Quantum Interpretation (Physics) - Information Field

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Summary: The paper generalizes and extends the 5 parameters of qualia required to generate subjective experience to physics. It presents the localization parameter and its relation to the collapse of the wave function to arrive at the plausible nature of physical universe. Alternative interpretations are discussed against the merit of Information Field interpretation. Few important quantum experiments are reviewed in the contrast with information field quantum interpretation. Finally, postulates of information field are developed and listed towards the end of the paper.

Keywords: parameters, information, quantum interpretation, wave function collapse, decoherence, information field, quantum eraser, delayed choice, quantum mechanics, quantum physics

Section 1

Theory: This paper is a generalization and continuation of the paper, "Parameters of qualia and the confounding of neural code" by Manohar, A 2021. The 4 out of 5 parameters namely localization, qualia nature, discrimination and externality were listed as fundamental to, at least, the human subjective experience (Manohar 2021). The externality was considered a function of localization parameter and was omitted from the analysis and *secondary impression* was considered as a parameter derived from the remaining fundamental parameters and was hence omitted. That left us with the 3 parameters – localization, discrimination and qualia nature as a minimum set of parameters necessary for subjective experience. With these parameters, a "pixel" can be sufficiently created in the life form's qualia field or information field as generalized in this paper.

Human brain is a complex information processing device (IPD) capable of integrating the above 3 parameters to create subjective experience. Generalizing qualia field to information field, I propose that only localization information is sufficient to create a location in the information field. When more information is available to the IPD it can become a sophisticated machine like human brain. Just like the quale of emotion does not have localization parameter, a fundamental IPD may lack discrimination and qualia nature information. The IPD will not see colour or hear a "ding" but has localization information. This minimum information is sufficient to collapse the wave function in the information field to create location information in the information field. But this minimum information is not vivid and perceptive as the information received and integrated by brain.

Rather than evolving many brains or information receiving machines to agree on the parameters, the information is created in a fundamental, real information field accessible and consistent to all IPDs in agreement with postulate 4 in section 6 of this paper.

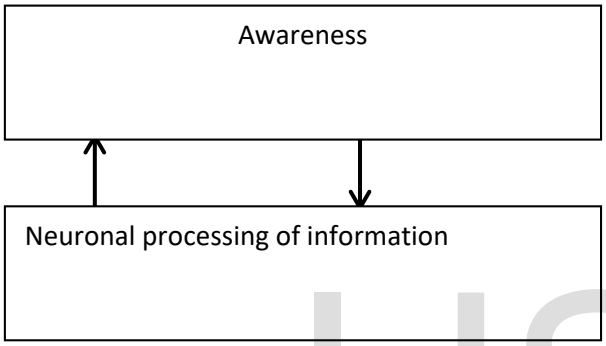
Microscopic particles certainly display wave behaviour. Macroscopic objects also have wave like features however, the wavelength of macroscopic objects is extremely small. The general rule is that if De Broglie wavelength ($\lambda = h/(mv)$) is greater than the size of object, the wave nature significant and cannot be neglected (Zettili 2009, Quantum Mechanics, concepts and applications). For a massive object like a bullet of 100 g, the De Broglie wavelength is of the order of 10^{-36} m. Clearly, the detection of wavelength is beyond human observational abilities. Wave behaviour is a general phenomenon.

We will begin with the information in the qualia field and slowly generalize to minimum information in the information field.

The philosophical theory of perception known as Direct Realism claims that we see the universe the way it is rather than as computed by the brain. The light which is an electromagnetic wave falls on objects and reaches our retina from where the neural signal is sent to the brain for processing. If the objects are a different entity than the observer

how can the actual object reach us? Even the light bouncing off the object is a field of varying electric and magnetic field not the object. So, light does not bring object to you. Also, even if the light brought the object to you, it never travels beyond the retina. You can only see the objects the way they actually are if you were the actual objects. That is the only way objects can reach you. So, if qualia are the final result of cortical processing, a separate field, called information field, should be allotted to them.

Contrary to emergence of qualia or existence of information field, Physicalism's primary attempt is to deny emergence of qualia over and above the physical substrate of brain or in the information field is explained by the diagram below (Graziano 2013, Consciousness and the social brain), though it is not specifically called Physicalism in the book. Neuronal processing of brain creates awareness shown by upward arrow. Awareness cannot be written back to the "neuronal processing of information" as awareness is causally closed. But, according to the author, *we are able to report qualia*. So, awareness is not something created above and beyond the information processing in the brain but awareness is actually information.



The fundamental mistake in this logic is that we do not report qualia. We report the output of the local neuronal network. To instantiate, when you see a red object, the local (visual) cortical networks process the stimulus and generate an output which triggers the "red" word in the language centre of the brain. The perception of red colour and the word qualia are only associated in the brain. The awareness does not have to re-enter the brain (as shown in diagram above by downward arrow) so that you could move your jaws and say "I saw red colour". The output generated by local neural networks is unique and it triggers the appropriate language centres of the brain for reporting. Even if you are seeing red for the first time, the output of local cortical network will trigger "I see something" in the brain. Physicalism cannot deny the emergence of consciousness above and beyond the substrate (neural networks) or presence of information field (fundamental ontology). I am not denying Physicalism but just proposing that interaction of IPD with wave function can give rise to phenomenal experience, though not in all cases. So, qualia (generalized to information further) can be ontologically distinct to physical universe.

Information (qualia) appears to be real and clearly, information cannot be expressed by or reduced into any other ontology though correlation with the brain is possible, in case of sophisticated IPDs. This entails that information is fundamental. So, location in the non-physical space is fundamental and a temporal pattern in the neuronal firing can by no means create non-physical space. Information field is not created by the networks but the neural networks only "activate" the "pixels" of the information field. Every quale pixel is a vector [nature, localization, discrimination]. Externality was assumed to be a derivative of localization parameter. Luminance, though fundamental parameter was not considered in the analysis (Manohar 2021).

If colours, sounds and other qualia are created in the information field, a basic IPD can also receive or "experience" the minimum localization information. I generalize this qualia field to information field for the rest of the paper. This paper proposes that it is plausible that wave function never collapses in the universe. The collapse happens in the information field as it receives minimum information. The necessity and involvement of an IPD in the collapse of wave function hints us to consider the possibility that collapse happens only in the information field.

Before an IPD observes, the system is in state $|\Psi>$. The observation forces the system into one of its eigenstates

$|\Psi_i>$ such that $|\Psi> = \sum_i |\Psi_i> <\Psi_i|\Psi> = \sum_i b_i |\Psi_i>$.

The outer product $\sum_i |\Psi_i> <\Psi_i| = I$ (unit operator).

This observation can be measured again with 100 % certainty as the information system has already populated its field with information about the observable.

The paper is not anti-realistic. It does not deny the existence of universe. It proposes that the universe remains as a wave function and the collapse only manifests in the information field.

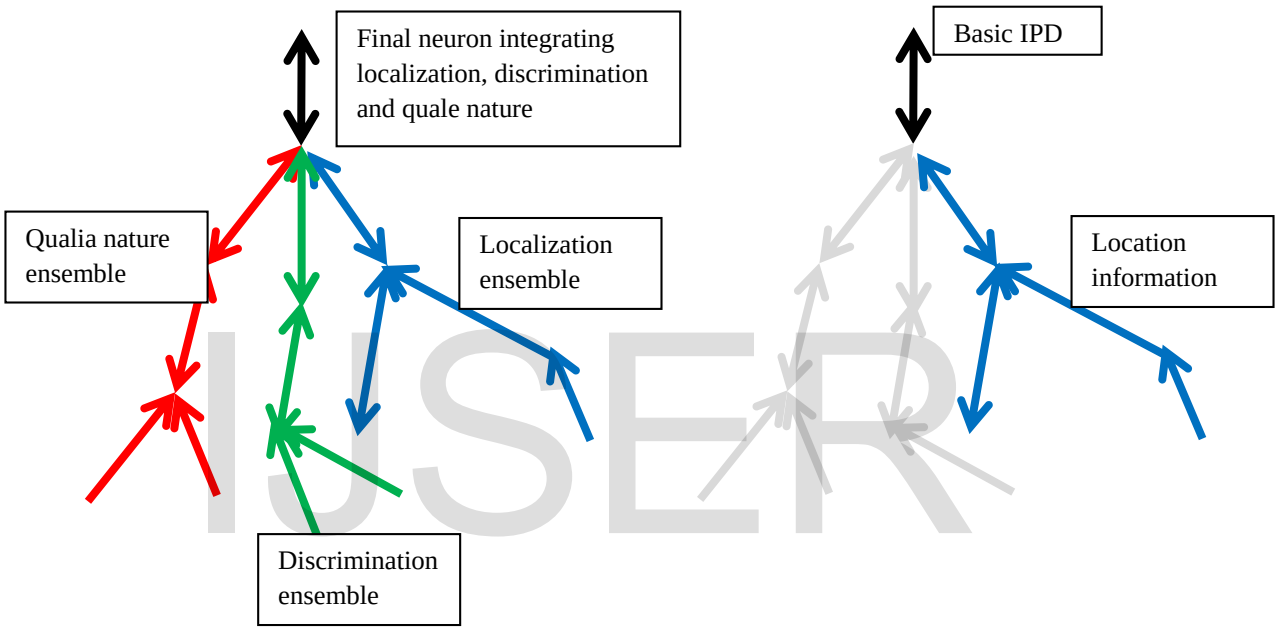


Fig 1. Depicts the confounding of discrimination, nature and localization parameters into the IPD of 1 neuron and a basic IPD (on right) with only localization parameter.

Localization is separately calculated by an IPD like brain but in case of brain it will be experience-less without the other 2 parameters – qualia nature and discrimination. However, even without experience, the localization information can be received by a basic IPD like air molecule.

Localization is the amount by which the location of information is known precisely. Visual sensations are highly isomorphic to the external reality however, the location of origination of auditory information cannot be known as precisely as visual information. Localization accuracy of auditory information is 1 degree for sources in front of the listener and 15 degrees for sources to the sides. Because sound stimulus typically does not vary across space it has a lower localization parameter than vision. Without localization, as in case of emotions or core self the quale is experienced at the location where the neural network output is created. The azimuthal visual location can be easily located by neural code or unique output of the neural network. However the location of depth of visual experience is approximate. Of course, the neural code or output is not variable enough to locate each and every depth point in the universe.

Localization is separately calculated by an IPD like brain but in case of brain it will be experience-less without the other 2 parameters – qualia nature and discrimination. However, even without experience, the localization information can be received by an IPD like brain.

The subscript $\mu \equiv \{d, n, l\}$ stands for discrimination, nature and localization respectively. The subscript Φ stands for spike trains responsible for each individual parameter namely discrimination, nature and localization.

In case of brain as an IPD, the final function produces a pattern of times with confounding of above 3 parameters. Each of the 3 components of the final function can be measured by varying 1 parameter and keeping the other 2 constant (Manohar 2021).

$f_\mu (t)\, \delta (t - t_\Phi) = f_d (t)\, \delta (t - t_i) + f_n (t)\, \delta (t - t_j) + f_l (t)\, \delta (t - t_k)$

The delta function was used just to remove the redundancy of the 3 components of the neural code in the graphing of model. So, If $(t - t_i) = 0$, then $(t - t_j)$ and $(t - t_k)$ are $\neq 0$

$f_\mu (t)\, \delta (t - t_\Phi)$ where μ and Φ together go from $\mu = d$ and $\Phi = i$ to $\mu = l$ and $\Phi = k$, $\mu \equiv \{d, n, r\}$ and $\Phi \equiv \{i, j, k\}$

The final function $f_\mu (t)\, \delta (t - t_\Phi)$ can be the sum of nature, localization and discrimination parameters considered here or an entirely new function

$f_\mu (t)\, \delta (t - t_\Phi) = g (t)$

Generalizing from qualia field to information field a minimum of localization parameter is sufficient to create information in the information field. So, the function

$f_\mu (t)\, \delta (t - t_\Phi) = f_d (t)\, \delta (t - t_i) + f_n (t)\, \delta (t - t_j) + f_l (t)\, \delta (t - t_k)$ becomes

Min $(f_\mu (t)\, \delta (t - t_\Phi))$ or $f_\mu (t)\, \delta (t - t_\Phi) = f_l (t)\, \delta (t - t_k)$ as a minimum.

Removing the delta function and adding the location q the function becomes,

$f_l (q, t)$ – *This is the main theme of this paper.*

$f_l (q, t) \Longleftarrow | \Psi >$

The localization information is gained by the IPD by interaction with state vector $| \Psi >$. Note the direction of the arrow for consistency with postulate 5 listed in section 6.

Only pure states like position and moment are considered for the scope of this paper. The 4 quantum numbers in dealing with energy spectrum of the electron are out of scope. A quantum state of spin, for example will require a 2-state detector or a 2- state IPD to distinguish between spin up and spin down.

$| \uparrow > | IPD^1 > \rightarrow | \uparrow > | IPD^2 >$

As soon as an IPD like air molecule, Geiger counter or human brain becomes available with a minimum of localization information, information field attributes the value in the field. A sophisticated IPD like brain compares the information received by both eyes etc. to generate localization but a simple air molecule has simple $f_l (q, t)$ information to build the information field.

Once the initial state and the Hamiltonian of a system are given, then future state of the system can be calculated by Schrodinger's equation,

$I\hbar\, d/dt\, | \Psi > = H | \Psi >$

Section 2

Alternative Interpretations: All interpretations analysed here in contrast with information field interpretation have their own merits and short-comings. The analysis is not intended to falsify any interpretation but to highlight their

differences with information field interpretation. Some of the other interpretations like Objective Reduction are meritorious but not discussed here

Copenhagen Interpretation: According to this interpretation proposed by Neils Bohr in 1928, when a measurement or observation of the wave is made by IPD, its wave function collapses in the physical world. Bohr emphasized that a classical IPD is required to collapse the wave function. Bohr also emphasized that the border must be mobile so that even the "ultimate apparatus"—the human nervous system—could in principle be measured and analysed as a quantum object, provided that a suitable classical device could be found to carry out the task (Zurek).

In the quantum interpretation of information field, presented in this paper, there is no collapse in the physical universe. However, a "collapse" or generation of a minimum of localization values takes place in the information field not in the physical universe. Physical universe is connected to the information field by Humean connection.

The Copenhagen Interpretation for quantum process creates a thin line between macroscopic world and quantum world. In the macroscopic world events *appear* to be localized. In this paper, the information field attributes values to the field as soon as there is interaction between a wave function and observer. The observer can be any IPD from an air molecule to complex human brain. There is no "shifty split", as John Bell called it, between macroscopic and microscopic world. As an IPD measures the localization of the test particle, the information assumes values in the information field.

In the Schrodinger's cat thought experiment the once the cat is observed there is a 50% chance that it is live and 50% chance that it is dead.

$(|\text{alive}\rangle + |\text{dead}\rangle)/\sqrt{2}$.

In the Copenhagen interpretation, the information transferred by IPD to information field causes the wave function to collapse in the physical world to the one of the many alternatives. This contradicts with the postulate 5 listed in the section 6 of this paper.

Many Worlds Interpretation: Proposed by Everett, every time a quantum system interacts with another quantum system the wave functions evolves in their own different universes. Certainly, Occam's razor is not a principle of science but it certainly doubts the many worlds interpretation as too complex to explain the boundary between classical and non-classical objects. Collapse will, of course, become unnecessary in many worlds interpretation. The information field interpretation presented in this paper discusses the plausibility of single fundamental information field rather than countless number of universes.

"We do not in general choose between competing evolutionary theories on the grounds of minimising the number of predicted alien civilisations, nor between competing theories of human prehistory on the grounds of minimising the number of homo sapiens who have walked the earth" - (Brown, Harvey R and Wallace, David (2005)).

Minimising the number of homosapiens is not a correct analogy of minimizing the number of worlds. We are assuming the existence of billions and billions of universes to explain a simple wave function collapse, the existence of which universes is hypothetical. The number of homosapiens who have walked on earth is not a hypothetical assumption created to explain human prehistory or evolution.

Even the information field interpretation presented here can be subjected to Occam's razor. We are presenting the existence of 1 real field to explain wave function collapse. Ideally, by Occam's razor, the number of fields should be zero! However, this paper presents the supporting arguments of why the additional complexity of 1 extra field is necessary.

Decoherence: According to Decoherence theory by Zeh, H, in Hilbert space $\mathcal{H}$, if $|\Psi_1\rangle$ and $|\Psi_2\rangle$ are 2 states of a quantum system, then the superposition $\alpha |\Psi_1\rangle + \beta |\Psi_2\rangle$ is difficult to observe for macroscopic systems. Quantum

systems are not isolated from their environment and continuously interact with its environment and become entangled with it. This entanglement defines what we can measure. If the quantum state of test particle passing through 2 slits in a double slit experiment is h1 and h2 respectively and it interacts with the IPD named I, then, $\alpha |h_1> |I_1 > + \beta |h_2>|I_2 >$ is the entangled state. The dynamics of this entangled system are irreversible and non-unitary even though the universe still evolves in an unitary fashion. Decoherence theory does not claim to actually collapse the wave-function. It only claims to provide a theory for causes of the loss of interference pattern, as the quantum system interacts with the environment. Decoherence does not explain the so called physical wave function collapse or the measurement problem.

The probability of transition from state Ψ to ζ is the inner product,

$\text{mod}(<\Psi|\zeta>)^2 = \text{mod}(\sum \Psi^*_i \zeta_i)^2 = \sum_i (\text{mod}(\Psi^*_i \zeta_i)^2)) + \sum \Psi^*_i \Psi_j \zeta^*_j \zeta_i \ (i \neq j)$, where i,j are usual basis indices.

The interference term $\sum \Psi^*_i \Psi_j \zeta^*_j \zeta_i \ (i \neq j)$ vanishes as system gets entangled with the environment.

$\sum_j (\text{mod}((\sum_i \Psi^*_I < i, h_i| \zeta, h_j>))^2 = \sum_j (\text{mod}((\sum_i \Psi^*_i \zeta_i, <h_i | h_j>))^2 = \sum_i (\text{mod} \Psi^*_i \zeta_i)^2$ where $<h_i | h_j>$) is the delta (δ) function and vanishes for different indices and becomes 1 for same indices ("Quantum Decoherence.").

The information field interpretation discussed in this paper, accepts the decoupling of the coherent phases of the wave function and its entanglement with the environment, say air molecule, but this paper goes ahead to claim that the availability of localization information causes information field to gain values. The physical universe continues to remain as a wave function and only information field generates information values.

Hidden Variable: This interpretation was falsified by Bell's theorem. Einstein, Podolsky, and Rosen (EPR) argued that quantum mechanics is an incomplete description of reality. Bell's theorem suggested that local hidden variables with pre-existing information are impossible.

$C_h (a, b) - C_h (a, b') + C_h (a', b) + C_h (a', b') \leq 2$ where C_h is correlation and a, a', b, b' are angles.

In 2 slit experiments, when a particle is passes through the 2 slits in the double slit experiment, the slit through which it passes is completely determined by its initial position and wave function. In entangled pair of particles, it was proposed that hidden variable contains information about the outcomes of measurement before the measurement is performed.

Information field interpretation proposes that the information field captures the values of, say, spin of both the electrons in an entangled pair, instantaneously maintaining the energy conservation. Information field, which is a non-physical field does not transfer or communicate information between entangled pair of electrons physically but only updates the information values of the spin of both particles in the entangled pair.

Quantum Bayesianism: According to Quantum Bayesianism or in short Qbism, a quantum state does not belong to the physical universe but only represents the degree of belief an entity has about the probable outcomes of measurements.

Quantum Bayesianism does not elaborate on how the measurements made by different IPDs agree with each other. This is the 4th postulate discussed in section 6 of this paper. The degree of belief is personal and has no relation with degrees of belief of other entities. Qbism fails to explain the objective world and only deals with what the entity is likely to experience.

Quantum Information approaches: These interpretations, though similar to information field interpretation, only posit that quantum mechanics describes observer's knowledge of the universe rather than the physical universe itself. They do not generalize the observer or IPD as any entity with the ability to gain basic information such as localization or a complex system such as brain which can access and experience the information field with many parameters (of qualia). According to these approaches wave function collapse does take place but only in the consciousness of the observer. Here again, the observer is assumed to be human or some life form and consciousness is supposed to pre-exist such that it can collapse the wave function in itself without any physical wave function collapse. Information field interpretation constructs the information in the information field after a wave function interacts with appropriate IPD.

Consistent Histories: This interpretation assigns probabilities to various alternative histories (($H_i = P_{i,1}, P_{i,2.....}$) where P is the projection operator of history i and time 1,2..) such that the probabilities for each history obey the rules of classical probability while being consistent with the Schrodinger equation. Wave function does not collapse in this interpretation and the measurements are replaced by decoherence hence the alternate name decoherent histories. Because decoherence is discussed above in contrast with information field interpretation I will not repeat the argument here.

Wigner – Neumann Interpretation: According to this interpretation consciousness or subjective perception causes the collapse of the wave function in the physical universe. Also, According to this interpretation, consciousness itself cannot be in superposition even though the rest of the chain of observers and the object measured are in superposition (Esfeld 1999). It assumes the pre-existence of consciousness and consciousness which according to information field interpretation is non-physical and without energy/ mass is able to cause changes in the physical world. This contradicts with postulate 5 and postulate 9 listed in the section 6.

"For another viewpoint, we may take note of the fact that the only completely clear-cut discrepancy with observation, in the Schrodinger cat experiment, seems to arise because there are conscious observers, one (or two!) inside and one outside the container. Perhaps the laws of complex quantum linear superposition do not· apply to consciousness! A. rough mathematical model for such a viewpoint was put forward by Eugene P. Wigner. (1961). He suggested that the linearity of Schrodinger's equation might fail for conscious (or merely 'living') entities, and be replaced by some non-linear procedure, according to which either one or the other alternative would be resolved out. It might seem to the reader that, since I am searching for some kind of role for quantum phenomena in our conscious thinking-as indeed I am I should find this view to be a sympathetic possibility. However, I am not at all happy with it. It seems to lead to a very lopsided and disturbing view of the reality of the world. Those corners of the universe where consciousness resides may be rather few and far between. On this view, only in those corners would the complex quantum linear superpositions be resolved into actual alternatives. It may be that to us, such other corners would look the same as the rest of the universe, since whatever we, ourselves, actually look at (or otherwise observe) would, by our very acts of conscious observation, get 'resolved into alternatives', whether or not it had done so before. Be that as it may, this gross lop-sidedness would provide a very disturbing picture of the actuality of the world, and I, for one, would accept it only with great reluctance". – Roger Penrose, Emperor's New Mind, Page 294 – 295.

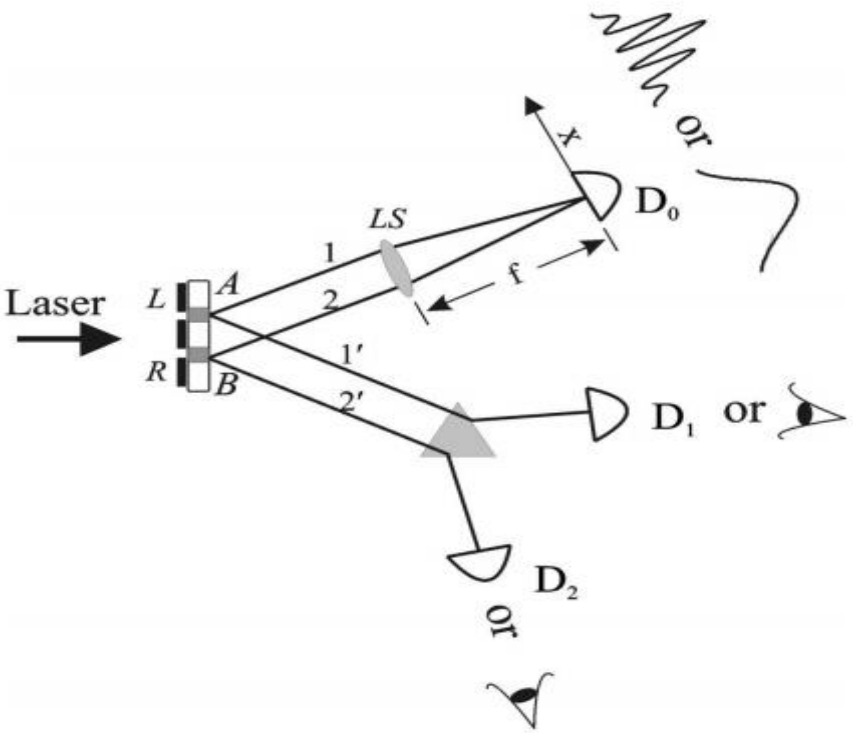


Fig 1. Experimental setup to test if consciousness causes collapse of the wave function (Yu S., Nikolić D (2011)).

i) No actual attempt to measure the "which-path" information was made, that is, D1 and D2 are not implemented at all. ii) The "which-path" information was measured as D1 and D2 are implemented in order to interact with the incoming photons. However, no results were recorded by a macroscopic device and hence are not visible or accessible to a human observer in any way. iii) The "which-path" information was measured by a macroscopic device such as D1 and D2. The results were not recorded but were instead presented to a human observer temporarily and directly such that the relevant information entered the sensory system but, at the same time, the observer was distracted in order to prevent conscious detection of this event (Yu S., Nikolić D. (2011).)

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First 2 of the 3 conditions listed above were experimentally tested to see if interference pattern was created at D0. Both were falsified and the falsification of the 3rd condition, according to the author, naturally follows from first 2 (Yu S., Nikolić D. (2011).)

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Section 3

What is an IPD? In a double slit experiment the interaction between an electron wave function directed towards the slits and an air molecule or the wave function of air molecule is *stochastic* as well as probabilistic. The air molecule is a basic IPD. As soon as the interaction "materializes" the position information of the electron is available to the air molecule. Once collapsed even by a basic IPD, the parameters gain value in the information field will, of course, remain consistent to all IPDs. As the wave function evolves as a Schrodinger equation, the measurement or observation remains constant in the information field until new measurement is made on the test particle. However, the stochastic nature of interaction between test particle and IPD is stochastic and less understood.

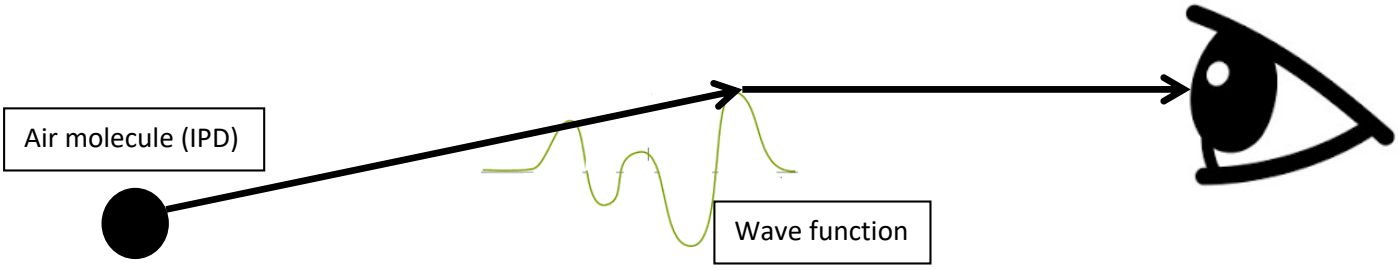


Fig 1. – The IPD air molecule after interaction with wave function collapses it only in the information field. As wave function evolves the information in the information field remains constant and assumes new value after a new measurement is made.

Section 4

Nature of physical Reality (Information field interpretation): *The wave function does not collapse according to information field interpretation.* The "collapse" happens in the information field accessible to an IPD. The wave function in the physical universe remains "mathematical" and real. As the information field fluctuates, even though the information is available with some IPD, the observation or measurement does not void the information in the field. As the quantum fields fluctuate due to uncertainty, waves are continuously created in the space-time. These waves upon observation by a correct IPD create a value in the information field.

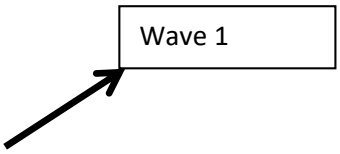
The information field interpretation has a hint of immaterialism and instrumentalism to it. The fundamental reality could just be about information rather than about physical things and a measurement is an attempt to gain information. Instrumentalism says that scientific theories do not attempt to describe the laws governing nature, but merely function as IPDs for predicting the results of experiments.

Empirically, an electron, as physics understands today, is not made up of sub-particles. If that is true, what is waving in the wave function? According to information field interpretation nothing is waving in the wave function. Only after the interaction of IPD and wave function does the information field approve of or populate information values in it.

Also, it is understood that electron is not smeared or spread out over the volume of wave function because the collapse is instantaneous and the wave function which in this assumption is spread out in the entire universe cannot collapse instantaneously to one location, travelling faster than speed of light.

Section 5

Delayed Choice Experiment



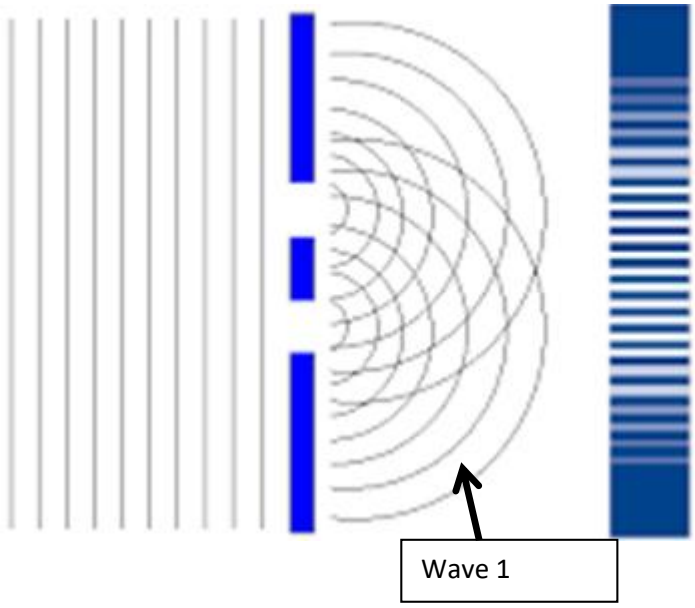


Fig 2. – Delayed Choice experiment collapses only 1 of the 2 coherent waves

The current understanding is that when wave function is collapsed after it passes through both the slits, the observation collapses the wave function to form 2 bands as if going back and changing the history of the trajectory of particle. This paper suggests that only the wave 1 or wave 2, as shown above is collapsed in the information field creating 2 bands rather than an interference pattern. The components of the coherent quantum system are decoupled and each gets entangled with the IPD.

Even if it is true that the history is erased after observation, the interpretation of information field holds. While the wave function passes through the 2 slits, no information is available to the information field but information field updates the information once the observation is done after the wave function has passed through the slits. The IPD learns about the number of slits the wave function came through from the nature of wave function itself.

Eraser Experiment:

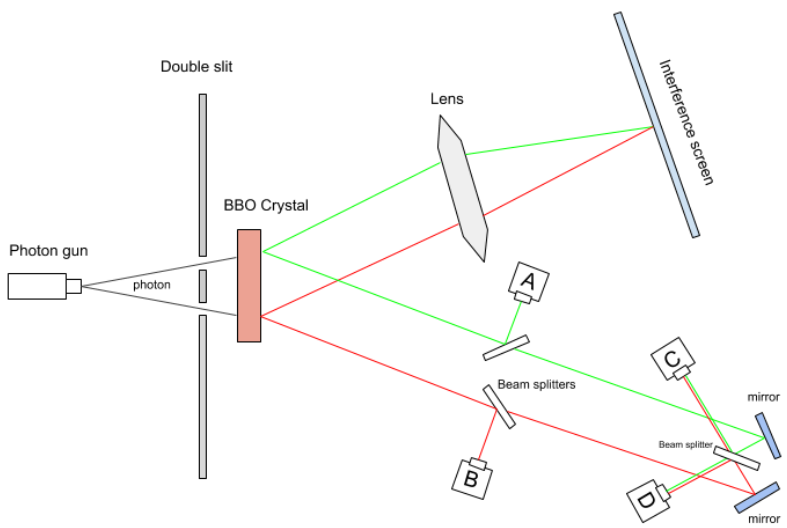


Fig 3. – Eraser experiment destroys the information in the information field

Coherent entangled pair is passed through the 2 slits as shown in fig above and the beam is split such that 1 part reaches the screen and the other reaches detector A or B (C and D not used). No interference pattern is observed as detector A or B has the information about which slit the particle went through. When detectors A and B are turned off and C and D are turned on, the information about which slit the particle went through is lost again and the interference pattern appears on the screen.

Since the environment remains the same in both the scenarios – 1) detector A or B is on and C and D not used 2) detector C and D on and A and B off, decoherence is not the factor for collapse and reformation of the wave function, regardless of the environment chosen for the experiment.

When an IPD gains information, the information field attributes values to the location information. As soon as the IPD loses information, the information field clears the values from the field.

Section 6: Postulates of Information Field

1) The information becomes instantaneously available in the information field: This postulate is in alignment with the phenomenon of quantum entanglement. One instantiation is when the spin of a particle is measured by an IPD, the entangled particle instantaneously assumes a value or information of spin in the information field to conservation of angular momentum. In entanglement the term,

$(| \Phi_i >)_A \circ | \Phi_j >_B - | \Phi_j >)_A \circ | \Phi_i >_B)$ is inseparable into pure states ($\circ$ symbol is used for tensor products)

2) The information can be erased from the information field: In quantum eraser experiment discussed in section 4, the information about the position of particle (slit) can be erased from the information field.

3) The information field obeys the laws of physics including conservation of energy in the universe: In accordance with the conservation of energy principle, the entangled pair of particles is spin up and spin down when measured in the same direction by an IPD. The Heisenberg's Uncertainty Principle is obeyed in the information field.

Example 1:

The uncertainty relation between 2 observables X and Y, which do not commute and be observed simultaneously, is given by

$\Delta X \Delta Y \geq ½ | < [X, Y] >|$ (Zettili 2009, Quantum Mechanics, concepts and applications)

Where $\Delta X = X - <X>$ and $\Delta Y = Y - <Y>$; $<X>$ and $<Y>$ are expectation values of X and Y respectively.

The product of uncertainties is greater than ½ the modulus of commutator of the operators. This generalized uncertainty principle is obeyed by the information field.

Example 2:

The Low energy information is less probable to break through higher energy barrier. The transmission coefficient for potential barrier with thickness a is given by,

$T = [1 + ¼((k_1 + k_2)/k_1k_2) \sinh^2 (k_2a)]^{-1}$ (Zettili 2009, Quantum Mechanics, concepts and applications)

Where $k_1^2 = 2mE/\hbar^2$ and $k_2^2 = 2m (V_0 – E)/\hbar^2$

V_0 = potential barrier

T is very low for classical objects while in the microscopic world the tunnelling effect is possible. These laws are obeyed in the information field.

4) The information is consistent across all accessing IPDs once it becomes available: Once information is created in the information field by interaction of 1 IPD with some wave function, the information remains consistent to all future IPDs. IPDs do not "experience" different universes and the interpretation is not solipsistic either. If the information is erased from the field, like in the quantum eraser experiment, it will be erased to all future IPDs accessing the information field. This is one of the improvements above quantum bayesianism which does not consider the experience of other IPDs.

5) The information field is uni-directionally causally connected to the universe: The waves in the universe causally impact the information field however the reverse is not true. The information field cannot change anything in the universe and is causally closed. In case of a complex, information rich IPD like brain, we call blue colour "blue" or sweet taste as "sweet" by association of visual cortex and language centres of the brain. Information or qualia is not required to be written back to the neural networks of the brain. Information field is non-physical, massless and energy-less. Which implies that information field cannot write back to the universe.

6) Information field can take the values of nature, discrimination, and localization for sophisticated IPDs: A sophisticated, complex IPD such as brain can assume qualia nature, discrimination and localization values of parameters to create subjective experience. From simple experience of localization, as in case of basic IPDs, to the complex, sophisticated IPDs like human brains, the information becomes rich in experience as more information is populated in the information field.

7) Minimum information of localization can collapse the wave function in the information field: A simple IPD like air molecule can collapse the wave function in the information field. f_1 (q, t) can locate the particle in information field. This does not mean that the basic IPD will have subjective perception as a sophisticated IPD like brain integrates discrimination and qualia nature parameters as well.

8) *Information field may be able to revise the history of wave function: A known from delayed choice experiments, the information field may be able to change the history of the universe. This postulate contradicts with the 5th postulate and it is unclear if the history is changed or only new values are assumed in the information field.

Section 7:

Conclusion: Information field is not made up of waves like the 17 (x2) fields of standard model of physics. Hence it is impossible to "see" it objectively. However, experience can become increasingly sophisticated as more information about test object becomes available. All interpretations of quantum mechanics are theoretical and speculative as is the information field interpretation due to the impossibility of "seeing" it objectively. As

information field itself does the task of seeing there is no further field or entity to see information field. However, most of the interpretations of quantum mechanics are theoretical than empirical and the interpretation of information field also requires empirical verification.

The paper does not take any of the 3 positions – realist (indeterminacy is not a fact of nature), orthodox (the particle wasn't anywhere, observation creates physical reality) or agnostic (refuse to answer)(Griffiths 2005). The wave function, in information field interpretation never collapses in the physical universe. However, the information field attributes values to the field or approves of the information gained after observation by an IPD. This concept tries to render the quantum philosophical conundrum un-mysterious by replacing the physical with the non-physical.

Further investigation is required to explain why information of curvature of space-time as explained by general relativity becomes available to the information field but sophisticated qualia are not formed.

*Some of the postulates listed towards the end of the paper may overlap with each other in terms of their meaning. The 8th postulate is unclear and requires further investigation. The 9 postulates of information field are not exhaustive and could inspire further thought and subsequent development.

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