectly determined when we know the initial wave function and the Hamiltonian of the quantum system.

(2) The second dynamical law is called the collapse of the wave function. The collapse is a process that occurs when the wave function interacts with a measuring apparatus. The initial wave function before the measurement is substituted by one of the eigenstates of the particular operator $\hat{G}$. Contrarily to the dynamical law given by the Schrödinger equation, the collapse is not deterministic, since the final wave function is randomly selected among the operator's eigenstates.

The duality in the equation of motions (linear or nonlinear) of a quantum system in the orthodox interpretation is certainly a persistent controversial issue. There are many scientists unsatisfied with this solution of the measurement problem (e.g., Bell, 1990). The dissatisfaction with the Copenhagen solution is that the theory does not clearly specify when, in which circumstances, the linear or nonlinear equation has to be used. In general, proponents of the Copenhagen Interpretation tend to be impatient with epistemic explanations of the mechanism behind it. This attitude is summed up in the oft-quoted mantra "Shut up and calculate!" (Oriols & Mompart, 2019).

De Broglie-Bohm theory tries to solve the measurement problem very differently: The information describing the system contains not only the wave function, but also supplementary data (a trajectory) giving the position of the particle(s). The role of the wave function is to generate the velocity field for the particles. These velocities are such that the probability distribution for the particle remains consistent with the predictions of the orthodox quantum mechanics. According to de Broglie-Bohm theory, interaction with the environment during a measurement procedure separates the wave packets in configuration space, which is where apparent wave function collapse comes from, even though there is no actual collapse.

This de Broglie-Bohm theory assumes that the wave function alone does not provide a complete description of the quantum state, that is, it ignores the (3) assumption and includes additional elements (hidden variables) in the theory. In a spatial superposition of two disjoint states for a single particle system, only the one whose support contains the position of the particle becomes relevant for the dynamics. Notice that, in Bohmian mechanics, it is not mandatory to define which interactions are considered a measurement and which are not. All interactions (implying a measurement or not) are treated identically. Thus, there is no special measurement problem in Bohmian mechanics.

By comparing with these two interpretations, Bell commented (Oriols & Mompart, 2019, p. 35):

> Vagueness, subjectivity, and indeterminism (in orthodox quantum mechanics), are not forced on us by experimental facts, but by deliberate theoretical choice. The orthodox theory is "unprofessionally vague and ambiguous" in so far as its fundamental dynamics is expressed in terms of "words which, however, legitime and necessary in application, have no place in a formulation with any pretension to physical precision".

Quantum Entanglement

Quantum entanglement is a physical phenomenon that occurs when a pair or group of particles is generated, interacted, or shared spatial proximity in a way such that the quantum state of each particle of the pair or group cannot be described independently of the state of the others, including when the particles are separated by a large distance. The topic of quantum entanglement is at the heart of the disparity between classical and quantum physics: Entanglement is a primary feature of quantum mechanics lacking in classical mechanics.

Measurements of physical properties such as position, momentum, spin, and polarization performed on entangled particles can, in some cases, be found to be perfectly correlated. For example, if a pair of entangled particles are generated such that their total spin is known to be zero, and one particle is found to have clockwise spin on a first axis, then the spin of the other particle, measured on the same axis, is found to be counterclockwise. However, this behavior gives rise to seemingly paradoxical effects: Any measurement of a particle's properties results in an irreversible wave function collapse of that particle and changes the original quantum state. With entangled particles, such measurements affect the entangled system as a whole.

Such phenomena were the subject of a 1935 paper by Albert Einstein, Boris Podolsky, and Nathan Rosen, and several papers by Erwin Schrödinger shortly thereafter, describing what came to be known as the EPR paradox (Oriols & Mompart, 2019). Quantum entanglement has been demonstrated experimentally with photons, neutrinos, electrons, molecules as large as buckyballs, and even small diamonds. The utilization of entanglement in communication, computation, and quantum radar is a very active area of research and development nowadays.

Different from existing interpretations, we explain the quantum entanglement as entanglement of minds. Any two bodies with minds which can make active movements can be entangled no matter the size of the body whether it is a human being or a quantum.

For most of physicists, the gravitational and electromagnetic forces are the only known long-range interactions in nature (e.g., Miransky & Shovkovy, 2015). However, many experimental evidences showed psychic force due to mind-body interaction (or Psychokinesis, PK) exists (Cardeña, 2018). So in our model, the gravitational, electromagnetic, and psychic forces are regarded as the long-range interactions while the weak and strong forces are regarded as the short-range interactions in nature. The gravitational force is caused by mass; the electromagnetic force is caused by charge while the psychic force is caused by mind-body interaction of a living being. While the gravitational force and the electromagnetic force are passive forces, and the psychic force is the active force which can be controlled by the living being through training. In order to explain the non-contact force, i.e., the actions at a distance, the field concept is introduced and this will be discussed in the next section.

Systematic studies of the gravitational forces with the use of modern scientific methods started in the 16th-17th centuries (with the works of Galileo Galilei, Isaac Newton, and others), and the studies of electromagnetism began in the 19th century (with the works of Alessandro Volta, Hans Christian Oersted, Andre-Marie Ampere, Michael Faraday, and James Clerk Maxwell, and many others). The other two known fundamental interactions of nature, responsible for the strong and weak forces, are short range and can be detected only under very special laboratory conditions. They were discovered much later, in the middle of the 20th century.

The Society for Psychical Research (SPR) was founded in London in 1882. Its formation was the first systematic effort to organize scientists and scholars to investigate paranormal phenomena. Through more than 136 years research, some experimental evidences have accumulated (Cardeña, 2018), but this force was still not widely accepted by physicists.

We attribute the entanglement actions to the psychic forces from mind-body interactions and since living lives can generate information and thus, minds entanglement could also transmit information and its speed could be faster than the speed of light (Lee, 2019).

Similar as the gravity potential to describe the particle trajectory, we can also use quantum potential to describe the psychic force actions. The presence of $Q(x, t)$ in the quantum Hamilton-Jacobi equation implies that Bohmian trajectories depend not only on the classical potential $V(x, t)$ but also on the quantum potential $Q(x, t)$, which is a function of the type of distribution of trajectories associated to different repetitions of the single-particle experiment, $R(x, t)$ (Oriols & Mompart, 2019). In fact, it is the shape and not the absolute value of $R(x, t)$ that acts on each individual quantum trajectory. On the contrary, each classical trajectory can be computed independently of the shape of the ensemble. The fact that the dynamics of one quantum trajectory in one particular experiment depends on the ensemble of other trajectories build from other identical experiments is highly counter-intuitive for our classical mind. However, this can be easily explained by the entanglement of minds for these different trajectories. Each trajectory is determined by initial positions and velocities and all the initial conditions are determined by experimenter. The initial conditions for different trials are not independent but satisfied a certainty type of probability distribution (i.e., some constrictions on this ensemble); thus, the trajectory of one trial may depend on the results of other initial conditions and this is mainly caused by the assumption that the initial conditions follow certain probability distribution.

Corrections to Some Famous Theorems

Based on our new mind-body model, we will find that most of the classical laws are not expressed accurately. Some of them are corrected as follows.

Original version of Newton's first law: An object either remains at rest or continues to move at a constant velocity, unless it is acted upon by an external force.

Revised version of Newton’s first law: A lifeless object either remains at rest or continues to move at a constant velocity, unless it is acted upon by an external force.

Original version of Newton’s second law: The rate of change of momentum of an object is directly proportional to the force applied, or, for an object with constant mass, that the net force on an object is equal to the mass of that object multiplied by the acceleration.

Revised version of Newton’s second law: For a lifeless object with constant mass, the rate of change of momentum of an object is directly proportional to the net force applied, or, the net force on an object is equal to the mass of that object multiplied by the acceleration.

Original version of Newton’s third law: When one object exerts a force on a second object, the second object exerts a force that is equal in magnitude and opposite in direction on the first object.

Newton’s third law seems to be valid for both lifeless objects and living creatures, so no revision is needed.

Original version of Newton’s law of universal gravitation: Every particle attracts every other particle in the universe with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

Revised version of Newton’s law of universal gravitation: Every particle attracts every other particle in the world we can observe with a gravitational force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

Original version of the first law of thermodynamics (also known as Law of Conservation of Energy): Energy can neither be created nor destroyed; energy can only be transferred or changed from one form to another.

Revised version of the first law of thermodynamics: For a given lifeless object of constant mass, its energy is conserved in any physical or chemical process; its energy can only be transferred or changed from one form to another.

A life can generate force and this force can do work which is another type of energy. In that case, we can say that a life can generate energy and currently what will lose for this life is unclear. Furthermore, since energy is a property of matter and if an object is decomposed into aether, since we cannot measure the mass and energy of aether, we are not sure about the conservations of both mass and energy. So some conditions must be added to this law. Furthermore, since energy is not an independent existence and it cannot be said to be created or destroyed and actually in the physical or chemical processes, not only energy but also mass and momentum may be conserved. Through these three conservation laws one can determine the trajectory of a particle. So this law must be greatly revised.

Original version of the second law of thermodynamics: The entropy of any isolated system always increases. Isolated systems spontaneously evolve towards thermal equilibrium—the state of maximum entropy of the system.

Revised version of the second law of thermodynamics: The entropy of any isolated system with no living creatures always increases. That is, isolated systems with no living creatures spontaneously evolve towards thermal equilibrium—the state of maximum entropy of the system.

This second law of thermodynamics can only be applied to lifeless objects while for a life this law is not valid. In order to overcome this problem, some people introduced a negative entropy for a system with living creatures. With the revised version, the concept of negative entropy may not be needed.

Original version of the third law of thermodynamics: The entropy of a system approaches a constant value as the temperature approaches absolute zero.

Revised version of the third law of thermodynamics: The entropy of an isolated system approaches a constant value as the temperature approaches absolute zero.

Since absolute zero is just a human beings' construct and it can never be reached in the laboratory, this can be regarded as a definition or an axiom rather than a proved theorem. Furthermore, for an open system, its temperature is hardly lowered to the absolute zero, so it is more reasonable to be confined to isolated system.

Reexamination of the Three Fundamental Postulates in Quantum Mechanics

Due to the hard explanation of the four phenomena of Anomalous Atomic and Molecular Stability, Anomalously Low Atomic and Molecular Specific Heats, Ultraviolet Catastrophe and Wave-Particle Duality with classical mechanics, quantum mechanics was born. The study of these simple experiments leads us to formulate the following fundamental principles of quantum mechanics (Fitzpatrick, 2015):

1. Dirac's Razor: Quantum mechanics can only answer questions regarding the outcome of possible experiments. Any other questions lie beyond the realms of physics.

2. Principle of the Superposition of States: Any microscopic system (i.e., an atom, molecule, or particle) in a given state can be regarded as being partly in each of two or more other states. In other words, any state can be regarded as a superposition of two or more other states. Such superpositions can be performed in an infinite number of different ways.

3. Principle of Indeterminacy: An observation made on a microscopic system causes it to jump into one or more particular states (which are related to the type of observation). It is impossible to predict into which final state a particular system will jump. However, the probability of a given system jumping into a given final state can be predicted.

The first of these principles was formulated by quantum physicists (such as Dirac) in the 1920's to fend off awkward questions such as "How can a system suddenly jump from one state into another?", or "How does a system decide which state to jump into?". This is certainly an overclaim. The capability of quantum mechanics is arbitrarily confined which is very different from other theories. As we shall see, the second principle is the basis for the mathematical formulation of quantum mechanics. But this is not necessary. As is well-known, linear is a special or ideal situation while nonlinear is more general. So for real physical system, the governing equation is not necessary to be linear and the Principle of the Superposition of States does not always hold. The final principle is still rather vague. We need to extend it so that we can predict which possible states a system can jump into after a particular type of observation, as well as the probability of the system making a particular jump. That depends on the current measurement method. As a well-known fact, any measurement to a system is carried out by operator with equipment. Obviously, all the factors in the measurement process such as the measurement method, the equipment, how the operator operates the equipment and how the operator interprets the measured results will influence the final measurement results. The performance of the system may also be influenced or disturbed by this measurement process. There is no qualitative difference between macro systems and micro systems but only the quantitative difference that the influence of the macro system performance from the measurement process may be negligible while the influence of the micro system performance from the measurement process may be significant at the current technology.

Reexamination of the Filed Concept

The concept of field is also a source of confusion in modern physics similar as the concept of energy. Let me briefly explain this problem.

In mathematics, a field is a set on which addition, subtraction, multiplication, and division are defined and behave as the corresponding operations on rational and real numbers do. A field is thus a fundamental algebraic structure which is widely used in algebra, number theory, and many other areas of mathematics. The earliest field is the field of rational numbers, then the real numbers, then complex numbers. After that, many other fields, such as fields of rational functions, algebraic function fields, algebraic number fields, and *p*-adic fields are commonly used and studied in mathematics, particularly in number theory and algebraic geometry. Most cryptographic protocols rely on finite fields, i.e., fields with finitely many elements. In terms of the element, only three are special while the rest may be unique. These are infinitely large (∞), infinitely small (ε), and zero (0); zero cannot be used in division while infinitely large (∞) and infinitely small (ε) are indeterminate number while the rest are determinate numbers.

This mathematical concept can also be used in physics. For example, let us consider a system of two bodies with masses M and m; then according to Newton's law of universal gravitation, there is an attraction force $F = GMm/r^2$ between the two bodies, where r is the distance between the centers of their masses and G is the gravitational constant. If there is no repel force, the two bodies will be moved toward each other. If there is a repel force coming from at least one of the bodies which has a mind, then the system can be stable. Let us treat one body as the earth and the other body away from the earth. By introducing an earth-fixed coordinate framework, then any massed body will be acted by a gravitational force whose magnitude is proportional to the mass m and disproportional to the square of the distance. Due to this force, an apple falling from a tree will automatically move toward the earth center. Thus, we can say that due to the existence of the earth, there is a gravitational field around the earth. Every massed body in the field will be acted a gravitational force. In general, the field is formed by the joint actions of all the massed bodies in the universe. Of course, the contributions from other stars are very small in comparing with the earth for the space nearby the earth.

So a field is defined as a physical quantity, represented by a number, a vector or a tensor, that has a value for each point in space and time. According to our dualist mind-body model, the psychic field, the gravitational field, the electromagnetic field, nuclear field exist in the world we can observe. Presently, we have a lot of study on the later three fields but little study on the psychic field. However, if we interpret the quantum potential as a description of psychic field, then many methods and laws in the classical mechanics can be extended. For a field, it is not an independent existence like a massed object so it cannot be said that it has density and energy etc. By clarifying this concept and generalize the classical mechanics carefully to the micro world, a new version similar as Bohmian mechanics can be derived.

The General Procedure to Construct TOE

Let us treat the world as a system we concern and the universe without the world as the environment, see Figure 1. We are interested in the problem of how a particular object is moving in relation to the earth. Let us construct an earth-fixed time-space framework; if the object has mass, then it is subjected to a gravitational force. If the object has charge, it is subjected to an electromagnetic force, and if the object has a mind, then it is also subjected to a psychic force. Different from other forces which can predetermine its direction, the direction of the psychic force can be changed from moment to moment. If we know all these forces, we can calculate its trajectory. From this problem-solving process, we can abstract the general procedure to construct a TOE.

(1) To construct the system model by defining the system to be studied and its environment.

(2) To apply mathematics to derive the governing equation for the system's performance.

(3) To establish the boundary conditions and the initial conditions.

(4) To solve the mathematical model.

(5) To interpret the mathematical solution to its physical properties of the system.

Since the practical system is often complex, in the second step, some postulates are often made in order to simplify the problem and thus, any mathematical equation is an approximation of physical reality rather than the truth of the physical reality. This concept is often ignored by many scientists and they treat some field equations such as Einstein's gravitational field equation, Schrödinger equation as universal truth that cannot be violated at all.

Summary and Conclusions

Whether a TOE is possible or not is a philosophical question and currently most of scientists select no and they criticize the other school to do pseudoscience. The two schools are in conflict with each other. Based on the relativity of simultaneity axiom proposed in this paper, the present author suggests to use a midway philosophy to replace the present materialist philosophy for modern sciences; then this conflict together with many other conflicts among different theories such as classical mechanics, relativity theory, and quantum mechanics can be solved and a unified theory of everything for the world we can observe can be constructed.

Overall, every scientific theory contains four parts, including axioms, laws, phenomena, and logical analysis methods. Presently logical analysis methods of induction and deduction are matured. Phenomena can be observed through advanced equipment such as telescope and microscope, and more and more new phenomena can be observed through the progress of these equipment. So the key issue to construct a scientific theory is the proposal of fundamental axioms and clarification of important concepts. In this paper, the axiomatic foundation for a TOE is proposed which contains six fundamental axioms. Obviously, whether these are adequate or redundant needs further study, the present paper shows a new promise and a new direction for TOE which would be helpful for the further development of modern sciences. The main conclusions of this paper are further summarized as follows:

(1) The science's dilemma described by Mao (2019) is not very scientific and this is because he did not make the distinction between universe and world. This is not only his misunderstanding but more or the less most of scientists. Currently this is the dominant opinion in the scientific community. According to the relativity of simultaneity axiom, there is no such thing as a perspective-independent concept of existence. Every existence including concrete objects and abstract concepts or theories is created by human beings. However, our human being's ability to know the world (external or internal to our body) is limited and thus our knowledge is of a relative truth in nature. Thus, science is a type of the knowledge on things in the universe but locally and partially about the world we can observe, and the knowledge is developed by ignoring the influence of the rest of the universe on the properties of the world. Therefore, we cannot treat the science as a truth globally holding on the reality of things in the universe. When we apply the scientific conclusions, i.e.,

technology to every practical problem, we need to remember this limitation of science. Thus, there is no dilemma here if we understand the nature of knowledge correctly.

(2) From my point of view, our great achievement from classical mechanics to general relativity and quantum mechanics is the discovery of the relativity of simultaneity axiom. By this axiom, if we want to accept the existence of matter (body), we have to accept the existence of non-matter (mind); thus, the mind-body problem must be addressed in a dualist model. If we define two essences of all existences in the world we can observe, aether and minds, the "creator" problem can be avoided and the rest of the scientific theory can be established.

(3) Every scientific theory has four components, including axioms, laws, logical analysis methods, and phenomena. Axioms are proposed by a scientist's limited observation together with the application of logical induction method. Laws are derived from axioms through logical deduction method. Axioms and laws can be used to explain the observed phenomena and predict the future phenomena, and be tested to be true in the future. If a theory follows the three requirements of clearly defined concepts, unfalsified axioms, and logical consistency, then it is a scientific theory and otherwise, it is a pseudoscience.

(4) Based on Gödel's incompleteness theorems, every scientific theory is based on several axioms which are not possible to be proved within the theory; thus, selection of the axioms is actually the starting point of a scientist to construct a scientific theory which reflects his philosophical belief. For a given set of observed phenomena, people can explain these phenomena based on different axioms. A good example is the co-existence of orthodox quantum mechanics and Bohmian mechanics.

(5) Since every scientific theory is created by human beings, whether a theory of everything (TOE) exists or not also depends on our belief. If all scientists select impossibility and give up the study, the TOE will never be created. However, if some scientists select to believe the possibility of TOE and make continuous efforts to construct the TOE, it is possible to be created. The development process of every scientific theory has followed that path. Any claim about the impossibility of future events is fundamentally an over claim. However, this possibility of TOE must be stood on the scope of the world rather than the whole universe.

(6) In order to completely resolve the "tool" problem of science that science is a tool and it could have good and bad effects, we need to construct a TOE by unifying religion, philosophy, and science. This is possible within the dualist mind-body model. Without the cause-effect law for human behaviour, the altruism does not have the philosophical foundation and that is the root of many social problems. Thus, the main task of science is to reveal this cause-effect law for everything in the world we are living, especially the cause-effect law for human behaviour.

(7) The possible six axioms for a TOE are proposed and they are subjected to be scrutinized for their adequacy and independence.

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