PARTICLES AND OTHER FORCES

Bertrand Wong
Eurotech, S'pore Branch
Email: bwong8@singnet.com.sg

Abstract A theory of everything (TOE), or, grand unified theory (which Einstein had been working on without success, with Superstring Theory now being a good candidate), is one which unites all the forces of nature, namely, gravity, electromagnetism, the strong nuclear force and the weak nuclear force. Important as this theory might be, it is lacking in one important fundamental aspect, namely, the role of consciousness, which could in fact be considered the most fundamental aspect of physics, for example its apparently significant role and impact in quantum theory which would be explained in this paper. This paper also raises important points pertaining to the theory of everything. It explains that a theory of consciousness is more important than a theory of everything or grand unified theory and should be the theory of everything instead, or, at least, a part of the theory of everything. Consciousness is essential for information-processing, for example, deducing the laws of physics from natural phenomena; without the physicist and his intelligent consciousness for deducing the laws of physics there would not be physics. As consciousness is so important, it is no surprise that physicists are now studying consciousness to unravel the mysteries of the universe which might be in some sense a Great Mind or large organism with will and consciousness. The paper also delves into the behavior of quantum particles, for example, quantum entanglement which has utility in quantum computing but remains a great mystery, describing their apparent relationship with consciousness which has been the model for artificial intelligence (AI) that has become very powerful and a threat to society itself. This paper is the sequel to the paper *The Ultimate Law of Nature* which was published in Physics Essays in 2009.

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1 Introduction

Einstein had tried very hard to unify the four forces of nature, namely, gravity, weak nuclear force, strong nuclear force and electromagnetism to arrive at a unified field theory but had failed. He had purportedly tried to make use of a set of 16 complex tensor equations, the combinations of ten of which representing gravitation and the remaining six representing electromagnetism, with the idea that a pure gravitational field could exist without an electromagnetic field but a pure electromagnetic field could not exist without an accompanying gravitational field. His field

equations are as follows:-

$$G_{uv} + g_{uv} A = \frac{8\pi G}{C^4} T_{uv} \qquad (1)$$

where:

G_{uv} represents the curvature of space-time

g_{uv} represents the structure of space-time

A (lambda) is the cosmological constant, a term which could describe a repulsive force throughout space – this term, represented by the Greek letter lambda, had been included by Einstein in his general relativity equations which describe how matter and energy bend space-time; A (lambda) might be the result of vacuum energy, the energy in empty space, made of "virtual particles" – pairs of particles and anti-particles which constantly appear and disappear, wherein the particles and anti-particles inter-act and annihilate each other; in turn A (lambda) might cause dark energy which is the force responsible for the acceleration of the expansion of the universe resulting in galaxies flying apart

G is the gravitational constant

T_{uv} represents the energy and momentum of matter and radiation

C is the speed of light

He was not able to derive the electromagnetic field equations, even for the weak-field approximation, and had no success at all with the unified field theory, which would be the theory of everything. [1-4]

This paper describes the behavior of quantum particles and provides the possible explanations for it for example their relationship with consciousness, and also advocates the modification and improvement of the theory of everything so that it would be more encompassing and serve a wider, more important purpose such as providing a deeper understanding of consciousness which is the

essence of human nature so that humans benefit from this understanding and would be better for it such as having improvement of intellectual capacity and creativity, for example being more analytical and being better at processing information (as a matter of fact, we humans have created and developed artificial intelligence (AI) modeled after consciousness, which has become so powerful that it has become a threat to society, for instance by displacing humans from their jobs by taking over their jobs, being able to perform the jobs much faster and better such as solving complex mathematical problems, beating chess grandmasters and champions in chess, composing songs, painting pictures, writing books, etc.), having better understanding of human nature in order to reduce or minimize conflicts, possibly even controlling the working of consciousness and make it work better so that it would benefit society, etc., besides providing a deep understanding of the external environment, for example, the nature of particles, wherein this understanding enables humans to utilize these wonders of nature for their own benefit, for example, generation of nuclear energy, having faster computers through quantum computing utilizing quantum entanglement, etc. Consciousness represents our internal nature while matter and particles represent nature external to us. Leaving out consciousness from nature thus gives an incomplete picture of the physical world, that is, the internal part of nature is missing while the external part is there. Also, consciousness is very important and is the essence of life or existence – consciousness is life itself (scientists have reportedly even found evidence of consciousness in plants, such as plants responding to certain stimuli). We may be able to live without quantum particles, for example, but we cannot live without consciousness. As there is also an apparent link between consciousness and particles (consciousness and particles seem to have a symbiotic relationship), the paper would also analyze this. The paper would make a strong case for consciousness though matter and quantum particles are not to be diminished in importance. It is therefore not surprising that physicists are now studying consciousness to unravel the mysteries of the universe. [5-6]

2 On Quantum Particles and Their Behavior

It is apparent that consciousness is somehow connected with phenomena in the quantum realm. Consider Bell's double-slit experiment. In this experiment, are the particles and waves just sensitive to screens and other equipment or are they picking up messages from the physicist's brain? It could be said that particles of matter and particles of mind might come into being together, but in any case our self-awareness and what seems to be some kind of consciousness at the quantum level appear to be in deep communication. David Bohm had in his classic work, *Wholeness and the Implicate Order*, developed a theory of quantum physics which treats the totality of existence, including matter and consciousness, as an unbroken whole. [7] There is the implication that at the sub-quantum level the observing device used to measure the quantum particles must have connections with all parts of the system, including the link with our consciousness, and through these a "signal" might be transmitted to the molecule that a certain observable was eventually going to be measured. [8-14] Consciousness is non-local; in other words, no one could say where the mind is or how far the effects of thought could reach. As a matter of fact, within the brain, all the forces are active, including gravity [15], which is the force that holds the entire universe together – however gravity appears to have little effect on quantum particles.

Though fundamentally the material brain and the other matters are comprised of the same thing, namely, atoms, reductionists might wonder why the material brain as compared to other matters is so special. Is this due to the special composition of the atoms in the brain? If we take a number of atoms and arrange their composition so that they would be similar to that of the material brain, could we produce a brain, and, consciousness?

The universe might be in some sense a Great Mind and a theory of everything might have to include a theory of consciousness. Superstrings, which are a strong candidate for a theory of everything, might be thought particles with a life of their own. Many physicists are making attempts at deriving a Grand Unified Theory of the universe on the basis of particle physics. This effort might be incomplete as particles might be just a reflection of the information-processing foundations of the universe (but it is certainly not a waste of time as this research might help us to figure out how the information-processing system works). In the last analysis, we might not be able to completely understand the universe, if it is ever possible to do so, until it is examined as a self-evolving and organizing information-processing machine, one which produces intelligent minds to examine itself with. Hence, a theory of consciousness might be consolidated with the theory of physics (such as the Superstring Theory or the Membrane Theory) into a Grand Information Theory (GIT). This could be considered the Theory of Everything. [16]

We examine several important ideas, including some which had helped their originators to win Nobel prizes. Nobelist Schrodinger had found an equation which could be applied to any physical system in which the mathematical form of the energy is known, which is as follows:-

$$\frac{\partial^2 \Psi}{\partial x^2} + \frac{8\pi^2 m}{h^2} (E - V) \psi = 0 \qquad (2)$$

where ∂^2 is the second derivative with respect to x, x is the position of the particle, ψ is the Schrodinger wave function, or, the probability amplitude for an electron in the state n to scatter into the direction m, E is energy and V is potential energy.

The Schrodinger equation is a deterministic time-symmetrical description of nature. In classical mechanics, when we say that a quantum system is in a particular "state", we mean that the state is a point in phase space. It is here described by a wave function whose evolution over time is expressed by the following equation:-

$$ih / 2\pi \, \partial\psi (t) / \partial t = H_{op} \psi (t) \qquad (3)$$

This equation identifies the time derivative of the Schrodinger wave function ψ with the action of the Hamiltonian operator on ψ. It is not derived but assumed at the start, and could thus be validated only by experiment. In quantum theory, it is the fundamental law of nature. Here, ψ is the probability amplitude for an electron – it is only an abstraction (a function of consciousness, having no physical reality). ψ is also, in a sense, the electron's own intensity wave. When it is squared and the absolute value is taken, it turns out to be a physical probability of the associated particle's presence. Later, Born stated that the probability of the existence of a state is given by the square of the normalized

amplitude of the individual wave function (i.e. ψ^2). This was another new concept, that is, the probability that a certain quantum state exists. Born had said there were no more exact answers in atomic theory, but just probabilities. The wave Ψ determines the likelihood that the electron would be in a particular position, and, unlike the electromagnetic field, has no physical reality. The formal solution of the Schrodinger equation is:-

$$\psi (t) = U (t) \psi (0) \qquad (4)$$

where $U (t) = e^{-iHt}$, $U (t)$ is the evolution operator that links the value of the wave function at time t to that at the initial time t = 0. Both future and past play the same role, since $U (t_1) U (t_2) = U (t_1 + t_2)$, whatever the sign of t_1 and t_2. This property defines a dynamical group.

In quantum mechanics, the behavior of particles, which are regarded as waves, could be predicted, as it were, and, they are thus known as probability waves or Dirac wave particles. Here, there is a wave/particle duality. When the particle is not observed (when consciousness is not present), it remains a wave (a probability wave), but on being observed (when consciousness is present) it becomes a particle.

We here consider the famous Schrodinger's Cat experiment. In the experiment, a cat placed in an enclosed space with a poison vial might be either dead or alive when the cover or lid is opened – the cat's life depended on whether the poison vial was broken by a hammer or not. When the cover is opened, either of the two following outcomes would be discovered:-

[1] The poison vial had been broken by the hammer and the cat had been killed off by the poison.
[2] The poison vial had remained intact and the cat had lived.

There is a 50/50 chance that the cat either lives or dies when the cover is opened. Our mind or consciousness is aware of this probability when it is aware of the contents of the container. If, on the other hand, the cover is never opened and our consciousness is never aware of the cat and the poison in the container, the probability of the cat dying of poisoning or carrying on living would never have occurred to our consciousness. Hence, the importance of the role of consciousness in this experiment as well as in quantum mechanics (where the scenario is similar). [17]

According to the Uncertainty Principle, for which Werner Heisenberg won a Nobel prize, the very act of observing a quantum particle affects its behavior, that is, consciousness affects a quantum particle. According to this theory, the position and the momentum of an elementary particle could not be known simultaneously. The reason for this is that if an electron could be held still long enough for its position to be determined, then its momentum could no longer be determined. A special point is that the product of two uncertainties (or spreads of possible values) is always at least a certain minimum number. From the de Broglie/Einstein relation, $\Delta p \sim h/\lambda$, Heisenberg obtained the imprecision in the momentum. Multiplying the two inaccuracies together, he showed that the product, $\Delta x \Delta p$, would always be greater than or equal to ($\geq$) a certain amount, as follows:-

$$(\Delta x) (\Delta p) \geq (\lambda) (h/\lambda) \geq h, \text{ or, } \ldots\ldots \qquad (5)$$

$$\Delta x \, \Delta p \geq h \qquad (6)$$

where Δp and h/λ represent the de Broglie relation, and, Δx and λ are from the diffraction limit.

The frustrated researcher seeking certainty must always make a compromise, knowledge gained about time, for instance, is paid for in uncertainty about frequency and vice versa. Though we do not notice Heisenberg Uncertainty Principle in our everyday experience with the gross macroscopic world, the wave/particle duality defeats the atomic experimentalist who seeks perfection. [18]

Pauli, who was a Nobelist, was fascinated by subatomic particles and consciousness, collaborating for some time with psychologist Carl Jung, whose patient he was for a time. [19] The mathematician, John von Neumann, the biologist, George Wald, and the physicists, David Bohm and Arthur Eddington, had declared that the universe is mind stuff. The mathematical physicist, Sir Roger Penrose, sometime colleague of Stephen Hawking, considers that there is "definite possibility" that consciousness is connected with phenomena in the quantum realm. The Anthropic Principles (both strong and weak) stipulate that in man there are intellectual capacities which are there for a reason, that somehow human beings with their minds are obliged to help the universe through the next stage; this is indeed manifested by the fact that scientists such as Einstein, etc., had been using their brains/consciousness to understand nature and many had been attempting to formulate a theory of everything or unified field theory. [20-21] The Gaia Hypothesis of biologist, James Lovelock, paints a picture of the earth functioning as one large organism, which implies will and consciousness being at work. [22]

A number of scientists had postulated that there has to be a "cosmic consciousness" pervading the universe; objects spring into existence when measurements are made, measurements which are made by conscious beings, which implies that there must be cosmic consciousness that pervades the universe determining which state we are in. Some scientists, for example, Nobel laureate Eugene Wigner, had argued that this is evidence of the existence of God or some cosmic consciousness. Wigner had remarked that it was not possible to formulate the laws of quantum theory in a fully consistent way without reference to consciousness.

Classical philosophers such as Berkeley and Hume had in fact questioned whether the existence of any object was independent of the existence of the mind or consciousness: If I had never seen (never been aware of) an object, does that object exist?

Thus the great importance of the role of consciousness in nature. In fact, there appears to be an intricate link between nature and consciousness, the latter being apparently the common denominator in the workings of nature, especially at the quantum level, as is described above. However, far-fetched as it might seem, consciousness could be some sort of particles, not unlike quantum particles, which could explain why they are able to interact with one another, as is afore-described. This could also possibly explain phenomena such as intuition, mind-reading and telepathy. For example, Rupert Sheldrake, a well-known biologist, in his "morphogenesis" theory, stated that all our minds or consciousness are linked or interconnected, so that how people think and behave in one geographical area affects how people living in another distant geographical area act and think without any

communication whatsoever between them, a phenomenon which applies to animals as well. Consciousness could therefore be regarded as a "force" of nature. [23]

We present an important poser here: What is life, the theory of everything or the grand unified theory without consciousness? This is in fact an irrelevant question as it is a tautology, for life and consciousness are synonymous, and, without life or consciousness to contemplate a theory of everything or grand unified theory, the latter is an impossibility and is redundant.

3 Conclusions

The discussion above more or less shows incontrovertibly that consciousness plays a highly important role in the physical world. It is hence foremost, most important, to have a theory of consciousness, which should precede a theory of everything or grand unified theory, for to contemplate a theory of everything or grand unified theory without taking into account the evident role of consciousness is like riding the horse-cart without the horse. Isn't it more important to better understand ourselves, our consciousness, our nature, first, an understanding we are still evidently lacking, before we try to probe further the nature external to us? Isn't it evident that it is mind which controls external matter and not vice versa, for otherwise life would be overwhelmed by natural phenomena? Therefore, shouldn't a theory of consciousness really be the theory of everything, or, at least, a part of the theory of everything, a very important, fundamental part, for example, as a Grand Information Theory (GIT), which is described above, consciousness and matter having some fundamental link as is also described above? Importantly, this theory of consciousness giving us a more comprehensive understanding of our mind would be a boon or aid to our affairs. [24]

We provide some possible explanations for the above-described effect of consciousness on quantum particles as well as for the behavior of quantum particles, which are as follows:-

[1] As is explained earlier, the brain itself, which produces consciousness (as well as the person's body, etc.), is also matter, and it (and the person's body, etc.) and the other matters in the universe are comprised of the same thing, namely, atoms, or, particles. It is possible that in the presence of consciousness, that is, the material brain itself (and/or the person's body, etc.), the particles in the brain (and/or the body, etc.) interact or engage with the other particles outside it affecting one another.

[2] (a) Like a broadcasting station which transmits radio and television signals which are received by the antennas of radios and televisions over very long distances simultaneously and instantaneously, quantum particles (which may be particles of matter, brain/consciousness, body, etc.) might be "broadcasting stations/transmitters" cum "antennas/receivers" capable of transmitting and receiving signals instantaneously between themselves, that is, quantum entanglement which is still a great mystery occurs. We elaborate further on how entanglement between two quantum particles might work. Even if a pair of particles were separated by a huge distance, the measuring of one particle's spin would result in the other particle's spin automatically resolving itself in the other direction, this effect occurring instantaneously, apparently breaching the velocity of light and the rules of relativity (wherein the velocity of light is the ultimate velocity for

any quantum particle which is described by the following equation where c represents the velocity of light:

$$v = (c + c) \div (1 + c.c/c^2) = 2c/2 = c! \text{ (And not } 2c!) \qquad (7)).$$

The two entangled particles might be linked by some kind of electromagnetic "force/link", the analog of which is the mechanical system of two similar physical objects linked by a rod. For instance, one of these two similar objects is directly joint or connected to one end of the rod while the other object is joint to the other end of the rod through two similar interlocking gears which are mechanically arranged in such a way that the turning of one of these objects at one end of the rod by a certain fraction of a revolution in one direction would result in the object at the other end of the rod turning by the same fraction of a revolution in the opposite direction instantaneously. What happens is that turning, for example, the first object joint or connected directly to one end of the rod would turn the rod in the same direction by the same fraction of a revolution at the same instant, the rod would turn the first gear joint to it at its other end in the same direction by the same fraction of a revolution at the same instant, this gear would turn the similar gear interlocked with it in the opposite direction by the same fraction of a revolution at the same instant, and, as the other object is joint to this second gear that turns in the opposite direction the other object itself also turns in the opposite direction by the same fraction of a revolution at the same instant (all these various actions taking place at the same time, all at once, simultaneously). A similar turning action on the second object joint to the other end of the rod would now result in the first object joint to the other end of the rod turning in the opposite direction by the same fraction of a revolution instantaneously. The following describes how the above-stated mechanical principle might apply to the behavior of the two entangled particles. Any spin motion (measured) in one of the particles may theoretically cause instantaneous motion (for example, spin or vibratory) in the electromagnetic "force/link" that links this particle to the other particle (as per the case of the first object and the rod in the above-described mechanical example). This instantaneous motion of the electromagnetic "force/link" may theoretically effect instantaneous motion in the other particle (as per the case of the rod and the second object in the above-described mechanical example) which may spin in the opposite direction (as it has been conditioned to do so through the entanglement process in accordance with the Pauli exclusion principle). (Note: The motions of the two entangled particles and the electromagnetic "force/link" may theoretically take place simultaneously, at the same instant or instantaneously (as is in the case of the moving objects/parts in the above-described mechanical example).)

(b) The two entangled particles may theoretically be simultaneously controlled by a "brain" or "controller" (consciousness). This "brain/controller" may theoretically issue a signal to both particles at the same instant causing them to act as they do at the same instant. This

is comparable, for example, to a computer issuing a command to two printers (or other equipment) at the same instant causing the two printers to print at the same instant (parallel processing comes to mind), with the two printers programmed to respond differently to the same command at the same instant (for example, one printer prints blue ink in response to a command while the other printer prints red ink in response to the same command at the same instant). (This may also be likened to the case whereby a light switch controls two (or more) light bulbs such that when the light switch is turned on the two (or more) light bulbs are lighted simultaneously. Entanglement of two particles is rather similar to the programming of an equipment with a computer resulting in the two particles acting the way they are expected or "programmed" to.)

(c) Information from one of the two entangled particles may theoretically be carried to the other particle by an extremely fast carrier wave that travels faster than the velocity of light (tachyon) causing the other particle to act with an opposite spin at practically the same instant. (Note: Since the speed of this carrier wave theoretically exceeds the velocity of light and light may be required to detect it, it may be undetectable. As quantum entanglement may be the result of tachyons, that is, faster-than-light particles, at work, it may thus signify the existence of tachyons, which is another outstanding challenge in physics.)

(d) There may theoretically be an unknown influence, a mysterious undiscovered force, at work bringing about quantum entanglement.

[3] The following is another possible explanation, namely, consciousness could be some sort of particles, not unlike quantum particles, which could explain why they are able to interact with one another (that is, consciousness interacting with quantum particles), as is described above, which could also possibly explain phenomena such as intuition, mind-reading and telepathy; all our minds or consciousness are possibly linked or interconnected, and, consciousness is apparently a "force" of nature.

The above-mentioned possibilities are worth looking into.

It is thus not surprising that physicists now take consciousness more seriously and are studying consciousness in order to unravel the mysteries of the universe. The problem is of course that consciousness is intangible and abstract compared to the objects of nature, for example quantum particles which are tangible, making it harder to unravel its mystery; unless consciousness could be proved to be linked to some tangible consciousness particles or some tangible quantum particles (wherein it is possible to describe with mathematical equations the interactions of these quantum particles of consciousness with the quantum particles of matter), quantitative or mathematical modeling of consciousness would be difficult though the manifestations of consciousness are evident all over the place; it is probably not far from the truth to say that consciousness is as mysterious as God who is commonly deemed the creator of the universe. That is, discovering the truths about consciousness which is intangible is apparently more difficult than discovering the truths about matter which comprises of tangible quantum particles, though it is evidently an important undertaking, perhaps the most important undertaking by physicists or scientists. However, we could find assurance in the fact that physicists are now studying consciousness to

unravel the mysteries of the universe such as having deeper understanding of the behavior of quantum particles wherein consciousness and quantum particles are apparently closely linked, as is stated above.

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