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Possible states theory and human destiny in the stars

Abstract

Possible states theory posits a universe of unique objects and unique collections of interactions between them. The interactions are designated the possible states. The states include past, future and possible interactions. The theory concerns the propagation of change in the collections of possible states. Using a few simple assumptions, it becomes possible to generalize about the occurrence of change. The theory is consistent with quantum electrodynamics in a finite and discrete environment; however, in the possible states universe an interaction does not cause alternative possibilities to disappear. The picture of the universe yielded by the theory differs from the conventional viewpoint in important ways. Past, future and possible states may interact with one another without reference to location in space-time. Per Gödel's incompleteness theorems the universe cannot be unambiguously described as moving particles; instead a description may be assembled from quantum mechanical wave functions, preserving fundamental ambiguity. Many truths, some contradicting each other, can simultaneously exist. The human future already participates in the present, opening possibilities never previously envisaged. To imagine the future, therefore, is to quantum mechanically assemble it. Accordingly, humanity prepares its path to the stars by dreaming of it.

Keywords

Possible states; Quantum electrodynamics; Incompleteness; Gödel; Philosophy of science; Truth.

INTRODUCTION

"I think therefore I am."
Descartes
"Before the future can occur, it must be imagined."
John Brandenburg, Aviation Week October 10, 2011

Philosophy is inherent in science and thought, although its role is often hidden. Science is a search for physical truth while philosophy is a search for a more abstract truth. It is no accident that Kant the philosopher was the originator of the "Nebular Hypothesis" for the birth of the Solar System or that Descartes not only connected self-awareness with existence but also invented Cartesian coordinates.

Quantum mechanics, because it introduces the role of consciousness into the collapse of the wave function[1], must impact philosophy. The collapse of the wave function occurs when a sentient being gains awareness of a system being in a specific state, whereas before it the same system had to be analyzed as being in a spectrum of superposed states. Thus, knowledge by a sentient being collapses the spectrum of states into one state. Therefore, quantum mechanics tells us that by being conscious beings we affect the universe. However philosophy, because it teaches us how to think, must also impact science in return. On the boundary of philosophy and physics sits Possible States Theory[2]. This theory attempts to extrapolate beyond present physics using the principles of integration over all possible histories used in Feynman's QED [Quantum Electro-Dynamics]. In this brief paper we will apply possible states theory to the problem of interstellar flight and its related problem of human existence and human destiny in the Cosmos.

RESULTS AND DOSCUSSION

Possible states theory and the cosmos

Feynman's QED is perhaps the most accurate physical theory in existence. It is the combination of Special Relativity, Quantum Mechanics and Electrodynamics. However, it is a very strange theory. Its predictions are accurate. Its assumptions are strange in that the future influences the present. It says that when an electron moves and interacts with a photon of light, it accesses all possible histories and futures in doing so. One can imagine that the quantum aspect, the spooky "Schrodinger's Cat" portion of the theory, makes the electron access futures as well as pasts. The alternative histories are values it can have. For example, its location can be anywhere. The quantum aspect is the collapse of these histories into an event. The multiple possible measurements collapse into one when the measurement is made.

The access to the future comes from Relativistic Electromagnetism because its own fields affect the motion of an electron as it moves. It was Wheeler and Feynman[3] who discovered that once the electron was reduced to a point charge, as it had to be because of quantum mechanics, then its motion would yield infinities unless it experienced an average of future [advanced] and past [retarded] potentials. So it can be said that the problem of the electron getting signals from the past and also the future in QED is actually a classical problem.

This means that the universe interacts with both past and future possible states. The codification and extrapolation of this tested QED concept is Possible States Theory: that every system evolves according to its past and future possible states.

Given this understanding we will apply Possible States Theory to the problem of humanity in the Cosmos.

Possible States Theory begins with the acknowledgment that all we can ever know about an object is through interacting with it. The Theory does not allow interaction-free measurements. The object is therefore associated with a collection of interactions with other objects; members of the collection are called the possible states. All past, future and possible interactions are in the collection. An object's collection of possible states is sometimes referred to as a "zoo." In this frame of reference objects are represented by their interactions; it follows that objects have no defined boundaries and the definition of an event is arbitrary.

When an object is considered to consist of its zoo of possible states it must be regarded as connected to everything it has ever been connected to or could have been connected to or will be connected to in the future. From this standpoint objects cannot be localized. An effort to determine whether object A is connected to object B makes a connection between them.

The same is true of an event. When the event started and when it stopped is an arbitrary decision. Did the experiment start when the experimenter had the idea for it, when he turned on the lights in the lab, or when he started up the apparatus? Did it stop when he turned the apparatus off, or when he published an article on the experiment or when readers finished reading the paper?

The common assumption is that we inhabit a three dimensional space in which time flows in only one direction, making the past unchangeable and the future inaccessible. The possible states standpoint is quite different. We consider events in terms of possible states interactions, which are ordered by similarity and not by proximity in space-time. An event is really a huge composite of past, future and possible interactions with other events. Moreover it is an evolving composite. Each zoo of states is constantly evolving through interaction with other collections of states.

A model of the universe should be both minimal and true; that is, it should not contain unnecessary premises or assumptions contrary to fact. Infinity and the continuum are excluded from the model, for the simple reason that no verifiable example of either exists. No stable will ever host a continuum of horses; no farmer will ever grow an infinite number of beets.

Let us assume that the universe consists of a countable number of unique objects; all that it is possible to know about them derives from the interaction between them. Let all interactions be considered: past, future and possible. Let us suppose that from the standpoint of a given observer interaction *a* preceded interaction *b*. The collection of possible states is not ordered either space-wise or time-wise. It follows that a different observer could see *b* before *a*. In consequence the arrow of change may point in any direction.

Everything that can happen does, and it all happens at once. We inhabit a permanent now, a complex present in which the past, the future and the possible coincide and interact. Every quantum electron[4] as it moves, interacts with the future equally as with the past.

The present is therefore, not just a product of the past, but equally, of the future. As conscious entities we collapse the wave function of the present using information about the past but also about the future. Our fearful imaginings, and hopeful visions of the future determine our present state of mind as much as the past and its legacies. Experience is normally our guide to the present, but we must realize that our aspirations play an equal role. Therefore, the future, as well as the past, must be acknowledged as part of the present.

Possible States Theory is consistent with quantum electrodynamics in a finite and discrete environment; however,

in the possible states universe, an interaction does not cause alternative possibilities to disappear. The picture of the universe yielded by the theory differs from the conventional viewpoint in important ways. Past, future and possible states may interact with one another; interactions occur without reference to location in space-time. Given that all possibilities are present, the possible states universe is complete.

The image is of a constantly shifting sea of possible states. However it cannot be the Dirac sea, a continuum of particles and antiparticle pairs occupying every energy state in the vacuum. Per Gödel's incompleteness theorems[5], a system of axioms must be incomplete, producing statements that are true (consistent with the axioms) but not verifiable. Alternately, if complete it must be inconsistent. For example, it is easily seen that the rational numbers and their arithmetic cannot describe the universe; the system is self-consistent, but is not complete: it cannot describe the number π or the square root of 2. Even the real number line fails to describe 1/x when x goes to zero. Likewise, therefore, the real numbers are complete, but infinity and zero cannot be included consistently in their arithmetic except as limits; thus the real numbers are not truly consistent.

Conservation laws are the main focus of physics, and these laws take the form of algebraic expressions that are consistent. One can see Gödel's incompleteness theorem at work in the physical laws of the universe, which are consistent, and can be run backward from the present until the moment of the Big Bang, when all conservation laws fail in a massive infinity.

Possible States Theory can be considered complete in the sense that it encompasses all possible states; however it allows singularities. A singularity is an interruption in continuity which cannot be characterized within the parameters of Possible States Theory. Singularities in turn are associated with self-awareness, which is the ability of one zoo of states to select another zoo with which to interact, choosing between multiple alternatives. In self-aware zoos, both as individuals and in coherent groups, intention, purpose and successive decisions can create multiplicities of possible states. Therefore, for human beings, Possible States Theory can be considered to hinge on human decisions and intentions. What we, humanity, wish to do is far more important than what merely seems possible to do.

The concept of truth with which we are familiar is consistency with a set of postulates or a system of axioms. The concept of truth in Possible States Theory is based upon a correspondence to some collection of possible states. "Infinity" cannot be true because no collection of possible states can be produced that provably or demonstrably has this quality. The same is true of the continuum. Truth, in the possible states sense, manifests as a chain of interactions between inhabitants of zoos of possible states. If such a chain exists, the chain is "true." If such a chain *could* exist, the chain is "true."

Because zero and infinity cannot be part of any such chain, the possible states are not consistent. hey are complete because they contain every interaction that has happened, will happen or could possibly happen, but they give rise to consequences that are not consistent: to multiple truths that may conflict with one another. In consequence, the laws of physics cannot be uniform throughout the entire universe.

A more profound form of inconsistency occurs from the presence of conscious observers. Efforts to compare one chain of interactions with another require an observation that changes all parties to it. Both a and ~a are changed, thus making the comparison impossible. There is no difference between a and ~a because there is no experiment that could reliably distinguish between them. Hence, the universe is inconsistent in Possible States Theory but this does not diminish the usefulness of the theory.

The theory requires no external or metaphysical causal factors to account for change. A principle of order is imposed on the possible states: change progresses from similar states to dissimilar states. Similarity is always assessed with reference to a specified observer, whose possible states are entangled with what is being measured or compared.

Note that the observer-whoever or whatever collapses the wave function-need not be a human being or even a life form. In the previous era of physics it was believed that only human consciousness could collapse the wave function. In this paper the authors revise that interpretation to say that consciousness or sentience collapses the wave function, but that consciousness (or sentience) must be regarded as a matter of degree and also very widely distributed.

Technology itself can potentially possess sentience and can collapse the wave function. And since we are not sure how to define a life form, we are not in a position to say "such-and-such can collapse the wave function but that other thing cannot." Anything that is capable of causing change can collapse the wave function.

By getting rid of the notion that only human consciousness can initiate change/collapse the wave function, we are expelling metaphysics from physics. Alternately, one could equally well say that we recognize the hand of the Creator in even the smallest and humblest part of the creation; there is a little bit of spirit, or consciousness, in everything.

Possible States Theory models consciousness as a property of strongly coherent states. Change propagates in coherent collections of possible states without reference to space-time and the conservation of energy. Conscious-

ness is therefore not limited to human beings, or even to biological life forms. It is an emergent property of complex systems.

The role of human consciousness

A popular convention holds that cosmic reality is composed of information. Possible States Theory contradicts this notion because consciousness must exist to apprehend the information. Information requires an algorithm to process it and consciousness is that algorithm. Without a consciousness present, information is noise. This stems from the role of consciousness in collapsing the quantum wave function. Consciousness is not singular but social. It can be shared.

The collapse of all possible choices into a single reality is an outmoded concept. We all experience a slightly different reality, so the presence of multiple conscious beings precludes a single reality. Not only is there no single reality, there is no single future. Past, future and possible states are intermingled.

In the past, acts of mind were differentiated according to their subject. Accessing a past experience is deemed memory; accessing a contemporary experience is deemed to be awareness, and accessing a future or possible experience is called imagination or perhaps intuition. Possible States Theory regards these acts of mind as interactions with chains of possible states. Like all interactions, they are participations. As such they must induce change. The act of predicting something, if done repeatedly and/or associated with a collection of coherent states, can evoke the change that was predicted. In a real sense the future is quantum mechanically *assembled.*

Possible States Theory implies that because we imagine Star Trek (a science fiction series), the human race will interact with the cosmos in the future. "Warp drive" will be discovered and used by humanity in the future because that collection of possible states already exists in the complex now, the eternal present in which all possibilities coincide. *If it could not happen, it could not have been imagined.*

Therefore, Possible States Theory may be held to predict that DARPA's 100 Year Starship study will meet with ultimate success. Travel to the stars is possible and in a sense has already succeeded. The future influences the past.

From this perspective, conservation laws and the belief that interactions are limited by space-time have served to keep us confined here, to a small planet, which we are outgrowing. Possible States Theory says that we must interact with our own future and embrace a future where humanity is a participant in the larger cosmos and not just a passive observer.

Explanatory power

Possible States Theory does not require external causal influences or metaphysical elements[6]. All change takes place in the same way. The theory makes no separate category for acts of mind; all interactions occur in the same way. The theory orders the possible states by similarity rather than space-time coordinates. Change is primarily nonlocal; it proceeds from one bloc of states to another similar bloc without reference to space-wise or time-wise separation.

The concept of time is revised. Because all states are present in the restless sea of possible states, no universal clock time exists. The interaction between possible states is ordered by similarity instead of space-time. The process of change can manifest instantaneously between sufficiently similar aggregates of possible states.

These ideas make it possible to include acts of mind in a physical theory without the introduction of metaphysics, and to take technological advantage of the presence of future and possible states in the complex present. The applications are diverse, ranging from new energy concepts (the light bulb lights because it can) to space travel (an instantaneous change of location is possible because the spacecraft could be in another place).

Of all of these, the understanding that acts of mind are possible states interactions exactly like physical acts, may prove to be the most liberating of concepts

CONCLUSIONS

The conclusions of this brief study are two-fold:

1. In both quantum and even classical relativity, interactions with future possible states are part of the present. This means that our conscious exploration of possible futures is part of the collapse of the wave function of the present. Because of the quantum nature of reality, plans, projections, and even dreams of the future must be recognized as interactions with possible futures. What we think about the future affects our present. This is especially true in the collective shared consciousness of a people, a civilization, or nation. "Where there is no vision the people perish"[7] as it is written in the Bible, but, alternatively, armed with a bold and positive vision, a people, a civilization, a nation can reach an optimal destiny limited only by the laws of physics. We must therefore, dream boldly and positively about the future of humanity.
2. Humanity is destined to travel to the stars and find dwelling place there because it has already imagined these things. The visions of Star Trek and Star Wars, which have drawn such powerful and positive reactions from humanity, are part of present reality. What we have imagined we can accomplish. The fact that DARPA would launch a 100 Year Starship Study has formalized what Science Fiction has proposed for

nearly a century. This enterprise is not just a daydream, it is quantum physics. Therefore, Possible States Theory would say that if we continue to imagine and develop ways travel to the stars and find places to dwell there, we will accomplish these goals. To imagine a future is to quantum mechanically assemble it.

Therefore, let us continue to aspire and work to realize travel to the stars, the finding of dwelling places there, and the joining of humankind with the community of peoples who already dwell there. This is the ultimate application of Possible States Theory to the destiny of humanity.

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