Philosophy Study, January 2023, Vol. 13, No. 1, 1-22
doi: 10.17265/2159-5313/2023.01.001

A Comparison of New General System Theory Philosophy With Einstein and Bohr

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The New General System theory was developed to be a theory of everything for complex systems within the world we can observe. This theory was constructed by supplementing a new mind-ether ontology into Bertalanffy's general system theory framework. This theory is basically a generalization of classical mechanics rather than a revolution to it taken both by Einstein and Bohr in developing their relativity theory and quantum mechanics. The purpose of this paper is to reveal the reasons why Einstein and many others fail to unify relativity theory with quantum mechanics through comparing the main differences in philosophical opinions among NGST, Einstein, and Bohr. It is the hope of the authors that this clarification could speed up the unification process.

Keywords: complex system (CS), New General System Theory (NGST), theory of everything (TOE), classical mechanics (CM), relativity theory (RT), quantum mechanics (QM), Bohmian Mechanics (BM), active force, entanglement of minds

Introduction

To construct a theory of everything (TOE) is a dream of many scientists such as Newton (1846), Maxwell (1865), Einstein (1916), and Kelvin (1931). However, after the failure of Einstein to unify the relativity theory with quantum mechanics and the dominance of Copenhagen Interpretation for quantum mechanics (Bohr, 1913a; 1913b; 1913c; 1934; Heisenberg, 1927; 1930; Dirac, 1927; Neumann, 1932; Fitzpatrick, 2015), most of scientists believe that it is impossible to have a theory of everything (e.g. Jaki, 1966; Schmidhuber, 1997; Robertson, 2000; Hawking, 2006; Dyson, 2006; Feferman, 2006; Weinberg, 2011) while still few scientists make the efforts to continue the research (e.g. De Aquino, 2012; Shen, 2013; Gong, 2016; Lee, 2019; Cui & Kang, 2020).

By considering whether a TOE exists or not together with many other similar questions for debate (Whitaker, 2006), what we found is the fact that most of the debates are basically caused by the monist philosophy of binary opposition such as materialism vs. idealism, theism vs. atheism, determinism vs. indeterminism. If we choose an oriental philosophy of binary coexistence such as Daoism (Capra, 1975) and Buddhist philosophy (Laumakis,

Acknowledgement: This work was supported by Zhejiang Key R&D Program No. 2021C03157, start-up funding from Westlake University under grant number 041030150118 and Scientific Research Funding Project of Westlake University under Grant No. 2021WUFP017.

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2008; Harvey, 2013), these debates can be easily unified. The essence of this binary coexistent philosophy is the relativity of simultaneity axiom used in NGST (Cui, 2021a, p. 247): There is no such thing as a perspective-independent existence. The existence of a concept is always related to other concepts, at least its opposite or complement.

As a demonstration example how to use this axiom to address the question whether a TOE is possible or not, if we divide the space into infinite and finite, then we can select possible for a TOE of finite space under the condition that we have selected impossible for a TOE of infinite space. This represents the co-existence of possibility and impossibility.

Using this axiom, we can identify that the main reason why classical mechanics cannot explain many observed phenomena is due to its incomplete ontology. However, the new theories developed to explain these phenomena such as relativity theory and quantum mechanics are suffered from the same problem. The ontology is even less clear as the classical mechanics. Instead, through the introduction of some new concepts and principles or modifying the meanings of existing concepts, they have successfully explained these phenomena with a cost of hard understanding since most of the people have been taught by the traditional meanings of fundamental concepts such as mass, time, and length and they are independent of coordinate frames, while speed and energy are properties of material objects and their values depend on the coordinate frames.

With a purpose of constructing a unified theory for complex systems which can cover from micro scale to macro scale and can consider living objects and lifeless objects, we found that this is possible if we adopt the general system theory (GST) framework (Bertalanffy, 1968; 1972) and combine Bohmian mechanics (Oriols & Mompart, 2019) for microworlds and classical mechanics (Goldstein, Poole, & Safko, 2002) for macroworlds. This is exactly our New General System Theory (NGST) for complex systems (Cui & Kang, 2020; Cui, 2021a; 2021b; Ma & Cui, 2021; Pan & Cui, 2021a; 2021b; 2022; Cui, 2022; Cui & Pan, 2022; Huang & Cui, 2022). Obviously, this theory is at an early stage and our current focus is on the application to engineering problems on the earth rather than the cosmological issues explained by general relativity.

From NGST's point of view, the main obstacles for the unification are the philosophical conflicts among classical mechanics, Einstein's relativity theory, and Bohr's quantum mechanics. These conflicts are not only shown in axioms but also in fundamental concepts. The purpose of this paper is to reveal the reasons why Einstein and many others fail to unify relativity theory with quantum mechanics through comparing the main differences in philosophical opinions among NGST, Einstein, and Bohr including their understanding of some fundamental concepts. The paper is structured as follows. In Section 2, we briefly summarize the main philosophical opinions of NGST and then in Section 3, we use tables to compare the differences among NGST, Einstein, and Bohr. In Section 4, immediate future research directions in NGST are discussed. Finally, some conclusions are drawn.

Brief Introduction to NGST

The general system theory (GST) was developed by Bertalanffy and many others in the 1920s-1970s (Bertalanffy, 1968; 1972) with the main emphasis on the following aspects: from objects to relationships, from quantity to quality, from substance to pattern, from closed system to open system, from linear performance to nonlinear performance. However, its philosophical foundation is more or the less the same as classical mechanics which was incomplete. It has only matter part (visible material objects vs. invisible ether), whether ether is of discrete nature (particle) or continuous nature (wave) is unclear. Thus, just by emphasizing the holistic approach to treat the living organisms in addition to the reductionist approach, this theory did not exhibit much power in

solving problems and since 1980s, people gradually lost their interest in GST. New general system theory (NGST) (Cui, 2021a; 2021b) has supplemented this deficiency by combining classical mechanics (Goldstein et al., 2002) and Bohmian mechanics (Oriols & Mompart, 2019) together with the oriental philosophy on ontology (Capra, 1975).

The basic ideas (or philosophical opinions) of NGST can be summarized into the following five aspects: the object of study, ontology, epistemology, methodology, and practical application.

The Object of Study in NGST

In Newtonian mechanics (Newton, 1846), the object of study is obviously the material objects such as a planet and an apple, time and space are the framework used to describe the movement of material objects. In order to explain why a material object can move, Newton introduced the force concept and attributed the movement to the force action. He discovered the gravity force to unify the movement of planets and the objects on the earth such as an apple falling down from a tree. He introduced three axioms to reveal the movement laws, but these laws are based on a non-physical assumption of the inertial frame (Huang & Cui, 2022). However, Einstein adopted a totally new timespace frame and matter concept and he unified concepts of space and time, mass and energy and forces (Einstein, 1916). The success of Einstein's theory of relativity is well-known nowadays but we paid the price that we have to be accustomed to two timeframe systems.

It is the attempt of us to generalize classical mechanics to explain these same phenomena. In NGST, we emphasize that in order to use the system model to solve physical problems, two types of objects must be clearly distinguished: concrete objects and abstract objects. Lazar Mayants emphasized the importance to distinguish these two types of objects. According to him, concrete objects are defined to be the actually existing objects which can be observed and measured (Mayants, 1984, p. 3), for example, the Earth we live on, the computer we use, the book we read, a particle we can observe. Each concrete object will have a definite mass and position at an instant of time. These are called the properties of a concrete object.

Concrete objects are the actual objects of study in science. In order to define concrete objects, we need abstract objects for their comparison according to the relativity of simultaneity axiom. An abstract object is the image of a class of the concrete objects. Abstract objects corresponding to different classes of concrete objects can differ in degree of their abstraction. Mayants (1984) has emphasized that if one is really eager to understand what probability is and master the fundamentals of probabilistics, it is necessary to understand the relationship between concrete and abstract objects. Elucidation of this relationship and, in particular, realization of the absolute necessity of differentiation between concrete and abstract objects, is not empty philosophizing, but one of the most important principles of the study of nature and building up the various branches of science (Mayants, 1984, p. 10). Confusion of a concrete object with an abstract, in some situations, could lead to paradoxes and absolutely erroneous conclusions (Mayants, 1984, p. 10). Mayants had illustrated how the well-known paradox can be solved through this differentiation: What comes first, the chicken or the egg? (Mayants, 1984, p. 11). By applying the same differentiation, we can conclude that in science, we should only study the origins of concrete objects like the world or the particular star we can observe but not the origins of abstract objects such as universe and life.

By using a system model one can realize that we need two spaces to define a system, one space is to enclose the system we are interested in while the other is the external space known as the environment which might influence the behaviour of the system. The actual space for the environment is obviously the whole universe

minus the system space if we define universe is the maximum space. Let us now adopt Einstein's suggestion to merge space with time (Einstein, 1905). In real situations, the environment we consider in a system model is much smaller than the whole universe. Furthermore, we know that scientific knowledge emphasizes its testability in order to differentiate its knowledge from those of religions. Thus, we have to distinguish these two concepts, universe and world, as shown in Figure 1. Universe is defined as the maximum spacetime as human beings can imagine while world is defined as the maximum spacetime human beings can observe. It is obvious that no matter how advanced the telescopes and microscopes are, the spacetime we can observe is of finite nature while we can never know the actual spacetime of the whole universe whether it is finite and infinite. Since our imagination in mathematics is infinite, we can take these two definitions as axioms:

The infinite Universe axiom: The universe is defined as the largest system our human beings can imagine and it is of infinite nature both in time and space (Cui, 2021a, p. 248).

The finite world axiom: The world is defined as the spacetime our human beings can observe and it is of finite nature both in time and space (Cui, 2021a, p. 248).

The advantage of this selection of the infinite universe is to avoid all the awkward questions of the properties of the universe which we can never test our answers with the scientific method. With the preexistence of the universe and the life in the universe, the origin of a particular world such as the Milky Way can easily be explained similar as human beings constructing complex structures on the earth. This requirement has also been realized by Bunge (1983).

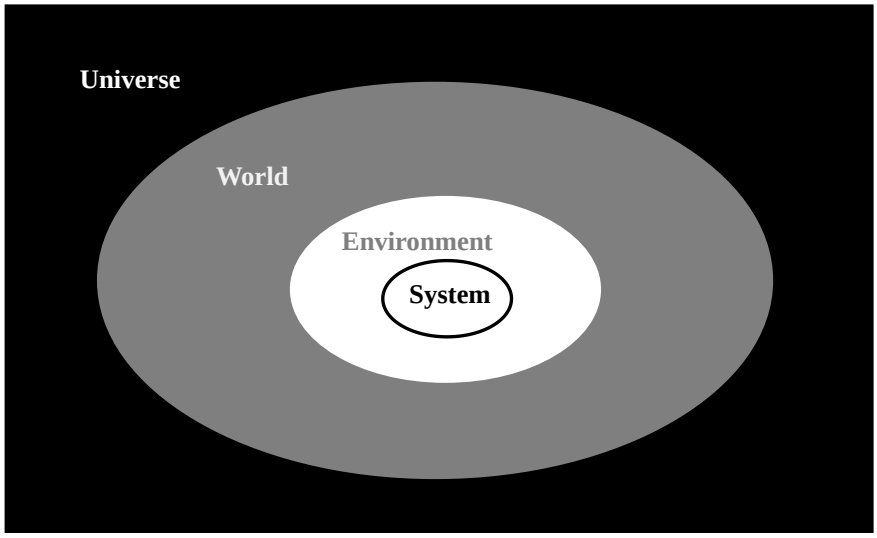

Figure 1. A schematic representation of the concepts of universe and world, system and environment.

With the differentiation of universe and world, we can realize that the system we can study together with its environment must be confined to the scope of the world, also see Figure 1. This can be summarized as an axiom: 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 (Cui, 2021a, p. 249).

Thus, it is clear that science has limitations and it is impossible for human beings to use scientific method to disclose the operation rules for the whole universe. Strictly speaking, all the axioms induced from finite observations and theorems deduced from axioms have only been tested in the world and it is an overclaim if we believe they are also valid in the whole universe. In NGST, we strictly emphasize this point while quite a lot of

scientific theories such as the Big-Bang theory (Uzan, 2015; Burago, 2017) and the string theory (Duff, 1996; Zwiebach, 2004) do not emphasize this point.

Ontology in NGST

In classical mechanics, it is clear that mathematics is a language used to describe the physical world. So we first need to know what the world is composed of. This is the ontological question.

As we have emphasized the fact in introduction that in order to define a concept we need to rely on other concepts, at least its complement. This is called the relativity of simultaneity axiom. Then, we can find that logical consistency and completeness are conflicted in nature.

Let us take a dictionary as an example. Since we did not accept the definition of "A is A", thus, if a dictionary wants to define every concept they presented, they must be logically self-circular (called logical inconsistency), otherwise, it must leave some concepts undefined and take them for granted (incompleteness). This rule can also be applied to a theory. This is the most important rule used in NGST (Cui, 2021b) and this is more or the less the generalization of relativity to every concept. We found that all the theories based on the monist philosophy basically violate this completeness-consistency-conflict principle.

Completeness and consistency are in conflict in nature and a scientific theory must be incomplete in order to be logically consistent.

This discovery can also be regarded as the application of Gödel's incompleteness theorem (Gödel, 1931). In order to attack quantum theory giving up the causality law, Einstein criticized its completeness (Einstein, Podolsky, & Rosen, 1935) and Bohr defended that it is a complete theory (Bohr, 1935). Both of them have not realized the fact that every scientific theory must be incomplete in order to be logically consistent. Of course, in these two papers, their definitions of completeness are slightly different from the completeness here. EPR assumed a completeness condition: "every element of the physical reality must have a counterpart in the physical theory"; and a reality condition: "If, without in any way disturbing a system, we can predict with certainty (i.e., with probability equal to unity) the value of a physical quantity, then there exists an element of physical reality corresponding to this physical quantity" (Einstein et al., 1935, p. 777). These are actually the relation between physical ontology and mathematical formulation. Ideally they should be complete if a mathematical theory can fully explain the observed phenomena and predict the future phenomena. Since both the past and the future phenomena can never be completely known, then such a condition can never be tested. So even in this sense, we have to accept that every theory is an incomplete theory from a realist point of view. A complete mathematical theory is an ideal situation which can never be proved.

Based on this *relativity* axiom we can deduce that the monist philosophy is incomplete while more than dualism is unnecessary. For example, materialism and theism cannot explain the creator problem (Sarfati, 1998) while idealism cannot explain the paradox of "A skillful woman can cook a meal without rice". Currently the trialism of matter, energy, and information is very popular (e.g. Trnka & Lorencova, 2016; Gaiseanu, 2021), but we think this is not necessary. Energy is a property of matter while information is created by minds in living creatures, so actually they are not independent (Cui, 2021b).

Based on this relativity of simultaneity axiom, a pair of mutually exclusive and domain inclusive concepts should be used to describe the properties of the system. For example, what does a system consist of? We can answer the essence is empty while the phenomena are beings or existences, this is in the sense of monism. If one is asked to describe what objects we can see phenomenally, we can first distinguish all beings into beings with

self-moving ability (living in a general sense) and beings without self-moving ability (non-living). Through this division process we can assign a different name to each different object we can observe. For non-living objects, we have known that they are made of atoms and each atom can be decomposed into electrons, protons, and neutrons. Protons contain two up quarks and one down quark. Neutrons contain one up quark and two down quarks. The nucleus is held together by the "strong nuclear force", which is one of four passive fundamental forces (gravity and electromagnetism are two others). Electrons and other particles can emit photons or even other particles. We speculate that as technology progresses, smaller particles may be created or found. So we can always divide the particles into visible particles which we can name them individually and invisible particles which we cannot name them individually. We call the ensemble of invisible particles as ether. Thus, the essence of matter is ether, and the phenomena of matter are visible particles.

In NGST, the unification of different schools of philosophy is achieved. The universe always exists and if we do not differentiate, then the universe is a whole. The essence of every thing in the universe is either empty or being. To be a being it can create everything, to be empty it cannot be seen by us human beings. So in the sense of monist philosophy, empty equals being, that is the main idea of oriental philosophy of the co-existence of two elements (empty and being) (Capra, 1975; 1996). The main idea of western philosophy is either empty or being. People are only allowed to select one, that is the source of conflict. If we are asked to describe the being, then we are applying a logical system to differentiate, two-valued logical system is the minimum while more than three is just a refinement of the two-valued system. For example, we can first differentiate the whole universe as human beings and the nature (non-human beings). The study to the latter is called philosophy and the study to the former is called religion. If we further divide philosophy, the knowledge that can be tested is called science while the knowledge that cannot be tested remains to be philosophy. This is where various sciences are born. For human beings we can simply divide them into good and bad (two valued logic), good, middle, bad (three valued logic), from good (value of 1) to bad (value of 0) (fuzzy logic). There is no contradiction among them.

According to the relativity of simultaneity axiom, the existence of the essence of matter implies the co-existence of the essence of non-matter, let us define this essence of non-matter as mind and we interpret it to be the essence of a living object. The selection of the word "mind" for this non-matter existence is to be in match with the famous mind-body problem raised by Ren é Descartes (1968). Since the three conservation laws of mass, momentum, and energy are the fundamental principles used in classical mechanics (Goldstein et al., 2002; Vanderlinde, 2004), we retain them in NGST. In parallel with the conservation of mass, we assume the conservation of minds. Based on these analyses, we can introduce the following two axioms:

The conservation axiom of ether: Ether cannot be created and destroyed, so it follows the conservation law.

The conservation axiom of minds: Minds cannot be created and destroyed, so they follow the conservation law.

By this axiom, if we want to accept the existence of matter (body), we have to accept the existence of non-matter (mind); thus, Ren é Descartes' famous mind-body problem must be addressed in a dualist manner (Ma & Cui, 2021) as claimed by Ren é Descartes (1968). Ether and minds are the two fundamental existences of everything in the world we can observe. The relativity of simultaneity axiom can solve the "creator" problem in materialism (Sarfati, 1998) and "creating some matter from nothing" problem in idealism (Cui, 2021b). The following axiom is derived from observation through logical induction (Cui, 2021a).

The particle generation and annihilation axiom: Lives can accumulate ether into particles and decompose particles into ether (Cui, 2021a, p. 253).

Both nuclear fision and fusion can be regarded as activities of particle generation and annihilation. Different from current interpretation of turning mass into energy for these two processes, NGST interprets that both mass and energy are conserved in these processes. They are just large particle decomposed into small particles or small particles are merged into large particle. In these processes small invisible particles such as photons are emitted. It must be pointed out that particles in the category of ether may have different properties such as volume, mass, position, velocity, acceleration. Thus, the ontology of NGST can be shown in Figure 2. The world we can observe is only a finite spacetime of the infinite universe, it is consisted of visible self-moving objects (living objects), visible lifeless objects, and invisible objects whose ensemble is called ether. All invisible objects are self-moving particles. The self-moving ability is due to the mind-body interaction, thus, the essence of a living object is a mind which is a non-matter existence and when the mind is separated from the body, the living object is dead and it will lose the self-moving ability. A living object can accumulate ether into a visible lifeless object or decompose the object into ether. All the ether and objects form a world of ocean which moves in the form of waves. These physical waves are called pilot waves in Bohmian mechanics (Oriols & Mompart, 2019). The movement of each particle or object contributes to the severity of waves and each particle or object is subjected to the force actions from the waves in addition to their own active force due to the mind-body interaction. The magnitude and direction of the active force for a living object is governed by the free-will of the mind and the study of the mind must rely on meditation (Goleman & Davidson, 2018). This physical wave field is the concept of a field to explain the actions at a distance (Pan & Cui, 2021a). Without ether, the mechanism to explain the force using the concept of a field is unclear.

Therefore, in order to use NGST for any complex systems, the following pairs of fundamental concepts are regarded to be important and their meanings need to be clarified: (1) universe and world; (2) time and space; (3) matter and consciousness; (4) mind and ether; (5) energy and field; (6) heat and work; (7) life and entropy; (8) probability and information. Some of them can be found in Pan and Cui (2021b) while others are to be clarified in our future work.

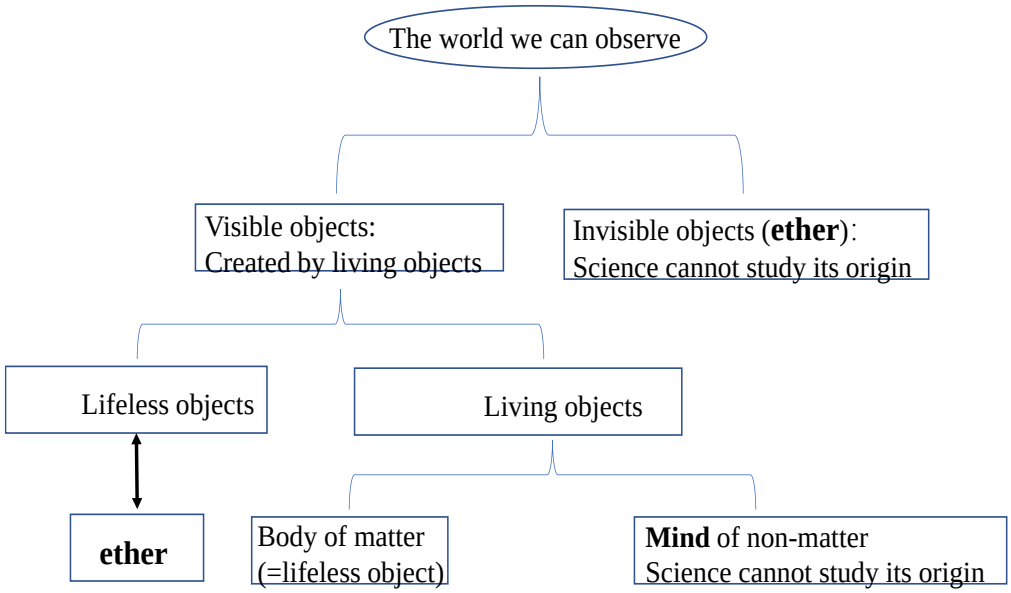

Figure 2. The ontology of NGST for the world we can observe.

Epistemology in NGST

Whether the world is operated with rules or not and whether our human beings can reveal these rules or not, what is the nature of our knowledge to the world, all these questions are epistemological questions. From the system model shown in Figure 1, one can see that human beings fundamentally cannot know the operations of the whole universe. If we assume that the influences from the objects outside environment to the objects inside the system we analyze can be neglected, we can analyze the behaviour of the system. Through many trials and error, such an isolated system model is found to be very powerful in solving system problems. Newton used that approach to unify the movements of terrestrial and celestial objects (Newton, 1846) and this was the born modern science.

Thus, we should realize that all scientific theories actually stand on the four pillars.

(1) The principle of locality: an object is influenced directly only by its immediate surroundings (Wikipedia).

(2) The principle of causality: 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 (Cui, 2021a, p. 255).

The causality axiom may be expressed in another way as follows: everything in the world such as events and actions do not arise *de novo* but are always preceded by other causal factors.

(3) The principle of extrapolation: Every rule we revealed has some sort of extrapolation ability and we can use it to predict future values based on past and/or present values (Cheng & Cui, 2023, p. 520).

(4) The principle of knowability: The causality law for governing the movement of objects in the world can always be revealed by human beings (Cheng & Cui, 2023, p. 520).

We think it is inappropriate to give up three of them in orthodox quantum mechanics (locality, causality, and knowability) in order to explain the quantum phenomena and by sticking to these four pillars, all the quantum phenomena can also be explained and this has been demonstrated in Bohmian mechanics (Oriols & Mompart, 2019).

The truth of knowledge is relative and scientific method cannot prove the absolute truth. If there is no locality law and human beings can never observe the whole universe, then we cannot induce and deduce any operational rules for the world and thus no scientific theory can be established. In each theory, there must be some concepts which are taken for granted and some axioms which cannot be strictly proved. So the knowledge we established for a particular system is of relative truth and they follow the following general uncertainty principle.

The general uncertainty principle (GUP): the performances of a finite system can only be captured with certainty by attributing all uncertainties to its complement of the infinite universe (Cui, 2021a, p. 249).

Proof: Based on the infinite universe axiom and the limited ability axiom, we can know that the uncertainty always exists due to the fact that the universe is an interrelated web of entities (Capra, 1996) and we cannot observe the whole universe due to the human limited ability. All our knowledge to a finite system (world) is related to this general uncertainty. In other words, all knowledge on a particular system is derived under the condition that the influence and interactions from the environment are assumed to be known (certainty) (the relativity of simultaneity axiom). This fact can be expressed as a general principle through logical induction.

The fundamental task of our scientific research is to reveal the 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:

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, p. 190).

Thus, the purpose of scientific research is to maximize the accuracy under the condition of correctness. Without the correctness, accuracy is not meaningful. This is consistent with Qian Xuesen's idea of the meta-synthesis from qualitative (correctness) to quantitative (accuracy) (Qian, Yu, & Dai, 1990; Yu & Zhou, 2002). 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, due to 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). Thus, in NGST, all the particles no matter visible or invisible have trajectories and this is the same as Bohmian mechanics (Oriols & Mompart, 2019).

Methodology in NGST

Methodology is the study of research methods and the procedure to discover new knowledge or to verify pre-existing knowledge claims. The most popular distinction among types of methodologies is between the quantitative and the qualitative approach. Quantitative research is the main methodology of the natural sciences. It uses precise numerical measurements, usually with the goal of finding universal laws that can be utilized to make predictions about future events. Qualitative research is more characteristic of the social sciences and gives less prominence to exact numerical measurements. It is often concerned with human behavior and experience. It aims more at an in-depth understanding of the meaning of the studied phenomena and less at universal and predictive laws.

System is a very general model and every problem we encounter can be modelled using a system model and the problem can be solved through the general procedure introduced in GST. For example, the system analysis can be carried out through the following steps: (a) to construct the system model by defining the system to be studied and its environment; (b) to apply mathematics to derive the governing equation for the system's performance; (c) to establish the boundary conditions and the initial conditions; (d) to solve the mathematical model; (e) to interpret the mathematical solution to its physical properties of the system. The system design can be carried out through the following steps: (a) to formulate the whole design problem as a mission system and specify the set of mission requirements; (b) to divide the whole design processes as pre-design, design, and post-design and carry out the preliminary design; (c) to construct the mathematical model for the system analysis using the general system theory; (d) to optimize the design according to some criteria by applying the multidisciplinary design optimization and this process ends with the contract design; (e) to finish the detailed design in consultation with the equipment manufacturers. Whether one uses CM, RT, or QM depends on the choice of users, in Bertalanffy's GST, he mainly relies on CM. However, due to the dropping off the God concept from Newton's ontology, its ontology of only matter is incomplete and the mechanism for force generation is always unclear. Due to this limitation, GST did not exhibit the great power expected by Bertalanffy and his

followers. Many different complex system theories were proposed in the twentieth century (Ladyman & Wiesner, 2020). The success of these theories has been demonstrated through the Nobel Prize in Physics 2021 being awarded to three scientists for their groundbreaking contributions to our understanding of complex physical systems.

Different from their practices, we tried the generalization of classical mechanics to solve the complex system problems. In order to study the movement of objects, we still need to keep some laws for the start. In NGST, Newton's second law together with three conservation laws of mass, momentum, and energy is still kept. In order to explain why a living object can move under its own internal force, an active force is introduced due to mind-body interaction and the mind has its own free will which can determine the magnitude and direction of this active force. The active force can also be derived from the relativity of simultaneity axiom since all the other four forces (Gravitational force, Electromagnetic force, Strong nuclear force, Weak nuclear force) are passive. Existence of passive forces implies the co-existence of active forces. Passive forces occurred between two objects while active force can be generated within one body through mind-body interactions. For example, a human being can stand up from a chair and can start to run according to his own free will. Of course, this active force can also act on the surrounding objects (Pan & Cui, 2021b; Cui, 2022; Huang & Cui, 2022). With these five types of forces, system behaviour from micro-scale to macro-scale and objects from lifeless objects to living objects can all be solved using classical mechanics (Cui, 2022). There is no need to introduce special axioms used in relativity theory and quantum mechanics. This is our current speculation and more further confirmations are needed.

According to Moreno and Mossio (2015), Kant was the first to defend the view that organisms are deeply different from man-made machines because their parts and activities are non-separable, and the functions of these parts are not externally imposed, but rather intrinsically determined. This special kind of causality is circular, namely effects derive from the causes but, at the same time, generate them. The very organisation of living beings, in which the parts generate the whole and, conversely, the whole produces and maintains the parts, shows a kind of intrinsic purpose. Kant grounds the idea of purposiveness and teleology in the holistic and circular organisation of organisms, and in the fact that they are able to self-organise. The authors further suggest that some aspects of the Kantian perspective are undergoing resurgence, for example, the recent blossoming of systems biology, focused on the complexity of biomolecular interaction networks. This is much closer to a holistic or integrative conception of living systems than the reductionist views which dominate large parts of biology today (Moreno & Mossio, 2015).

Many of these authors put strong emphasis on the idea that the constitutive organisation of biological systems realizes a distinctive regime of causation, able not only to produce and maintain the parts that contribute to the functioning of the system as an integrated, operational, and topologically distinct whole but also able to promote the conditions of its own existence through its interaction with the environment. This is essentially what they have called in the book of biological autonomy (Moreno & Mossio 2015, p. 26). However, instead of using the terms of autonomy, autopoiesis, self-organization, self-regulating, we attributed all these special or emergent properties to the mind-body interaction (Cui, 2021b). Only for a living body in a living state it has these functions and different living bodies may have different levels of autonomy. When the body is dead, i.e., mind is separated from the body, then, the body is a dead body, all these functions will be lost. So the dualist model of mind-body relationship can easily explain the difference between living state and dead state, between living creature and

lifeless object. Obviously, we need to interpret all the micro particles and all the stars in the sky as living objects since they continuously move under the active force. However, the degree of the free will of the minds for these micro particles or stars may be much lower than the degree of the free will of the human minds and the active forces may be back-calculated from measured trajectories (Cui, 2022).

This interpretation is similar as the famous Gaia hypothesis put forward by the chemist James Lovelock (1972) and co-developed by the microbiologist Lynn Margulis in the 1970s (Lovelock & Margulis, 1974).

In the methodology part, another debate is whether deterministic method and probabilistic method should be used. In NGST, this is also unified and it depends on the information available. If there is uncertainty then the probabilistic method is employed while deterministic method is a special case of the probabilistic method where no uncertainty is specifically considered.

Practical Applications of NGST

Basically all the problems which can be solved by classical mechanics and quantum mechanics can be solved by NGST, however, how to determine the active force is the key difficulty. At the moment, this concept can only be used to explain various phenomena such as two-body problems (Pan & Cui, 2021b; Huang & Cui, 2022) and modern Pisa tower experiment (Cui, 2022). That is, we can use the known trajectory to back-calculate the active force and then use this active force to make predictions and explain other phenomena. How to study the active force behavior for human beings is the next challenging issue for future research.

A Comparison of Philosophical Opinions in NGST With Einstein and Bohr

It is obvious that the philosophical opinions of NGST are very different from other physicists, especially Einstein and Bohr. In this section we will make a comparison of philosophical opinions in NGST with those of Einstein and Bohr and let the readers understand the differences. The philosophical opinions of Einstein and Bohr come from these sources (Einstein, 1916; Einstein et al., 1935; Bohr, 1934; 1935; Whitaker, 2006; Heisenberg, 2007; Howard, 2007). Tables are used to show the differences.

The Fundamental Arguments

Table 1

A Comparison of Attitude to Classical Mechanics and the Object of Study

Question	Einstein	Bohr	NGST
Attitude to classical mechanics	Revolutionary	Revolutionary	Generalization
Definition of science	Science can study the whole universe	Science can study the whole universe	Science can only study a finite part of the universe
Whether to distinguish the world from universe from a systemic point of view?	No	No	Yes
Can science study the whole universe?	Yes	No answer	No

Table 2

A Comparison of Fundamental Postulates of NGST With Einstein and Bohr

Question	What are the fundamental postulates for the theory?
Einstein	Revolutionary. (1) The laws of physics are the same for all observers in any inertial frame of reference relative to one another (principle of relativity). (2) The speed of light in a vacuum is the same for all observers, regardless of their relative motion or of the motion of the light source.

Table 2 to be continued

Bohr	Revolutionary. (1) The state of a quantum mechanical system is completely specified by the wavefunction Ψ(r, t). (2) To every observable in classical mechanics, there corresponds a linear, Hermitian operator in quantum mechanics. For example, in coordinate space, the momentum operator $\hat{P_x}$ corresponding to momentum p_x in the x direction for a single particle is $-i\hbar\frac{\partial}{\partial x}$. (3) In any measurement of the observable associated with operator $\hat{A}$, the only values that will ever be observed are the eigenvalues a which satisfy $\hat{A}\Psi = a\Psi$. Although measurements must always yield an eigenvalue, the state does not originally have to be in an eigenstate of $\hat{A}$. An arbitrary state can be expanded in the complete set of eigenvectors of$\hat{A}$ ($\hat{A}\psi_i = a_i\psi_i$) as $\Psi = \Sigma_i c_i\psi_i$, where the sum can run to infinity in principle. The probability of observing eigenvalue a_i is given by $c_i^* c_i$. (4) The average value of the observable corresponding to operator $\hat{A}$ is given by $\langle A\rangle = \frac{\int_{-\infty}^{\infty}\Psi^*\hat{A}\Psi d\tau}{\int_{-\infty}^{\infty}\Psi^*\Psi d\tau}$. (5) The wavefunction evolves in time according to the time-dependent Schrödinger equation $\hat{H}\Psi(r,t) = i\hbar\frac{\partial\Psi}{\partial t}$. (6) The total wavefunction must be antisymmetric with respect to the interchange of all coordinates of one fermion with those of another. Electronic spin must be included in this set of coordinates. The Pauli exclusion principle is a direct result of this antisymmetry principle.
NGST	Generalization. (1) Invariant physics (Phipps, 2014; Sato, 2018) to replace the principle of relativity: The seven fundamental quantities of the International System of Units, including length, quality, time, current strength, thermodynamic temperature, amount of substance, and light intensity are the same for all observers in any frame of reference. (2) Revised Newton's four laws. (3) Three conservation laws of mass, momentum, and energy.

Ontology

Table 3

A Comparison of Ontology of NGST With Einstein and Bohr

Question	Einstein	Bohr	NGST
Ontology	Matter and energy	Matter and energy	Ether and minds
How many independent existences in the world we can observe?	Unclear, matter, energy, information, field …, dark matter and dark energy	Unclear, matter, energy, information, field…	Dualism: ether and minds. Matter is created by living objects through the accumulation of ether and a living object consists of a body with a mind.
Is energy an independent existence in parallel with matter?	Yes	Yes	No, it is just a property of matter.
Concepts of space and time	Fourth dimensions of spacetime	Same as classical mechanics	Same as classical mechanics
Is spacetime the object of study?	Yes, study structure of spacetime	No	No. NGST argues that spacetime is a framework constructed by human beings for the study of the existence and movements of concrete objects. Time is unidirectional from past to future while space is bidirectional.
Whether the theory relies on the inertial frame assumption?	Yes	Yes	No
Whether the theory relies on the existence of vacuum assumption?	Yes	Yes	No
Whether mass is the fundamental property of matter?	No	No	Yes
Mass of photon	Zero rest mass, and mass increases with speed.		Speed independent and non-zero
Is field an independent existence?	Yes, gravitational field theory	Yes, quantum field theory	No, field is formed by the moving of all objects in the universe in the form of waves and it can explain the action-at-a-distance using wave theory.
Is heat an independent existence in parallel with matter?	Yes	Yes	No. Heat is fundamentally a process variable similar as work. When it is used as a state variable, it is another name of the kinetic energy of the system.

Table 3 to be continued

Is information an independent existence in parallel with matter?	No answer	No answer	No, it is created by minds.
How many forces existed in the world we can observe?	Four passive forces	Four passive forces	Five, four passive forces of gravitational force, electromagnetic force, strong nuclear force, weak nuclear force and one active force of psychic force due to mind-body interaction.
Superluminal speed of information transmission	Impossible	Impossible	Possible through the entanglement of minds which is called telepathy.
Existence of time arrow?	Yes, it is a problem of study.	Unclear	Yes. It is our experience and definition. It should not be a problem of study.
The second law of thermodynamics	Cannot be violated	Cannot be violated	Can be violated by living objects. Thus, there is no need to introduce negative entropy or negative energy.

Table 4

A Comparison of Wave Perspective of NGST With Einstein and Bohr

Question	Einstein	Bohr	NGST
Wave-particle duality	Yes, but wave and particle	Yes, but wave or particle	Yes, but wave and particle
Wave collapse	No	Yes	No
The measurement problem	No	Yes, Bohr attributes to apparatus, simplified as an operator.	Yes, NGST attributes to both apparatus and observer, cannot be simplified as an operator.
Existence of entanglement	No, because it violates locality	Yes, locality should be given up	Yes, but the locality still kept
Interpretation of entanglement	No	Quantum entanglement which is regarded as a special feature of quanta, however, experimental evidences showed that some large macro objects also have this property.	Entanglement of minds is regarded as a special feature of living objects.
Does entanglement decrease with the increase of distance between two objects?	No answer since not allowed.	No	Yes. The strength of entanglement of minds decreases with the increase of distance between two objects but the decrease rate of psychic force is much slower than the passive forces.

Interpretation of Superposition

Table 5

A Comparison of Interpretation of Superposition State

Question	Interpretation of superposition state
Einstein	Einstein thought there exists an actual state for superposition state, although we do not know the actual state before measurement. His famous question: Do you really believe that the moon exists only when I look at it? The same question can be asked to Schrödinger's cat.
Bohr	Bohr thought there exists no actual state for the superposition state, and the actual state occurs at the instant of measurement. He defined this sudden change as wave collapse.
NGST	NGST adopts a similar interpretation as Einstein that the actual state always exists no matter we observe or not. Through the measurement, we can know the actual state but each measurement will always disturb the original movement of the system. Superposition is a mathematical representation for the probability to be one of the possible states. After the measurement, these probabilities can be determined. This is fundamentally the same for both micro and macro worlds.

Cosmological Perspective

Table 6

A Comparison of Cosmological Perspective of NGST With Einstein and Bohr

Question	Einstein	Bohr	NGST
Origin of time and space	Yes	Yes	No
	NGST: Science should only study the origin of a particular world rather than the whole universe which includes space and time.		
Curved spacetime	Yes	Yes	No
	NGST has only curved solid objects. Spacetime is just the framework we used for studying the movements of objects. We can use Euclidean space or non-Euclidean space which are defined in mathematics.		
Existence of parallel universe	Yes	Yes	No
	NGST: That depends on the definition. We call them parallel worlds in the universe and reserve universe to be the maximum spacetime human beings can imagine which is infinite now.		
Dark matter	Needed	Not related	Not necessary
	Relativity: in order to explain various astrophysical observations—including gravitational effects which cannot be explained by currently accepted theories of gravity, dark matter is introduced but after more than 100 years search, no commonly accepted discovery has been made. NGST: it is not necessary to introduce this concept. If we do, we define dark matter to be the invisible matter in the form of ether waves in the universe which contains a lot of energy similar as water in the ocean.		
Dark energy	Needed	Not related	Not necessary
	Relativity: In order to explain the accelerating expansion of the universe, dark energy is introduced by Dragan and Turner (1998) but up to now, no discovery has been made. NGST: In NGST, this concept is not necessary. If we do, we can define the energy carried by dark matter as dark energy, that is, the energy contained in ether waves.		

Epistemology

Table 7

A Comparison of Epistemology I of NGST With Einstein and Bohr

Question	Einstein	Bohr	NGST
Locality	Yes	No	Yes
Causality	Yes	No	Yes
Knowability	Yes	No	Yes
Extrapolation	Yes	Yes	Yes
Testability of Scientific knowledge	Yes	Yes	Yes
Falsification criterion of a scientific theory	Yes	Yes	Yes
Whether the theory violates testability and/or falsification criteria?	Yes	Yes	No

Table 8

A Comparison of Epistemology II of NGST With Einstein and Bohr

Question	Deterministic vs. probabilistic
Einstein	Physics should be deterministic in nature like classical mechanics and probabilistic due to the hidden variables in quantum mechanics.
Bohr	Classical mechanics is deterministic but quantum mechanics should be probabilistic in nature.
NGST	Deterministic and probabilistic co-exists for any physics including classical mechanics and quantum mechanics. Probabilistic is due to lack of information. It is wrong to think that we can predict in classical mechanics the long-term future by giving the initial conditions only. Both the coefficients of the governing equations and the forces acted on the objects are varying and it is hard to predict their long-term behaviour.
Question	Principle or constructive
Einstein	In order to defend for his special theory of relativity, Einstein proposed that there are two types of theory (Howard, 2007). Classical mechanics is constructive while his SR theory is principle.
Bohr	According to Einstein's categorization, orthodox quantum mechanics is also a principle theory.
NGST	Both Einstein and Bohr thought principle and constructive are mutually exclusive and we think it could be a theory of both principle and constructive. NGST is such an effort.

Further Researches Towards a Unified Theory for Complex System Theory

From our point of view, why people failed in unifying the relativity theory with quantum mechanics is because both proposers have adopted a revolutionary thinking from classical mechanics in constructing the new scientific theory. Every scientific theory includes four parts: axioms, theorems, logical reasoning method, phenomena. If we regard the observed concrete objects as objective, then description of the observed phenomena after measurement is certainly a mixture of objectivity and subjectivity. In classical mechanics, this subjectivity in the description of measurements is often ignored. This practice may have little influence on simple systems but for complex systems this influence could not be ignored no matter in macro and micro scales. Quantum mechanics have emphasized this fact and defined it to be the measurement problem. For the unobserved objects, whether these objects exist or not, this is basically another philosophical question. People can use different answer to construct different theories. It is obvious that Einstein and Bohr adopted a totally different attitude to many philosophical questions. Furthermore, they have redefined many fundamental concepts of time, space, matter, energy. The success of relativity theory and quantum mechanics indicated that scientists can construct their own theory with their own axioms and concepts in their own systems.

The most attraction of scientific theory is their accuracy in representing things in comparing with natural language which is often fuzzy. So in NGST, a new criterion to demarcate scientific theories from pseudoscientific theories is proposed, this criterion includes three aspects: (1) clear definitions of important concepts; (2) logical consistency that all axioms are induced from finite observations and all theorems are deduced from axioms; (3) not falsified yet. No counter examples have been found against axioms or theorems.

According to this criterion, many problems can be found in both relativity theory and quantum mechanics. First, the meanings of many fundamental concepts have been changed from classical mechanics which make people hard to understand since all the people are educated with classical mechanics. Second, the axioms are set from requirements rather than from finite observations or life experience. So many axioms are counter intuitive such as the speed-dependent mass and independent existence of energy in parallel with matter. Third, the fundamental requirements of inertial frames and vacuum are physically impossible.

It is well known that classical mechanics was constructed in the Euclidean geometry, however, relativity theory and quantum mechanics were constructed in Riemannian geometry and Hilbert spaces. Hilbert spaces are the generalization of finite-dimensional Euclidean vector spaces to spaces that may be infinite-dimensional while Riemannian geometry is a non-Euclidean geometry. From finite to infinite is a big jump which could always introduce paradoxes (Clark, 2007) and from Euclidean to non-Euclidean is another big jump. This inconsistency in mathematics also provides a big obstacle for the unification.

So our idea for the unification is the generalization of classical mechanics and we still keep the Euclidean geometry and adopt most of the fundamental concepts defined in classical mechanics. We apply the general procedure developed in general system theory to model the physical problem, to derive the governing equations by using the revised Newton's laws and three conservation laws. Then we apply mathematical theory to solve the problems and interpret the results to physical problems. Up to now, the general ideas for the new general system theory have been presented but in order to make the theory more attractive to the people, the following researches need to be done urgently.

Firstly, to refine the philosophical framework of NGST. We need to do following two things:

(1) To check the dependences among axioms and deduce a minimal set of axioms.

In Section 2, we have listed many axioms needed for NGST, whether these are all fundamental or some can be deduced from other axioms need to be addressed. For a good scientific theory, the axioms should be as less as possible.

(2) To check how many important concepts are needed for complex systems.

In the process of comparison with three theories, we really found that the inconsistency of some important fundamental concepts is the key issue. In order to construct the unified theory, these concepts must be redefined. Up to now what we think important concepts for the complex systems are the eight pairs of 16 concepts and they are: (1) universe and world; (2) time and space; (3) matter and consciousness; (4) mind and ether; (5) energy and field; (6) heat and work; (7) life and entropy; (8) probability and information. It seems to us that information and entropy are the two most fuzzily defined concepts that need to be clarified. It may be important to point out that not all these eight pairs of concepts are the pairs we emphasized previously for mutually exclusive and domain inclusive. They are collected together just for the convenience of memory.

Secondly, to construct the mechanics framework of NGST, we need to do two things:

(3) To refine all the existing theorems in classical mechanics for its application to both living and non-living systems.

Since Newtonian mechanics was built on the ontology of ether with God and there is no active force introduced, furthermore, his theory relies on the existence of inertial frames which is physically impossible. So quite a lot of theorems are found to be valid only for lifeless objects. They need to be revised. Cui (2021a) has provided a preliminary revision to these theorems. Whether this revision is valid or not needs to be further confirmed.

(4) To check the equivalence of Newtonian mechanics, Lagrangian mechanics, and Hamiltonian mechanics.

Classical mechanics is built on the Newtonian mechanics, then developed to Lagrangian mechanics and finally to Hamiltonian mechanics. Quantum mechanics is built on Hamiltonian mechanics. It was educated in classical mechanics that these three mechanics are equivalent, however, some scientists are questioning this equivalence. Curiel (2014) specifically pointed out that classical mechanics is Lagrangian but not Hamiltonian. We support his opinion by supplementing the following suspect.

The degree of freedom of a particle in Newtonian mechanics is three. It is written in 2nd order partial differential equations. In Lagrange mechanics, it is written in six dimensions of 1st order partial differential equations, but there are three speed constraint equations, so there are still three independent variables. However, Hamiltonian mechanics becomes a complete six-dimensional space problem. If the three constraint equations are not considered, is the solution space expanded? Mathematically, all Lagrangian solutions should be included in Hamiltonian, but some Hamiltonian solutions may not meet the three constraints of Lagrangian. Therefore, these two systems are not completely equivalent. This suspect needs to be investigated.

Thirdly, to apply our ontology (mind-ether model and active force) to solve frontier problem of physics and life science.

(5) To study the mechanism of active force and its measurement and control methods.

The active force is supposed to be the psychic force first suggested in nineteenth century (Earwaker, 1871; Cox, 1872; Crookes, 1874; Newcomb, 1884). William Crookes was the first British scientist of note to engage in psychical research, conducting experiments with Daniel Home and other mediums in the 1870s (Crookes, 1874). His claim to have discovered a new “psychic force” was strongly contested by other scientists, but his reports continue to be widely cited and discussed today. In NGST, the existence of active force was identified

from the axiom of relativity of simultaneity. The magnitude and direction of this force is governed by the free will of the mind. Thus, how to understand its mechanism more deeply and how to measure and control this force are urgently to be solved. Previous researches in this field are certainly a foundation for this study (Alvarado, 2015; 2019).

(6) To demonstrate the capability of using active force to solve special problems in relativity and quantum mechanics.

It is our speculation that due to the missing of active force for the living objects, that is the main reason why some phenomena could not be explained in the framework of classical mechanics. For example, when Newton saw an apple falling down from a tree, he considered the question why the moon is stable in the sky. By seeking the answer to this question, he discovered the law of gravitation. However, such an explanation is not perfect since the providers of the initial throw force to the moon orbit and the continuous centrifugal force to balance the gravitational force are unclear. Furthermore, if one considers the resistance the moon is subjected to during its movement from the environment, the energy supplement mechanism is also unclear. If we interpret the moon to be a living object which can have the ability to generate the active force to survive for the environmental changes happening all the time, this problem can be easily explained (Huang & Cui, 2022). So now we need to use this active force to explain some famous experiments such as double-slit experiment (Young, 1804), blackbody radiation (Plank, 1901). For example, Bohm (1952) found that the critical difference between quantum mechanics and classical mechanics is the existence of the quantum potential originated from the non-uniform spatial distribution for the probability of matter waves. A straightforward question, therefore, is whether quantum pressure could be an essential source of active force and whether its mechanism arises from the interaction among non-uniform particles in the ether.

(7) To use our new interpretation of dark matter and dark energy to check the suitability to explain the observed phenomena.

In classical mechanics, energy is a property of matter and later Plank and Einstein introduced independent existence of energy. However, when Einstein's theory of general relativity is used to explain the observed cosmic phenomena, difficulties met and in order to explain these difficulties, dark matter and dark energy are introduced. According to latest estimation, the universe consists of less than 5% observed matter, about 27% dark matter, and 68% dark energy. From this theory, one can find a strange fact that we cannot distinguish explicit matter with explicit energy but we can distinguish dark matter with dark energy. From the definition of science, we realized that we should not study the whole universe but just the world we can observe. In that case, the expansion and contraction of the world can be well explained using the active forces. We need to use NGST to re-explain these many phenomena in cosmic observations such as Velocity dispersions, Galaxy clusters, Gravitational lensing, Cosmic microwave background (Arun, Gudennavar, & Sivaram, 2017).

Summary and Conclusions

To construct a theory of everything (TOE) is a dream of many scientists and Einstein devoted many decades to unify his theory of relativity with quantum mechanics but he did not make any progress. According to Bohr and Heisenberg together with many physicists accepting their philosophy, this was impossible and micro worlds are operated totally different from macro worlds and even now, scientists still intend to provide more evidence to support this philosophy (Li et al., 2022; Chen et al., 2022). However, from New General System Theory

perspective, this is a self-circular logic (Cui & Pan, 2022). The question itself is a philosophical question and its answer is a selection problem rather than a truth problem (Cui & Kang, 2020). We argued that to select yes is better than to select no for the further development of science. Based on this belief, the authors took Bertalanffy's general system theory mainly as an epistemology framework and supplemented a new mind-ether ontology (Cui, 2021b), and combined classical mechanics with Bohmian mechanics to construct our new general system theory (NGST). This theory is basically a generalization of classical mechanics rather than a revolution to classical mechanics taken both by Einstein and Bohr in developing their relativity theory and quantum mechanics. The purpose of this paper is to further compare the philosophical opinions among NGST, Einstein, and Bohr. From this comparison, the following conclusions can be drawn.

(1) The main differences among NGST, CM, RT, and QM can be summarized in Table 9. The unrealistic assumptions of God, god-coordinate system of inertial frame (Huang & Cui, 2022), vacuum in classical mechanics, and the counterintuitive assumptions of constant speed of light and invariant mathematical format of physical laws, indefinite superposition state interpretation are not adopted in NGST. Testability is the strict criterion to follow in NGST, that is, fundamental concepts are as close as possible to classical mechanics, axioms are induced from finite observations and thus match our life experience, theorems are deduced from axioms. Past and present phenomena should be explained and predicted future phenomena can always be tested.

Table 9

The Main Differences Among Four Theories

Item	NGST	CM	RT	QM
Geometry space	Euclidean geometry	Euclidean geometry	Riemannian geometry	Hilbert spaces
Object of study	Concrete objects	Concrete objects	Spacetime and matter	Particle and wave
Inertial coordinate frame	Not relied on	Relied on	Axioms Relied on but theory extended to non-inertial frame.	Relied on
Vacuum	Not relied on	Relied on	Relied on	Relied on
Ontology	Ether and minds	Matter and God	Matter and energy	Matter and energy
Free will controlled active force	Yes for all minds	No except for god	No	No
Satisfaction of four pillars of a scientific theory	Yes	Yes	Yes	Violations of three.
Coordinate transformation	Galilean transformation	Galilean transformation	Lorentz transformation	Galilean transformation
Fundamental property of matter	Mass	Mass	No	Wave-particle dualism
Speed dependent mass	No	No	Yes	Yes
Speed limit of information transmission	Yes, but can be superluminal through entanglement of minds	Speed of light	Speed of light	Speed of light
Mass-energy equivalence principle	No	No	Yes	Yes
Invariance	Invariant fundamental units	Invariant fundamental units	Invariant mathematical format of physical laws	Invariant mathematical format of physical laws
Superposition state	A definite state to be measured	A definite state to be measured	A definite state to be measured	An indefinite state

(2) The main obstacles for the unification are the philosophical conflict among classical mechanics, Einstein's relativity theory, and Bohr's quantum mechanics. These conflicts are not only shown in axioms but also in

fundamental concepts especially the geometry space. Classical mechanics was constructed in the Euclidean geometry, however, relativity theory and quantum mechanics were constructed in Riemannian geometry and Hilbert spaces. Hilbert spaces are the generalization of finite-dimensional Euclidean vector spaces to spaces that may be infinite-dimensional while Riemannian geometry is a non-Euclidean geometry. From finite to infinite is a big jump which could always introduce paradoxes (Clark, 2007) and from Euclidean to non-Euclidean is another big jump. This inconsistency in mathematics also provides a big obstacle for the unification. So NGST intends to generalize classical mechanics in Euclidean geometry to explain the phenomena in relativity theory and quantum mechanics through the introduction of active forces for living objects.

(3) In order to use the system model to solve physical problems, two types of objects must be clearly distinguished: concrete objects and abstract objects. Such a differentiation is necessary for the resolution of a well-known paradox: What comes first, the chicken or the egg. In science, we should only study the origins of concrete objects like the world we can observe but not the origins of abstract objects such as universe and life, space and time, etc.

(4) Knowledge to a system can be established through definitions of concepts and derivations of axioms through logical induction from finite observations and theorems through logical deduction from axioms. Every scientific theory is built on the four pillars: the principle of locality, the principle of causality, the principle of extrapolation, and the principle of knowability. Therefore, scientific theory must be confined to the world we can observe but not the whole universe. In NGST, knowability and agnosticism are a pair of co-existent concepts, knowability to world while agnosticism to universe. In QM, their selection is knowability to macro world while agnosticism to micro world.

(5) From the relativity of simultaneity axiom, we can derive that existence of passive forces implies the co-existence of active forces. We interpret the psychic force first suggested in nineteenth century for human beings (Earwaker, 1871; Cox, 1872; Crookes, 1874; Newcomb, 1884) to be the active force and extend this active force for all the moving bodies such as micro particles and stars. Thus, the entanglement of quantum particles is re-interpreted as entanglement of minds. It is not the scale but the living nature that matters. So the actual question is what is life (Schrödinger, 1944). In NGST, life consists of a body with a mind or several minds but a lifeless object or a dead life consists of a body only.

(6) So the key idea for the unification is the generalization of classical mechanics and to still keep the Euclidean geometry and adopt most of the fundamental concepts defined in classical mechanics. For example, time and space are the framework we defined to describe the movements of concrete objects. The fundamental property of matter is mass and energy is just a property of matter. By introducing the active force for living objects which is due to the mind-body interaction and controlled by the free will of the mind, the trajectory problem of an object can be solved through the use of three conservation laws of mass, momentum, and energy. There is no need to make the claim that micro particles do not have the trajectories at the time that measurement technology has not reached that level. It is also in contrast with the life span of particles such as the current measurement of electron's life span is 6.6×10^{28} yr.

(7) Seven urgent research directions are detected in order to develop NGST into TOE and within these, to study the mechanism of active force and its measurement and control methods are the most important. This will significantly advance the rapidly emerging life mechanics of living organisms and the information mechanics of intelligent machines (Yang, Zhao, & Wang, 2020).

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