Article

The Physicist's Dilemma: Ultimate Reality – The Non-Physical Nature of Consciousness

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Abstract

A physical argument is made for the non-physical nature of consciousness. It is argued the source of consciousness is the ultimate nature of reality. This source cannot be found in the physical world, but in what remains when everything in the physical world disappears. Traditionally, this ultimate reality is called the void.

Key Words: physicist, dilemma, ultimate reality, non-physical, nature, Consciousness.

Ultimate reality is invariant [1]. Ultimate reality is the same for all observers. Ultimate reality cannot change with a change in an observer's point of view or a change in an observer's frame of reference. In the spirit of relativity theory, we understand an observer as the consciousness present at the central point of view or the origin of a coordinate system that characterizes a frame of reference.

The nature of the four fundamental forces (gravity, electromagnetism, and the strong and weak nuclear forces) have something important to tell us about the nature of ultimate reality. The fundamental forces are all gauge forces or fictitious forces [1] as they can vanish with an appropriate kind of coordinate transformation. In relativity theory, we call a coordinate transformation in which a force vanishes a freely falling frame of reference. If an observer enters into an ultimate freely falling frame of reference, then all four fundamental forces vanish. This is easily seen with the Kaluza-Klein mechanism [2], which gives a natural geometrical explanation for how the four fundamental gauge forces are unified.

The Kaluza-Klein mechanism extends the usual 3+1 extended dimensions of space-time with extra compactified dimensions. For electromagnetism an extra fifth dimension is needed. Coordinates are written as x_μ, where $\mu=0, 1, 2, 3, 5$, and the fifth dimension is curled up into a circle of radius r at each point of the usual 3+1 dimensions. Positions on the circle are located with an angle θ and are written as $x_5=r\theta$. A five dimensional metric $g_{\mu\nu}$ then defines the electromagnetic potential as $g_{\mu 5}=-rA_\mu$. If this metric is plugged into Einstein's equations, the result is Maxwell's equations for the electromagnetic potential. A gauge transformation corresponds to a rotation in the fifth dimension by an angle θ as $A_\mu \rightarrow A_\mu - \partial\theta/\partial x_\mu$, where the phase angle $\theta(x)$ depends on the 3+1 extended dimensions.

Quantization of electric charge follows from the requirement of periodicity of the wave function in a compactified space. Only an integral number of wavelengths can fit into the circumference of the circle, and so the wavelength is constrained as $n\lambda=2\pi r$, where $n=\ldots-2, -1, 0, +1, +2, \ldots$ is

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a positive or negative integer that specifies the amount of electric charge found at each point in space-time. In the Kaluza-Klein scenario, electric charge is only fifth dimensional momentum. Since momentum in quantum theory is quantized in terms of the wavelength, $p=h/\lambda$, a negative sign only indicates momentum directed in the negative x_5 direction.

In relativity theory, there is only one invariant measure of geometrical length, called the proper time. The proper time, $\tau=\int ds$, is the geometrical length of a worldline followed by an observer through the space-time geometry, which is given in terms of the metric as $ds^2=g_{\mu\nu}dx^\mu dx^\nu$.

The Kaluza-Klein mechanism is the natural way to understand electromagnetism as an extension of relativity theory. The electromagnetic potential is just another aspect of the curvature of space-time geometry, no more mysterious than the nature of gravity. Gravity corresponds to accelerated frames of reference in the 3+1 extended dimensions of space-time, while electromagnetism corresponds to accelerated frames of reference in the extra compactified fifth dimension. Gravity disappears in a freely falling frame of reference in the 3+1 extended dimensions, and electromagnetism disappears in a freely falling frame of reference in the extra compactified fifth dimension. This is easily extended to include the strong and weak nuclear forces if there are six extra compactified dimensions [2].

There is another fundamental force besides the four fundamental gauge forces, called the force of dark energy. The force of dark energy is a kind of anti-gravity, which in relativity theory is understood in terms of a cosmological constant Λ. The solution to Einstein's equations with a positive cosmological constant gives the metric for an exponentially expanding space, called de Sitter space. In terms of the usual extended 3+1 dimensions of space-time, written as (x, y, z, t), this metric takes the form $ds^2=dt^2-e^{at}(dx^2+dy^2+dz^2)$, where $a=\sqrt{\Lambda}$.

In an exponentially expanding space, every observer is surrounded by a cosmic horizon. At the cosmic horizon, things appear to move away from the observer at the speed of light. Since nothing can travel faster than the speed of light, the cosmic horizon is as far out in space as the observer at the central point of view can see things in space. The cosmic horizon is a bounding surface of space that limits the observer's observations in space due to the limitation of the speed of light. An observer in an exponentially expanding space is in a frame of reference in which space accelerates away from the central point of view of the observer.

The nature of a cosmic horizon as a bounding surface of space surrounding an observer at the central point of view has profound implications due to the nature of Hawking radiation, horizon complementarity, and the holographic principle [1]. The inevitable conclusion of these recently discovered paradigm shattering developments in physics is the one-world-per-observer paradigm. This paradigm tells us that everything observable in the world is inherently observer-dependent.

Quantum theory can only be understood in a way that makes any real sense in terms of the one-world-per-observer paradigm. It is simply not true that multiple observers share a single world described by a single Hilbert space of observable values [1]. Each observer has its own world defined on its own holographic screen.

Each observer's holographic screen is a bounding surface of space that surrounds the observer at the central point of view and encodes fundamental quantized bits of information for that world in a pixelated way, with one bit of information encoded per pixel on the screen [3], and so each observer has its own Hilbert space that describes all possible observations in its own world.

The idea of quantum theory is a natural extension of relativity theory [2]. The natural definition of action is in terms of the geometrical length of a worldline, which is only a path through the space-time geometry followed by an observer. Relativity theory only allows for the path of least action. In quantum theory, all possible paths are allowed. Each possible path is weighted with a probability factor we call the wave function $\psi=e^{i\theta}$, where the phase angle $\theta=S/\hbar$ is given in terms of the action S, which in turn is proportional to the proper time τ. Each possible worldline through the geometry is weighted with this probability factor. The path of least action is like the shortest distance between two points in a curved space-time geometry, but quantum theory allows for all possible paths.

The natural consequence of this quantization procedure is a Hilbert space that describes all possible observable values of all observable things observed in the observer's world as the observer follows some possible worldline through the geometry. The holographic principle and the one-world-per-observer paradigm tell us each observer has its own Hilbert space of observable values defined on its own holographic screen. A consensual reality shared by many observers is possible if their holographic screens overlap [3] in the sense of a Venn diagram.

An observer's holographic screen is only a bounding surface of space that arises because the observer is in an accelerated frame of reference. The holographic screen constructs a Hilbert space of observable values for everything observed in the observer's world. This is possible in a non-commutative geometry when position coordinates on the bounding surface are represented by non-commuting variables [3]. The eigenvalues of an SU(n) matrix then define n bits of information on the screen. The natural pixel size is a Planck area $\ell^2=\hbar G/c^3$, and the number of bits encoded is given by $n=A/4\ell^2$, where A is the area of the bounding surface.

The holographic principle [4] tells us that all information for the observer's world is ultimately encoded on a bounding surface of space, which we understand as an event horizon that acts as a holographic screen. The event horizon only arises because the observer is in an accelerated frame of reference.

In an ultimate freely falling frame of reference, all the fundamental gauge forces disappear, the force of dark energy disappears, there is no bounding surface of space, no event horizon, and no holographic screen. In an ultimate freely falling frame of reference, all the bits of information for all the observable things in the observer's world disappear, and so the observer's world disappears. When everything in the observer's world disappears, only the observer's underlying reality remains. Since there is nothing in that ultimate reality, we call it the void.

Ultimate reality is the same for all observers. Ultimate reality does not depend on an observer's frame of reference. Ultimate reality is observer independent. If everything in the observer's world is observer-dependent and can disappear in an ultimate freely falling frame of reference, then what is ultimately real? What is the observer's underlying reality? The only possible answer is the source of the observer's consciousness. We call the primordial, undifferentiated source of the observer's consciousness the void. Ultimate reality is the nothingness of the void.

The Gödel incompleteness theorems prove this is the inevitable conclusion for any world described by a consistent set of computational rules, as is the case in quantum theory. The second incompleteness theorem proves that any consistent set of computational rules as complicated as arithmetic can never prove its own consistency. The proof of consistency is always found outside the rules. This proves the nature of the consciousness that knows about the consistency of the rules cannot itself emerge from the rules, but must be found 'outside' the rules [5].

This is the Physicist's dilemma. The source of the observer's consciousness is not something that can be found in the physical reality of the observer's world, but can only be found in the underlying reality that remains when everything in that physical reality disappears. That ultimate, underlying reality is the source of the observer's consciousness, but it can only be described as the void.

The mystery of the observable world is nothing *appears* to become something [1] when a boundary arises in infinite, undifferentiated empty space. A bounding surface of space holographically constructs a Hilbert space for the observer's world, arising when the observer is in an accelerated frame of reference and surrounding the observer at the central point of view. In an ultimate freely falling frame of reference, the boundary disappears, and so too does everything in the observer's world. It is tempting to call the nothingness that remains an Absence, but in reality what remains is a Presence, since it is the source of consciousness.

This distinction is a matter of perspective. What is seen to be an Absence when one looks outwardly at the world is seen to be a Presence when one looks within.

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