

# The Quantum Theory of Entanglement and Brain Physics

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## Abstract

*Entanglement is a century old issue. Our current knowledge of quantum mechanics provides a considerable experience on the subject of reality. Gravity is a subject of force. Forces experienced by the interaction of quantum particles are called the fundamental constants of Nature. Here, we say that constants of Nature have special significance for the fundamental cause of gravity. Physics is on doldrums without incorporating a theory of entanglement, quantum gravity, constants of nature, perceived abundance of dark matter, conflicts between collapsing wave functions and logistics, and biology involving the brain including consciousness.*

**Keywords:** Quantum Gravity, Non-Locality, Dark Matter, Consciousness, Microtubules

## Introduction

Penrose-Hameroff Orchestrated Objective Reduction (Orch OR) is a hypothesis that consciousness originates within neurons despite the conventional view of its origination between neuron connections. Despite decades of hard work and responses, the hypothesis is not acceptable to scientists, mathematicians and philosophers [1-9]. It needs an acceptable theory of quantum gravity, starts with a questionable collapse of the wave function, and is criticized for implicit decoherence in organisms among other trivial issues. We explain how our quantum theory of gravity can support entanglement in organisms, question the collapse of the wave function, and lead to coherence in biology [10]. We provide a physical basis for the validity of our theory by referring to our articles on dark matter, strong coupling etc.

## The Quantum Theory of Entanglement

A spooky kind of non-locality now seems to emerge from our 2007 theory of probabilistic gravity on the arXiv.org preprint archive and published elsewhere [11]. We see similar consequences in Nobel Laureate Gerald's Hooft's 2009 attempts to quantize gravity [12]. So be it. We remember Hooft's peculiar smile while looking at our presentation. Science has to proceed with whatever resources available, spooky or not. So we do as we partly did in our talk to explain our theory. We say that the fundamental cause of gravity is elementary particle interactions and they are what create the curvature of space-time [13,14]. Two particles must approach each other in space to a separating distance in Planck scale in order for an interaction to occur and create the forces of the constants of nature that constitute gravity we perceive. The brain cannot be an exception. Due to the measurement problem, the measured separations between tubulin-subunit electrons in the microtubules may appear to be higher and therefore be in nanoscale instead of Planck scale, but will be close enough to create entanglement, supporting Hameroff's claim

[15]. It is at a separation of one Planck length that two nucleons interact and create the black hole like force of  $10E40$  g per our article [16]. We extended it to explain the cause of well-established Newtonian Inverse Square in [14]. Our theory supports quantum vibrations every where that includes the microtubules [17].

Per Newtonian gravity, the force (F) between two masses (particles) depends on their separating distance (D). Per quantum mechanics, the forces of the constants of Nature arise from the forces of probability (P) of the particle interaction in space. We substitute the (P) for (F) to say that (P) depends on (D) with a profound implication that one interacting particle can interact with multiple surrounding particles at varying distances ( $D_1, D_2 \dots D_x \dots D_n$ ) instantaneously. Considering the measurement problem, we say that these multiple particles can reciprocate and those that do, can get entangled as musicians looking at the orchestra director. The measurement problem is not a philosophical one anymore, since it is substantiated by Bell's Theorem. Our approach differs from that of the ORCH OR, so we dub it as ORCH SE (subjective experience). We keep ORCH since the orchestration is common. We are not rediscovering the wheel, just adding the tire to make it roll.

Decoherence is another problem faced by ORCH OR, meaning there is a missing link between neuroscience and physics [18]. ORCH SE eliminates the missing link by quantizing Newtonian gravity for reasons described below [10, 11].

## Why Quantize Newtonian Gravity?

Einstein's century old theory of general relativity (GR) is a user friendly, classical theory for applications far beyond the solar system, but not for microscopic applications. The Newtonian Inverse Square does a superb job of associating with the information and its digital attributes of Planck scale quanta or particle spins. The continuity of the curvilinear variation of GR, derived by Einstein using calculus cannot be broken down to statistical step functions and linked to information. Newton's idea of infinitesimals gave birth to calculus. "By the end of his life, he had denounced the idea of the infinitely

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small altogether [19]”. This must be the reason why GR cannot be quantized. We will stop here.

We augment our view with a statement by Steve Giddings, Theoretical Physicist at the University of California, Santa Barbara: “Apparent need to retire classical spacetime as a fundamental concept is profound—and a clear successor is not yet in sight. Various approaches to the quantum framework exist. Some show promise, but none yet clearly resolves our decades-old conundrums in black holes and cosmology [20]. We encounter such comments verbally at conferences. Cosmic black holes must be approximate observations resulting from cumulative effect of high order of magnitudes of quantum black holes created by particle interactions shown by equation 1 of [14]. There has to be a fundamental cause for cosmic black holes.

Our quantum gravity implies that each elementary particle is interacting with multiple particles on a probabilistic basis via some hidden pathways, wavelets or not, somewhat like a centipede, explaining the Newtonian Inverse Square without the need of gravitons and unfound dark matter as in, as if Nature used only one idea to create cosmology and biology, substantiating Newton’s view that Nature is too simple once we understand it. Nevertheless, there has to be a physical basis for biology [16].

If it is assumed that it is human consciousness that makes the wave function collapse in a double slit experiment, a test done by a robot at its own accord should eliminate the collapse. If not, the presumption is falsified, reminding us of this popular book [21]. Cosmic consciousness is inseparable from quantum consciousness per our book, where we put our quantum theory of gravity on redundant record with at least one observation of strong coupling to support it then and got the book reviewed anyway per the publisher’s suggestion [22]. The subject assumption also leads to weirdness: A thought experiment, done after there was light and before the evolutionary advent of human like consciousness of a living species, would not have collapsed the wave function. We disagree with the collapse of the wave function. This thought experiment does not prove that the wave function collapses. We say it does not.

### **Collapse of the Wave function**

“The Many Worlds interpretation accepts what quantum theory says literally. Where the Copenhagen interpretation has observation mysteriously collapsing the atom’s wave function into a single box, and Schrodinger’s cat into living or dead state, the Many World’s interpretation just says “no” to collapse. Quantum theory says the cat is simultaneously alive and dead. So be it!” We may never know the ensemble of the cat’s particles in their own separate worlds and how it constitutes the algorithms [23]. So be it. Quantum physicists in general agree with “no” to collapse. Below is one example:

“A wave function is a description of a probability, and probability is a description of ignorance. Ignorance is not a physical object, and neither is wave function. When new knowledge displaces ignorance, the wave function does not collapse; it merely becomes irrelevant [20].” We have the profound issue of dark matter to support the view [16].

After spending billions of dollars we have not located dark matter with thousands of physicists looking for it. There is an interesting idea in a recent article published in Scientific American; we responded.

We posit quantum mechanics to be weirder than known to be [24, 16]. A particle exists at multiple places in the universe. Its wave function extends far beyond human imagination, whether or not to infinity. A nucleon behaves like a string  $10E60$  Planck lengths rolled up in a  $10E20$  Planck length in diameter per our Large Number Hypothesis. Per string theory, a particle extends to the universe. We say that it extends and it interacts with other particles invisible to us and the force created by the interaction pulls a particle out of the well in quantum tunneling, explaining Newton’s adamant quest for the cause of action at a distance and our quest for quantum gravity.

Anil Ananthaswamy asks a very important question on the cover page of his recent book: “Is there a place where the quantum world ends and the familiar classical world of our daily lives begin, and if so, can we find it? And if there is no such place, then does the universe split into two each time a particle goes through the double slit?” The obvious answer is “no”. We say the wave function does not collapse, if that contributes to the coherence aspect of brain physics [25].

### **Coherence in the Brain**

“Instead of “collapse”, a physicist today might use the word “DE coherence.” It refers to the now well-studied process by which the wave function of a microscopic object interacts with the macroscopic environment to produce the result we actually observe, what Copenhagen accounts for with the unexplained “collapse” of the wave function [23].”

The combination of the above two different statements (one on page 210 for “no” to collapse and another one on page 208 for decoherence) in the same elegant book by two reputed authors implies that since there is no collapse, there is coherence in the brain despite its being “warm, wet and noisy”, supporting the quantum consideration in ORCH SE, and questioning the missing link between physics and neuroscience in [23, 18]. This is consistent with the sense of smell, bird brain navigation, and the warm quantum coherence in plant photosynthesis and brain microtubules. We also have an important physical logistical basis to support the non-collapse. It is the basis for Newtonian Inverse square unexplained by Newton [14].

### **Global Information**

The ON and OFF particle interactions of the electrons in microtubules protein every Planck time will constitute the 0, 1 or superposition state of the information system functioning globally throughout the brain connecting different sections of the brain even where the structural connection between neurons is questioned. The patterns of variation in the functional and structural connections between neurons overpowering certain sections of the brain over the others could potentially cause bipolar and other diseases. Age related structural changes could impact the process leading to Alzheimer’s as we mentioned in our book. Regardless, we have presented the cause of entanglement in biology in general, consistent with our abstract [26].

### **Conclusion**

Science has reached a stage where any new proposition must have some unifying characteristics. Our quantum gravity has it and it supports entanglement in biology. Armature physicists respond to us humorously saying that the dark matter is spooky.

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