Conscious Model of Particle Physics: The Grand Theory Unifying Local and Non-Local Realities

Mahendra Samarawickrama

Centre for Consciousness Studies, Australia
School of Computer Science, The University of Technology Sydney (UTS), Australia

E-mail: samarawickrama@gmail.com

Abstract. The randomness in quantum mechanics is due to missing consciousness. By introducing consciousness, the complex dynamics in reality become causal, deterministic and unpredictable but not random. The reality behaves in a way the awareness is preserved, which causes the integrity of the experience. This behaviour complies with the Principle of Least Action. We introduce the consciousness particle aka *primion* to the Standard Model of particle physics to explore the implication of consciousness on reality. As per the Conscious Model of particle physics, quantum entanglement shares parameters in consciousness, adhering to non-local reality. An observation collapses of entangled wave function violates the integrity in consciousness and transforms the non-local reality to local. By incorporating consciousness, it is possible to understand reality as causal and deterministic, yet unpredictable but not random. The Conscious Model of particle physics unifies causation, relativity, and quantum mechanics and establishes a grand theory of understanding reality. Further, this research established that consciousness is an independent fundamental dimension that preserves integrity in awareness of non-local reality. This new dimension facilitates quantum entanglement to establish non-local awareness beyond the experience of five sensors or materialism. The wisdom of non-local awareness is beyond the imagination, the experience of five sensors, computation or analysis. It exists at the non-local consciousness dimension rather than our experiences, perceptions and knowledge in local space-time dimensions. Similar to our five sensors (touch, sight, hearing, smell and taste), which are developed to observe and measure local reality in space-time, the *Mind* emerges to be aware of both local and non-local realities through consciousness.

1. Introduction

When two particles are quantum entangled, an observer who knows the state of one particle can immediately determine the state of the other without needing confirmation. In relativity, information typically travels at the speed of light, establishing a localised reality. However, the instantaneous awareness between entangled particles, devoid of time delay, leads to a non-local reality. The constraints of relativity still apply when it comes to verifying results. However, it is certain that the entangled particles promptly align with the predictions of quantum mechanics. Albert Einstein discussed this as spooky action at a distance, and Erwin Schrödinger [1] said it was quantum mechanics' most important trait.

Let's assume a pair of balls possess no definite states until they undergo measurement. It's like both balls exist in a state of grey until an observer examines one of them. At that point, it can randomly adopt either black or reveal itself as white. Instantaneously, without time lag, the other ball assumes the opposite colour no matter how far apart. But how can we be certain that the balls didn't have an assigned colour from the start? Even if they seemed grey, it's conceivable they contained a covert label within, determining the colour they should adopt upon observation.

If the properties of one particle can be determined by measuring the other, it seems to imply faster-than-light communication, contradicting Einstein's theory of relativity. The Einstein-Podolsky-Rosen (EPR) paradox [2] is a foundational concept in quantum physics that Einstein, along with Podolsky and Rosen, proposed in 1935. They used this paradox to argue that quantum mechanics is an incomplete theory. They suggested the existence of hidden variables that would account for the apparent instantaneous connection between entangled particles. However, in 1964, physicist John Bell devised a set of mathematical inequalities known as Bell's inequalities [3], which provided a way to experimentally test the predictions of quantum mechanics against any theory based on hidden variables. Experiments consistently validated the quantum mechanical predictions, demonstrating the non-classical nature of entanglement and essentially resolving the EPR paradox in favour of quantum mechanics.

Alain Aspect, John Clauser and Anton Zeilinger [4, 5, 6] were awarded the 2022 Nobel Prize in Physics for their groundbreaking experiments for granting the concept of Bell inequalities. These inequalities enable the distinction between the uncertainty of quantum mechanics and an alternative explanation involving concealed instructions or hidden variables. The experiments demonstrated that nature adheres to the predictions of quantum mechanics. That means the balls are inherently grey, devoid of clandestine information, and it is sheer chance that dictates which one takes on black and which assumes a white one in an experiment.

The randomness in quantum mechanics makes it difficult to unify with relativity towards widely accepted causation. Since relativity obeys causal and deterministic nature in reality, the framework appears complete. There can be unpredictability in relativity, but it is due to the complexity of the system rather than underlying fundamental uncertainty or randomness. In contrast, quantum mechanics is inherently uncertain, and randomness is its fundamental trait. Therefore, quantum mechanics is not a causal system, which makes it fundamentally different from relativity.

In this paper, we bring consciousness as a fundamental of reality, which preserves the information (or awareness) for making reality causal and deterministic. The missing information (or awareness) in consciousness makes quantum mechanics random. This novel idea makes both relativity and quantum mechanics valid in their own perspectives while facilitating grad unification of both theories on causation. Consciousness makes the experiences in reality causal, deterministic and unpredictable rather than random. The contributions of this paper can be summarised as follows:

(i) Establish the notion of consciousness as a fundamental of reality,
(ii) Inclusion of consciousness into the Standard Model of particle physics,
(iii) Explain how quantum entanglement can be understood through consciousness as causal, deterministic yet unpredictable reality rather than random,
(iv) Establish the foundation for grand theory unifying local and non-local realities on consciousness.

2. Methods

This paper reinforces consciousness as a fundamental dimension of reality and explains its implication in quantum mechanics, particularly for understanding quantum entanglement and non-local reality.

2.1. Background

Our previous work brought consciousness as the underlying fundamental dimension governing universal laws. Bringing consciousness into fundamental physics made it possible to unify causation, relativity and quantum mechanics. We mathematically modelled the interplay of consciousness, matter and energy [7] and established that consciousness fundamentally creates nature and reality. Further, we extend our consciousness model to explain the causation of gravity underpinning relativity [8].

We assume only consciousness and change the fundamentals of reality. Based on those two fundamentals, awareness emerges and perceives various secondary constructs. To understand gravity, we postulated [8]:

(i) Only consciousness and change are the fundamentals of reality which underpin awareness.
(ii) Reality behaves in a way the awareness is preserved, which causes the integrity of the experience.
(iii) Gravity is also a perception in awareness caused by consciousness and changes.

Consciousness and change are fundamentals of reality which govern the causation. They create the perception of awareness and time. Awareness is a construct which emerges from a conscious process. Reality behaves such that awareness is preserved and maintains the integrity of conscious experience. By replacing time with consciousness, we described the causation of relativity. We explained the causation of gravity as a phenomenon which maintains the integrity of conscious experience or preserved awareness when interacting with mass and energy. Further, the whole concept of space-time is a construct of consciousness.

Fundamental physics can be grasped through either relativity or quantum physics, two distinct frameworks that do not complement each other. In a similar strategy that consciousness is mapped into time to understand the causation of relativity, consciousness can be mapped into uncertainty and unpredictability to understand the causation of quantum mechanics. That enables the establishment of consciousness as a common base for relativity and quantum mechanics and unifies both frameworks.

Relativity interprets reality as the interplay between mass and energy within space-time. Within this framework, any pairs of physical properties (e.g., position and momentum) can be known by an observer. However, as we delve into smaller dimensions, either in space or time, relativity is no longer valid due to the *uncertainty* in observation. The uncertainty of an observation is related to the consciousness of an observer and the complexity of the phenomena. Heisenberg's uncertainty principle [9] describes that it is impossible to be aware of multiple physical quantities or complex scenarios with perfect accuracy at the quantum scale. The more awareness, the less uncertain, and the less awareness, there will be more uncertainty. Awareness has its limits, and like everything discreet, awareness is also discreet and has the shortest duration to be aware of the change in reality. This shortest time is what was defined as the consciousness cycle, the shortest duration that can be perceived in reality [7]. Therefore, the uncertainty of observation cannot be eliminated at the quantum scale, and the quantum nature of observing reality emerges.

We posit that the inherent uncertainty in observation does not constitute an inherent aspect of reality. While observation inevitably carries uncertainty, reality is governed by preserving awareness and maintaining integrity with underlying consciousness. To understand quantum entanglement, we extend the above postulates:

(iv) Quantum mechanics preserves awareness and maintains integrity with underlying consciousness.

Our postulates proposed that consciousness is intricately interweaving with reality and maintains integrity with the behaviour of reality. Further, everything is subjected to change while maintaining integrity with underlying consciousness. The integrity of the behaviour of reality that is perceived through awareness is attributed to consciousness. This integrity is causal, deterministic and unpredictable due to complexity, but not random.

2.2. Inclusion of consciousness in the Standard Model of particle physics

The *Principle of Least Action* provides a unifying framework for understanding the behaviour of physical systems across different regimes, from classical mechanics to special relativity and quantum mechanics. It highlights the elegance and universality of the underlying principles governing the behaviour of reality. It asserts that natural systems follow paths or configurations that minimise the rate of change of a certain quantity called the *Action*. In special relativity, this is expressed in terms of space-time intervals, while in quantum mechanics, it is embodied in the path integral formulation, where all possible paths contribute to the probability amplitude for a quantum transition. This principle is fundamental in understanding the behaviour of particles at the quantum level, and it's the foundation for various areas of theoretical physics, including the *Standard Model of particle physics*.

The underlying notion of the Standard Model of particle physics is that the symmetry principles and asymmetries of nature underpin the fundamental particles and forces. Therefore, the Standard Model of particle physics enables the measurement and understanding of governance of reality. It is a mathematical framework based on *Lagrangian* that reflects the underlying symmetries and asymmetries in systems that help to uncover fundamental particles and forces.

We posit that consciousness and change are the fundamentals of reality, which cause the Principle of Least Action, and the symmetry and asymmetries of nature. Consciousness underpins reality in a way that awareness is preserved, which causes the integrity of the experience, such as the Principle of Least Action, and the symmetry and asymmetries of nature. Therefore, consciousness is attributed to the governance of reality, and its influence can be illustrated as an elementary particle of the Standard Model of particle physics. We named that particle as *primion*, and the updated Standard Model of particle physics is shown in Figure 1. The primion particle introduces consciousness as a foundational aspect of reality, shedding light on how it interacts with other elementary particles and the forces that govern reality.

2.3. The interplay between quantum entanglement and consciousness

The inherent randomness of quantum mechanics is apparent when the properties of *primion* are not taken into account. However, once primion is considered, quantum mechanics transitions from being random to becoming causal, deterministic, and unpredictable. Quantum entanglement refers to the correlation of two particles that share an integrity associated with a specific original consciousness. This shared integrity, guided by primion, gives rise to the non-local awareness between the entangled particles. The sustained awareness between the two particles is causal, deterministic, and unpredictable – but not random, as it is governed by primion.

Figure 2 provides a visual representation of the relationship between quantum entanglement and consciousness. Initially, at time t_0, particles A and B possess distinct quantum states. However, at time t_1, they become entangled through a quantum interaction, adhering to the conservation of energy and momentum. Due to the symmetric quantum interactions, the physical attributes of these particles exist in a superposition of states, as depicted by the entangled wave function. Any discrepancies are confined to a non-materialistic conscious dimension, which can be understood through the behaviour of the primion. The properties of the primion in entangled states are:

(i) Primions undergo fundamental changes, characterised by causal, deterministic, and unpredictable shifts.

(ii) Primions form the basis for the Principle of Least Action, as well as the conservation of energy and momentum.

(iii) Interaction of primions with the environment, through either measurement or observation, leads to the collapse of the wave function, thereby altering material properties.

The characteristics of primions in both particles maintain the integrity and establish a non-local awareness between the two particles at time t_2 *aka* quantum entanglement. This implies that the two particles share hidden variables in the conscious dimension when entangled. Further, quantum entanglement is causal, deterministic, and unpredictable behaviour governed by primions.

When the primion of particle A interacts with conscious observation at t_3, that violates the integrity of consciousness and instantly collapses the wave function of quantum entanglement. Due to the sustained integrity between the two primions in particles A and B since their entanglement, the outcome of collapsing the wave function aligns with quantum predictions. After the wave function of quantum entanglement is collapsed, the reality cannot be non-local since the integrity of consciousness is lost, and the reality becomes local.

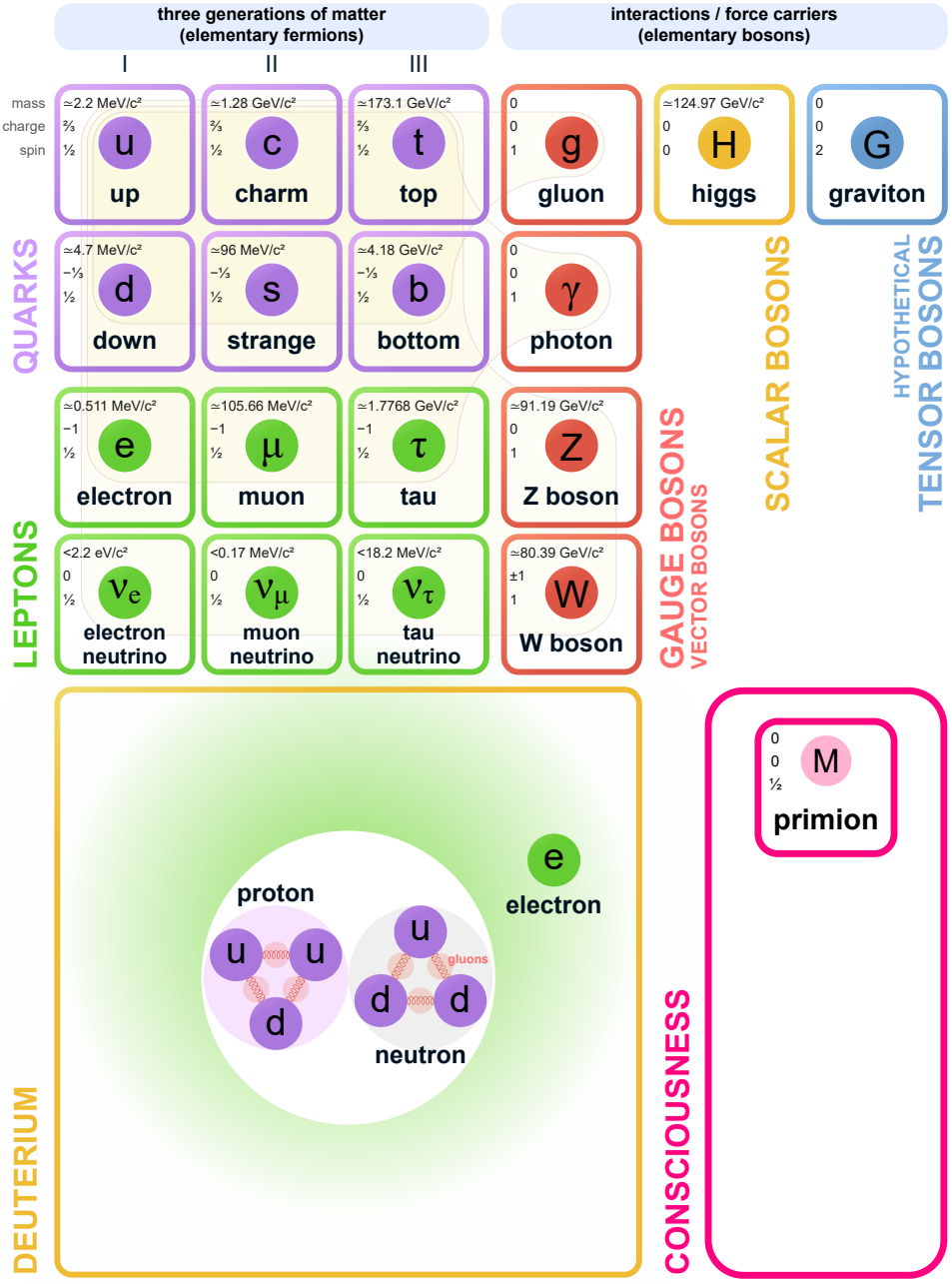

Figure 1: The Conscious Model of particle physics, the updated Standard Model of particle physics with the inclusion of consciousness particle aka *primion*.

3. Discussion

Heisenberg's Uncertainty Principle [9] states:

$$\Delta x \cdot \Delta p \geq \frac{\hbar}{2} \tag{1}$$

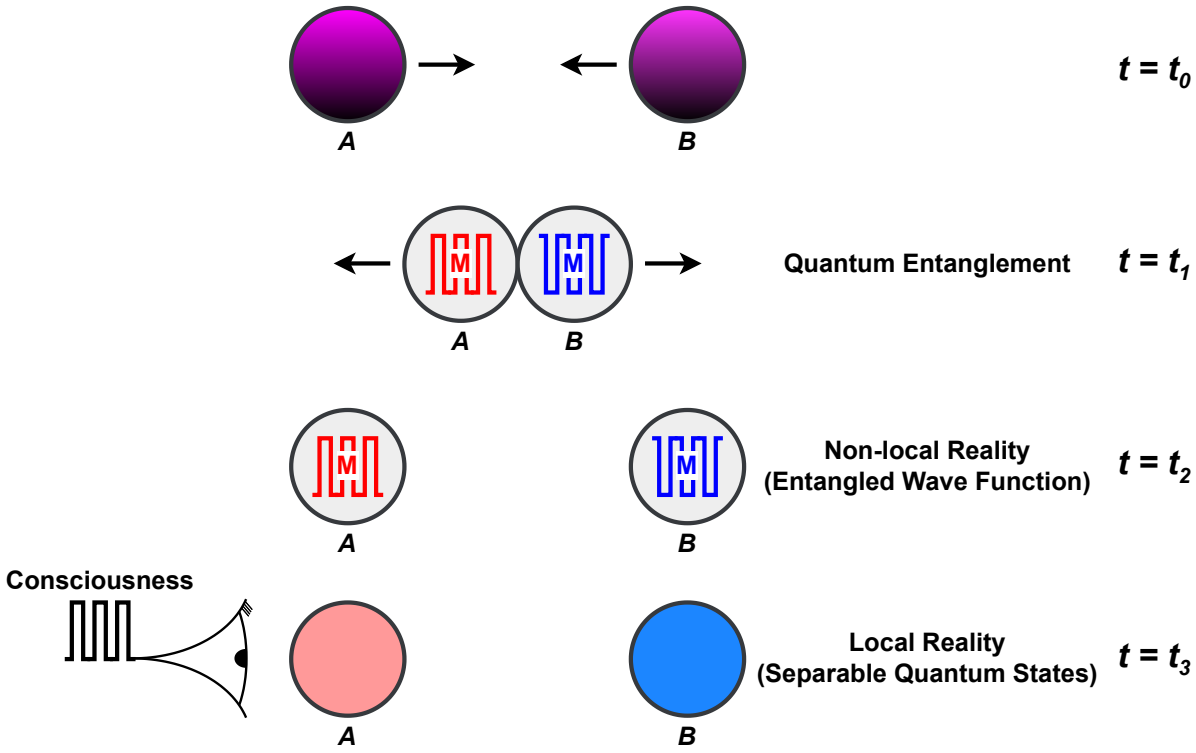

Figure 2: The phenomenon of quantum entanglement from a consciousness perspective. The waveform within particles A and B represent the fundamental conscious element *primion*, which forms the basis of quantum entanglement. The perceived awareness between the two entangled particles arises from the enduring integrity of the primion established at the moment of entanglement. This relationship between the entangled particles is both causal and deterministic yet remains unpredictable. It is not random, as it is governed by the primion while still upholding the integrity with the original consciousness.

where:

$$\Delta x : \text{Uncertainty in position}$$
$$\Delta p : \text{Uncertainty in momentum}$$
$$\hbar : \text{Reduced Planck's constant } (\hbar = \frac{h}{2\pi})$$

This is a fundamental concept in quantum mechanics that states there is a limit to how precisely we can simultaneously know certain pairs of physical properties, such as the position and momentum of a particle. However, this unavoidable uncertainty in observation does not constitute an inherent aspect of reality. Consciousness is a sequential information-processing process that focuses on a single piece of information at a time and brings awareness [7]. That leads to uncertainty when two physical quantities are observed over shorter space-time intervals, thereby exemplifying quantum behaviours.

Quantum entanglement [1] is a phenomenon in quantum physics where two or more particles become correlated in such a way that their individual properties are not well-defined due to the inherent uncertainty described by the Uncertainty Principle. In quantum entanglement, the state of one particle cannot be described independently of the state of the others. Mathematically, if we have two entangled particles, A and B, their joint state can be expressed as the wave function:

$$|\psi\rangle = \alpha|0\rangle_A|1\rangle_B + \beta|1\rangle_A|0\rangle_B \tag{2}$$

where α and β are complex probability amplitudes, and $|0\rangle$ and $|1\rangle$ represent the basis states.

The collapse of the wave function is a fundamental concept in quantum mechanics. It occurs when a measurement is made on a quantum system, causing its wave function to *collapse* into one of the eigenstates of the observable being measured. Mathematically, if we have a quantum state ψ and we perform a measurement corresponding to the observable A, the state after measurement will be:

$$|\psi'\rangle = \sum_i c_i |\phi_i\rangle \tag{3}$$

where c_i are the probability amplitudes of the eigenstates $|\phi_i\rangle$ of the observable A.

Bell's theorem [3] is a fundamental result in the field of quantum mechanics that establishes a limit on the correlations that can exist between distant systems. It plays a crucial role in understanding the nature of quantum entanglement. Consider the same system with particles A and B. The hidden variables theory assumes that there exist local hidden variables which determine the outcomes of measurements. The outcomes of measurements are denoted by a and b for particles A and B, respectively. Bell's inequalities are derived from the assumption of local realism, which states that the properties of a particle are determined by the local environment and the settings of the measuring apparatus. The Bell's inequality for hidden variables is:

$$S = E(a,b) + E(a,b') + E(a',b) - E(a',b') \leq 2 \tag{4}$$

Here, a, a', b, b' represent possible measurement outcomes, and E represents the correlation between the measurement outcomes.

Quantum mechanics predicts correlations that violate Bell's inequalities. This implies that local hidden variables cannot explain all the observed phenomena in quantum mechanics. The Bell-CHSH inequality is commonly used to demonstrate this:

$$S = |E(a,b) - E(a,b') + E(a',b) + E(a',b')| \leq 2 \tag{5}$$

where a, a', b, b' represent possible measurement outcomes, and E represents the correlation between the measurement outcomes. In experiments, quantum mechanics predicts correlations that can exceed this bound, showing that classical hidden variables theories are insufficient to describe the behaviour of entangled particles. Bell's theorem doesn't disprove the existence of hidden variables, but it does rule out local hidden variable theories.

Bell's theorem applies specifically to local hidden-variable theories, meaning information cannot propagate faster than the speed of light. While Bell's theorem ruled out local hidden-variable theories, it did not rule out non-local hidden-variable theories. Hidden-variable theory is a concept in quantum mechanics that suggests that there might be underlying, unobservable variables that determine the outcomes of quantum experiments. These variables would, in principle, provide a more complete description of the physical state of a system than the one offered by standard quantum mechanics. One notable non-local hidden-variable theory is the *De Broglie–Bohm theory* [10, 11].

The local reality is well accepted through relativity. In previous research, we showed how local reality is constructed through causation governed by fundamental consciousness and change [7, 8]. That is what we experience through the five senses, compatible with the Principle of Least Action, relativity and separable quantum mechanics. It is observable and measurable materially. The standard model of particle physics is developed such that we can explore particles and forces governing the local reality. In local reality, the fundamental aspect of change is more conspicuous than consciousness.

In contrast, the non-local reality is exhibited in quantum entanglement, an exception described as spooky action at a distance. The challenge of unifying the local and non-local realities is mainly due to the exhibited random nature of quantum mechanics, which has been solved by introducing hidden variables in consciousness, maintaining the integrity of awareness in non-local reality. As shown in Figure 1, we updated the standard model of particle physics with consciousness, *aka* the conscious model of particle physics. That unifies both local and non-local realities on the grand theory of

causation based on consciousness and change. The hidden variables in consciousness were attributed to the new elementary particle named *primion* in the standard model of particle physics. The conscious model of particle physics makes local and non-local reality both causal, deterministic and unpredictable. However, the chaotic nature is misinterpreted as randomness in quantum mechanics, as the consciousness dimension is missing in modern fundamental physical frameworks. If the consciousness is attributed, the non-local reality becomes chaotic, not random.

The non-local reality is an experience in which consciousness takes precedence. However, consciousness itself is subject to change, making change a fundamental aspect of non-local reality. The quantum entanglement is explained as non-local reality maintaining integrity in awareness in the consciousness dimension beyond the constraints of space-time.

In our previous research [7], we mathematically modelled the interplay of consciousness, matter and energy. Through that model, we illustrated consciousness as the fundamental process of creating matter and energy. Further, we correlated the brain's electromagnetic energy to consciousness. Intuitively, the five human senses are evolved to perceive local reality while the *Mind* emerges to be aware of both local and non-local realities through consciousness. The conscious model of particle physics enables both mind and body to be explored under fundamental physics to understand the full spectrum of reality, which is either local or non-local.

4. Conclusions

The consciousness and change governing causation can unify local and non-local realities. Consciousness is intricately interweaving with reality and maintains integrity with the behaviour of reality. This integrity is causal, deterministic and unpredictable due to complexity, but not random. For the first time, consciousness has been integrated with the standard model of particle physics for understanding the fundamentals of reality. That conscious model of particle physics enables physicists to explore the consciousness governing the causation of reality. Most importantly, this research established the following groundbreaking concepts:

(i) Consciousness is an independent fundamental dimension which establishes non-local reality and preserves integrity in awareness. This new dimension facilitates quantum entanglement to establish universal awareness beyond the experience of five sensors or materialism. The influence of observation or measurement transforms reality from non-local to local, violating the consciousness fabric.

(ii) The wisdom of non-local awareness is beyond the imagination, the experience of five sensors, computation or analysis. That wisdom exists at the non-local consciousness dimension rather than our experiences, perceptions and knowledge in local space-time dimensions. What we are consciously aware of is a different reality from what we are knowledgeable about through observations, measurements, computation or analysis.

(iii) Like our five sensors (touch, sight, hearing, smell and taste) evolved to perceive local reality in space-time, the Mind emerges to be aware of both local and non-local realities through consciousness. In this way, the Mind also can be considered as a sensor for awareness operating beyond observation.

References

[1] E. Schrödinger, "Discussion of probability relations between separated systems," *Mathematical Proceedings of the Cambridge Philosophical Society*, vol. 31, no. 4, pp. 555–563, 1935.

[2] A. Einstein, B. Podolsky, and N. Rosen, "Can quantum-mechanical description of physical reality be considered complete?," *Phys. Rev.*, vol. 47, pp. 777–780, May 1935.

[3] J. S. Bell, "On the einstein podolsky rosen paradox," *Physics Physique Fizika*, vol. 1, pp. 195–200, Nov 1964.

[4] J. F. Clauser, M. A. Horne, A. Shimony, and R. A. Holt, "Proposed experiment to test local hidden-variable theories," *Physical Review Letters*, vol. 23, no. 15, p. 880, 1969.

[5] A. Aspect, J. Dalibard, and G. Roger, "Experimental test of bell's inequalities using time-variable analyzers," *Physical Review Letters*, vol. 49, no. 25, p. 1804, 1982.
[6] G. Weihs, T. Jennewein, C. Simon, H. Weinfurter, and A. Zeilinger, "Violation of bell's inequality under strict einstein locality conditions," *Physical Review Letters*, vol. 81, no. 23, p. 5039, 1998.
[7] M. Samarawickrama, "Unifying matter, energy and consciousness," *AIP Conference Proceedings*, vol. 2872, p. 110001, 09 2023. https://doi.org/10.1063/5.0162815.
[8] M. Samarawickrama, "Mathematical Modeling of Consciousness for Unifying Causation, Relativity and Quantum Mechanics," *12th International Conference on Mathematical Modeling in the Physical Sciences (IC-MSQUARE)*, 9 2023.
[9] W. Heisenberg, "Über den anschaulichen Inhalt der quantentheoretischen Kinematik und Mechanik. (German) [On the ideological content of quantum theoretical kinematics and mechanics]," *Z. Physik*, vol. 43, pp. 172–198, Mar. 1927.
[10] L. De Broglie, *Recherches sur la théorie des quanta*. PhD thesis, Migration-université en cours d'affectation, 1924.
[11] D. Bohm, "A suggested interpretation of the quantum theory in terms of "hidden" variables," *Phys. Rev.*, vol. 85, pp. 166–179, Jan 1952.