



Quantum Entanglement of Consciousness and Space-Time A Unified Field of Consciousness

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ABSTRACT

Albert Einstein in 1938 demonstrated that gravity depends from the geometry of a warped space-time, caused by the presence of matter. In 1935 he wrote the famous EPR paper about entanglement, he called “spooky action at distance”, trying to show that quantum physics was incomplete. In the 1970’s Bekenstein and Hawking show black holes have temperature and entropy. Susskind studies (2008) discovered a relationship between entropy, and area as a consequence of entanglement and Atlan in 1979 and Di Biase in 1999 have been proposing to see entropy as the information and complexity content of a system. Susskind (2008) could quantise space-time developing a quantum theory of gravity demonstrating that the relationship between entropy and area is a holographic one. Jacobson (1999) in a brilliant argument shows that entropy multiplied by temperature is the energy of a system and that a simple energy-entropy relationship can become Einstein’s gravitational equation relating mass energy space-time and quantum information theory.

Maldacena could demonstrate that wormholes would only form if blackholes were quantum-entangled in the outside a **revolutionary conclusion that suggests entanglement is what binds space-time together!**

Di Biase (1999; 2008; 2009; 2011; 2014) have been conjecturing that consciousness is non-local quantum information with a status equal to energy, matter, energy and space-time, and Wheeler described an elegant information-participatory universe putting together quantum information theory consciousness and physics with ‘*the it from bit*’ concept.

Bohm’s (1983; 1993) superimplicate order allows us to understanding consciousness, energy and matter as expression varieties of a same informational order. Pribram’s (1991; 1997) neural network equation is similar to Schrödinger’s wave equation that allows me to develop an elegant and beautiful holoinformational brain-mind entanglement with the quantum-holographic universe that I see as an extended holoinformational universal conscious interconnectedness.

Key Words: consciousness, quantum information, holoinformation, blackholes, brain-cosmos entanglement.

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Introduction

Albert Einstein in 1938 demonstrated that gravity depends from the geometry of a warped space-time, caused by the presence of matter. In 1935 he wrote the famous EPR paper about entanglement, he called “spooky action at distance”, trying to show that quantum physics was incomplete. In the 1970’s Jacob

Bekenstein and Stephen Hawking demonstrated black holes have temperature and a large amount of entropy, but in Einstein’s theory of relativity space-time is smooth and malleable, and a black hole as an extreme scrunching of it cannot have quantum substructure and entropy. This contradiction was solved when Bekenstein, Hawking and Susskind

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studies (2008) show a relationship between the energy-temperature of a system as measured by its entropy, and its area, that occurs as a consequence of entanglement. Atlan (1979) and Di Biase (1999) have been proposing to see entropy as the information and complexity content of a system, and not the disorder of the system.

Susskind in 2008 working with string theory and black holes developed a mathematic that can calculate the information content and he could quantise space-time developing a quantum theory of gravity demonstrating that the relationship between entropy and area is a holographic one, he calls the holographic principle, and so he could calculate the entropy of the surface of a black hole. This relationship is a universal principle in tune with the concept of Smolin's (2000) holographic web, that proposes the universe is a network of holograms, with each hologram containing the information about all the others. Smolin see any surface area in space as a "channel of information". For him the area is a measure of the capacity to transmit information, and space is only the channel of information from observer to observer.

Jacobson in 1999 developed a brilliant and elegant argument showing that entropy multiplied by temperature is the energy of a system. As large mass represents a huge energy that make a greater curvature in space-time, so, a simple energy - entropy relationship can become Einstein's gravitational equation relating mass energy space-time and quantum information theory.

Information measured by entropy is related to both quantum mechanics and gravity showing an interconnection between quantum physics and relativity.

Juan Maldacena in 1997 developed equations of string theory that describes gravity in some volume of space-time that were just the same as quantum equations describing the surface of that volume. Solving the surface equations, he described gravity in that volume of space-time what came to be known as "Maldacena Duality". In 2001 he had a powerful insight revisiting a paper written by Einstein and Rosen in 1935 showing that black holes connected by a shortcut through space-time, can become what came to be know as Einstein-Rosen bridge or wormhole. Maldacena could demonstrate that the wormhole would only form if the blackholes were quantum-entangled in the outsides.

This is a revolutionary conclusion that suggests entanglement is what binds space-time together! He concluded that:

"Space-time is really just some geometrical manifestation of entanglement, showing a very close connection between quantum mechanics and space-time, and the continuity of space-time which seems to be something very solid, could come from the ghostly properties of entanglement"

As Susskind also put it **"quantum entanglement is a form of information and so space-time is a manifestation of quantum information"**

Linking Quantum Information to Consciousness and Space-Time

All this contemporary physics conclusions are showing us that the fabric of reality is a quantum information web and the universe is a quantum holographic entangled reality, and that the key property behind everything is quantum information.

Since the 90's Di Biase (1999; 2008; 2009; 2011; 2014) has been proposing that consciousness interconnects through the universe by means of quantum information entanglement of our quantum-holographic brain with the quantum holographic space-time reality. Space-time is a manifestation of quantum information entanglement as Maldacena and Susskind have demonstrated, so the wave function collapse can be seen as an entanglement of our quantum-holographic consciousness in the quantum-holographic space-time web

The informational entanglement of our quantum-holographic consciousness with the fabric of space-time is what explains the greatest mystery of quantum physics: the wavefunction collapse by the observer consciousness.

I have been conjecturing that consciousness is non-local quantum information with a status equal to energy, matter, energy and space-time, since 1998 when I first proposed this in a insight I had during my presentation on the Symposium Science and the Primacy of Consciousness in Lisbon, Portugal, organized by Karl Pribram, Stanislav Grof, Amit Goswami and Ruppert Sheldrake stating then that

"information and consciousness are an intrinsic, irreducible and non-local property of the universe, capable of generate order, self-organization and complexity".

As soon as I proposed it, Dr Karl Pribram the moderator of my talk in the rectory's amphitheater,



came to me and congratulated me very effusively agreeing with all. Since then I and Karl became very close friends and I have the privilege of be co-author with him of two books in USA and two others in Brazil, and it allow me to bring him for the Simposyum Frontiers of Consciousness I organized in Rio de Janeiro in 2004.

This insight was an enlightenment!! It extended Chalmers' 1996 definition of consciousness as "*an irreducible aspect of the universe, like space and time and mass*", and Stonier's 1997 definition of information as "*the cosmic organizational principle with a 'status' equal to matter and energy*" putting it in the context of the Quantum Information Theory, yet little known in 1998.

In the Holoinformational Model of Consciousness (Di Biase, 1999), information, space-time, mass, energy and consciousness are non-local quantum information entangled with the quantum-holographic cosmos. Quantum information and entanglement are the way consciousness acts over matter, energy and space-time **in-forming** this universe.

Others Precursors

Also Wheeler (1990) studying blackholes, described an elegant **information-participatory universe** with '**the it from bit**' concept that united quantum theory to information, consciousness and physics:

"...every it — every particle, every field of force, even the space-time continuum

itself — derives its function, its very existence, entirely — even if in some

contexts, indirectly — from the apparatus-elicited answers to yes-or-no

questions, binary choices, bits".

Wheeler's *it from bit* is an idea that every item of the physical world

has an immaterial source and explanation. Reality arises for him in the

last analysis from the yes-no question and the informational registering of equipment evoked responses. Wheeler (1990) states that:

"all things physical are information-theoretic in its origin and that this is a participatory universe".

For Wheeler, when a photon is detected by a

photodetector we ask the yes-or-no question and we say '*a photon did it*'. He affirm that "*we know perfectly well that the photon existed neither before the emission nor after the detection... The yes or no that is recorded constitutes an **unsplitable bit of information***".

When Wheeler developed this informational '*it from bit*' model he proposed quantum information as more fundamental than energy, matter and space-time.

I have been proposing (Di Biase and Rocha, 1999; Di Biase and Amoroso, 2008; Di Biase, 2009b; 2011) that information and consciousness are a cosmic primacy.

Bohm (1983), and Bohm and Hiley (1993) in his Quantum-Holographic Theory of the universe shows a non-local indivisible cosmos organized by a non-local information he calls *holomovement*. Bohm adds to the field equations a new *Quantum Potential* that satisfies Schrödinger's equation, that depends on the form but not on the amplitude of the wave function, creating a quantum model of the universe in which the quantum potential, carries '**active information**' that '**guides**' the particle along its way. Actually, the particle originates from a global quantum field fluctuation, being its behavior determined by the quantum potential that carries information about its environment in-forming its motion.

Bohm's holographic universe has an spectral dimension of frequencies, a *implicate order* continuously unfolding in an *explicate order* (our manifested space-time universe) and enfolding again in the implicate order by means of the *holomovement*. Later, he also proposed a *superimplicate order*, as he explained to Weber in 1982:

"the implicate order is a wave function, and the superimplicate order or superior informational field, is a function of the wave function, i.e., a super wavefunction that makes the implicate order non-linear by organizing it in complex and relatively stable structures". For him (1983) this superimplicate order allows us to:

"understanding consciousness, energy and matter as expression varieties of a same informational order".

Vedral (2010) also developed a quantum informational theory of the universe in which everything including us, are information. He retakes the profound correlation between entropy (disorder) and the celebre teorem of Brillouin that relates



information (order) to negentropy applying this correlation reformulated to the quantum universe.

Brain and Cosmos Entanglement

We live in an interconnected and indivisible universe made of quantum entangled information. This universal interconnectedness is not limited by space-time and is a field of non-local information that interpenetrates everything in the cosmos instantaneously, as Umesawa demonstrated in his quantum field theory. And our consciousness is an active and dynamical part of this whole.

Pribram (2011) has demonstrated that:

“receptive fields in cortical units are wavelet-like patterns as Gabor Elementary Functions. Gabor’s Quanta of Information used the same mathematics as Heisenberg in quantum microphysics. Here they define processes in the material brain. Gabor invented his function, to find the maximum compressibility of a telephone message without destroying its intelligibility. The Gabor function thus describes both a unit of brain processing and a unit of communication. Brain is material, communication is mental. The same mathematical formulation describes both. There is an interactive mind/matter duality that is a “ground” from which both matter and mind are “formed” and the “dual” emerges.

Pribram (2011a) sees that common ground as a potential reality (as Heisenberg potential world) and states that

“when a potential is realized, information (the form within) becomes unfolded into ordinary space-time appearance; in the other direction, the transformation enfolds and distributes the information by the holographic process. Because work is involved in transforming, descriptions in terms of energy are suitable, and as the structure of information is what is transformed, descriptions in terms of entropy (and negentropy) are also suitable”.

Pribram (1991; 1997) developed his quantum-holographic theory of consciousness showing experimentally that the fields of electromagnetic activity in the brain cortex are quantum holographic non-local informational distributed patterns. His neural network equation is similar to Schrödinger’s wavefunction equation, that I see as the mathematical foundation of this elegant and beautiful holoinformational brain-mind-universe entanglement model I propose, that explains the wavefunction collapse by the observer consciousness.

Holographic systems of information are non-local mathematically and technologically distributed and every part of the system has the information of the whole system, as we can see in the broadcast diffusion of radio, TV and internet we can access from everywhere. Bohm’s quantum-holographic universe and Pribram’s brain-mind holographic model are entangled by this distributed quantum holographic non-local informational mode. For Bohm as for Wheeler, Wigner, Vedral and Di Biase we live in a cosmos made of quantum information and plenum of consciousness. This foundation of consciousness is buried in the very profound non-local informational organization of our quantum-holographic universe and in the quantum-holographic organization of our brain-mind. It is the basis for understanding consciousness as the fabric of reality (Di Biase and Rocha, 2000; Di Biase and Amoroso, 2008; Di Biase, 2009; 2011).

Putting all together: Bohm’s quantum holographic physics data, Beckenstein-Suskind holographic principle, Smolin’s holographic web, Maldacena’s duality, the energy-entropy conservation principle of Jacobson, the experimental data of the holonomic theory of Pribram, and its extension made by Di Biase I see an extended holoinformational universal conscious interconnectedness. A universal entanglement in which each part of the universe, each brain-consciousness, interconnects with all the quantum information stored in the holographic patterns distributed in the whole cosmos, in an indivisible irreducible informational brain-cosmos unity. A universe conceived as quantum-holographic non-local information with consciousness shows us a wider holistic and spiritual cosmivision than the classic materialistic Cartesian-Newtonian paradigm. It can also reconnect our scientific knowledge to the wisdom of the ancient spiritual philosophies of mankind that saw man always interconnected with the cosmos.

The beautiful budist methafor of Indra’s Net (Cook, 1977) reflects in its poetry this holoinformational nature of the universe:

In the heavenly abode of the great god Indra, there is a wonderful net which stretches out indefinitely in all directions. There is a single glittering jewel at the net’s every node, infinite in number. If we select one of these jewels and look closely at it, we will discover that in its polished surface there are reflected all the other jewels in the net, infinite in number. Each of the jewels



reflected in this one jewel is also reflecting all the other jewels, so that the process of reflection is infinite.

This methafor show a Cosmos with an infinite network of holograms, in which each part of this holographic system contains the information about all the others, every one defining and maintaining all others.

The Cosmos is a self-referent self-maintaining and self-creator organism. It's also non-teleological, because don't exist a beginning of time, nor a concept of creator, nor a questioning about the purpose of all. The universe is conceived as a gift, without hierarchy: It has not a center, or maybe if exists one, it is in every place (Cook)

We are this conscious universe !

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