The Double Slit Experiment

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Abstract

The 2-slit experiment is explained by using the Network Model, which then transfers to other experiments: entanglement, delayed choice and quantum erasure etc.

In essence, De Broglie pilot wave, on a Feynman path are aspects of a fermionic quantum channel transmitting bosonic excitations between tho nodes of the quantum network formed as part of the experiment. This model is called the Network Model.

A essential feature of the Network Model is that it evolves in transient-steady state cycles, akin to machine learning: The Living Universe.

Other considerations involving Space-Time, antimatter, Heisenberg uncertainty relations, fermion-boson unification etc., are included.

1 Introduction

Feynman said the double slit experiment contains the only mystery in Quantum Mechanics. He also said "... nobody really understands QM.", but meanwhile we have made considerable progress [11] (See the Appendix for a synopsis).

Once one understands the material connectivity of the matter-nodes ("particles") of the Universe, a Network Model is mandatory and with it, one can explain the other "mysteries" of QM, including entanglement, quantum tunneling etc.

If instead we insist in modeling reality in terms of particles and waves, even under the "particle-wave duality", all happening in an ambient Space or Space-Time, even with quantum fluctuations from the "Dirac See" of occupied energy levels, many experiments will not be understood, and those that we can, will not receive an elegant explanation: "If "this" ... then use particle model Else use wave model"; or just put together a particle with a pilot wave on it (de Broglie); or it's just a potential possibility (amplitude) and when you measure "the thing" it "colapses" the wave, cocreating reality as we see it ...

Of course there are partial truths in all these statements, as we shall see from the Network Model of the "Quantum Matrix" (since everything is logically speaking, Quantum Computing: Von Newman-Birkhoff (quantum logic), Heisenberg (S-matrix as a pre-qubit QC), Feynman (QM is QC), Deutsch (Father of QC) etc.

Hence the Network Model, explained next, unifies the ideas behind de Broglie pilot wave, Feynman paths and more modern experimental finding of quantum wormholes in teleportation of states in quantum computers [13].

2 The Network Model

There are various concepts which historically attempted to capture the invisible "elements of reality" that are the connections of the Network Model: ether and wormholes, the vector potential (with loops determined by the topology of the equipment) etc.

2.1 Is there a Space-Time?

But historically the two dominant concepts, that of particle and wave, were considered primordial, yet later complementary, since phenomena were conceived as happening in an *ambient continuum space*. Later this receptacle of phenomena was upgraded to Space-Time: Minkovsky, Einstein.

The approach changed with Mach's philosophy that there is no "empty space", as Einstein intended to implement with his General Relativity, to account for interactions, primarily Gravity, as due to matter and energy. The existence of an empty universe (Schwartzschild solution to Einstein's equations) was a disappointment in this regard.

2.2 Space and Ether

In parallel there were many theories advocating an "invisible" medium, the ether, not yet quantized / discretized, capable of carrying the interaction between charges, primarily associated with EM.

2.3 Towards a discrete model: Quantization

Once quantization era started with Planck's postulate (and constant) QM emerged, introducing discreteness in the laws of physics. It started with spectral lines and the theory of Bohr's atom, followed by the quantization of "free light" as photons by Einstein, to explain photoelectric effect (Nobel Price) etc.

Network Models were introduced much later, e.g. foam models of Space-Time and of course the formalism of Quantum Computing[1].

2.4 The Main Postulate

There is no "Space-Time", but just a Quantum Network [14]:

$$World\ Wide\ Quantum\ Web^{2}.$$

Of course the Network processes quantum information, "is alive" [9].

Its dynamics is similar with that of an evolving brain (nodes/gates and connections analog to neurons and synapses, that change while processing QI: qubits).

... and not only alive, but also "learning" (see also Duane Elgin [19]).

2.5 Relation with other concepts

Those readers familiar with chi and odic force, know that such "emanations" can actually be felt and even seen by sensitive people.

Why these macro-interactions should be any different from the micro-ones in quantum physics?

Why the biological aura should be any different in nature, to an atomic orbital?

The author's claim is that they are not: atomic orbitals, teleportation wormholes, chi connections, telepathic communications all have a common support, The Quantum Network.

2.6 The Learning Process

This is not a static construct and rather changes quasi-statically, in a suggestive manner like streamers of a lightning or chi emanations of a palm, or new synaptic connections in the learning process.

Once a connection is established, repetition consolidates the channel and the statistics of interference - measurement process ensues.

This occurs for instance when taking a sun bath. Moving around inhibits the consolidation process, avoiding the nasty burn if sleeping on the beach (without sunscreen, sure).

This later process can be felt by sensitive people. To see it, one has to have quite deem sources of light, or even just a magnet, where the red and blue colors of the emanations from the two pols can be recognized.

The speed of prospective connecting (learning) is a few feet per second, according with the experiments of Baron Carl Von Reichenbach [10]. Of course Sun's streamers are already all around us at the beach.

[1] ... together with the "3rd quantization" which postulates that the qubit space is a discrete geometry of the Platonic/binary subgroups of $SU(2)$.

[2] "The Quantum Matrix" if you prefer.

2.7 ... and Nuclear Force

Similar "connections" occur in Elementary Particle Accelerator experiments (transient and steady-state regimes), while in a nucleus the mesonic bonds are closed (bound states: steady state regime) yet fluctuations are in order (different levels of energy, for example for the u/d mesons pi, omega, sigma [4].

3 The Double Slit Experiment

This is a classical and fundamental experiment showing the particle-wave aspects of a quantum phenomenon [2], yet not really understandable through this "alternative": particle or wave? [3].

Indeed, when using photons or electrons, one can arrange to have one quanta emitted at a time (as seen on the receiver screen). If modeling quanta as a particle a paradox ensues, since the two slit acts as a beam splitter, so what will it split: the particle or a wave?

This experiment, with photons, is similar to a beam splitter experiment, where the paths are redirected using mirrors, to obtain interference on a screen.

The new theoretical model should encompass both experiments, explaining them in a unified way. This naturally invites the Network Model, which then plays a universal role in many aspects of physics phenomena; in fact it is a universal device at the foundations of quantum Computing, as a language for modeling "reality" [7, 8, 6].

3.1 Transient and Steady-state Regimes

The 2nd main claim, is that the process has a transient stage, where the particle, photon or electron traverses one path and another time the other, establishing a connection (think open orbital) similar to streamers and solar flares, or new neuron synapses, which transits the process in the steady-state regime.

The result in each case is the establishment of a fermionic channel (fermions, here electrons) that can transfer quantum information in individual paths (bosons, here the photons).

3.2 Fermion-Boson Unification

As noted above, the Network Model entails the unification of fermions and bosons, in the sense that they have different roles, yet depend on (serve) each other.

There may be a fermionic channel without a bosonic "transmission", for some macroscopical time interval, but there is no "boson particle" traveling through "empty space"[3]:

$$There\ Is\ No\ Space!...nor Time.$$

3.3 Measurement "Intrusion"

The act of observation obviously perturbes, or even destroys the quantum circuit, and it was at some point modeled as "collapse of the wave function".

In the Network Model the wave function acquires a real support modeling the quantum circuit (topological skeleton of Feynman paths, where the amplitude is stationary). Such "quantum geodesics" (see Hamilton-Jacobi and Bohm theory) correspond to actual "elements of reality" which are physical, material entities: eteric in nature, fermionic in their properties, serving, as said several times, to the unification of particle and wave models, fermions and bosons concepts.

Now what happens when you approach a screwdriver to a coil or condensor of an old transistor radio, or even touch a soldering node? the behaviour / functionality is affected! With an "etheric" (fermionic) quantum circuit (think "electronic distributed fractional charge", classically modeled by the wave function of the electron; ... and yes, in baryons we see how charge can be distributed in three parts, we call quarks), when probing one path with an interaction (it's not just a particle photon illuminating that side, it's a channel interaction), it acts as a short-cut in an electric circuit, affecting the quantum potential (Bohm theory) making that path preferred to the point that we may say "it collapses the wave function".

[3] The ether does exist! but in a different sense.

So, Schrodinger's wave function is a good mathematical device to understand the connections of the Network, and its collapse is "real", meaning that there is a hardware change in the quantum network, when we try to see, via "measurements", which way the "particle" (preconceived idea!) it goes (and again preconceived idea) ...

3.4 Is the Electron Point-wise?

The clear answer is: No! Its detections, e.g. in particle accelerators, appear localized, but HEP would benefit from understanding Low Energy Physics: atoms, 2-slit experiment etc.

Its spin property also shows there is a need to implement this concept via a model that also serves other experiments: the fermionic channel model.

So, what is not isotropic for such a channel that leads to the bending in a magnetic field? The natural idea is that the channel is "twisted" in some sense ... or maybe, since everything is reversible (unitary matrices; no arrow of time), it is a duplex channel too: if a loop has particle-antiparticle components, a conceptual symmetry requires doubling it ... The picture of a solenoid on a cylinder, combined with the quantum phase of a moving particle leads to a twisted coordinate system ...

These are some ideas to explore at this stage ...[12].

3.5 Space, Time and Anti-matter

The Space-Time concept is a model pioneered by Einstein in his theory of Special / General Relativity, yet empty space is a consequence of our emphasis on the concept of distance (metric) and macro perception of a global time, "flowing" in a preferred direction. Time is a parameter, and in fact there is no per se arrow of time [5].

The presence of feedback loops / quantum loops in quantum phenomena, together with the choice of a global time in the Lab, to map the process, leads to the misconceived idea that anti-matter exists independently of the concept of time. Then Cosmology ponders why it is not observed in the Universe, on an equal footing with matter, and invents various mechanisms to get rid of it [4]

3.6 Heisenberg Uncertainty Principle

This reflects that there is no well defined continuum Space (Space-Time), and it is the result of the discreetness of the Quantum Network.

The symplectic mechanics approach can handle this "discretness" in a satisfying way, yet hiding the truth: everything is discrete! A similar misleading effect was due to Schrodinger'[s wave Mechanics, after Heisenberg's formulation of Matrix Mechanics, which pointed in the right direction: QC.

If we insist in having a background Space with a metric, like in Whitney Th (any manifold can be embedded in some R^{2n+1}), the problem is the topology of the Q-Network, and discretness implies resonance, nodes etc. modeled via interference (constructive or destructive). The impact of multiple-paths contributing to the outcome is also viewed in GR, where geodesics with multi-focal points are due to the curvature of Space-Time, even in the absence of topological multiple connectivity.

In conclusion, Heisenberg's UP and commutation rules is NOT an uncertainty in the measurement itself, but rather in the mapping to a model of space (configurations) and momenta (motion / paths), in a tangent space TM of a manifold M which defines the configurations (space) and derives momenta from it T^*M (This is why the general symplectic space approach "solves" the problem ... "for now", temporarily).

3.7 Is QM complete?

So, in some sense QM as a basic language of Q-Physics (superpositions, observables, eigenvalues etc.) is "complete" (enough) but its implementations at various conceptual stages (Heisenberg CR, Schrodinger eq., etc.) are incomplete: it needs the Network Model, as the original Matrix Mechanics also suggests, as a pre-cursor of QC.

Then, Einstein was right: there are "hidden variables", but associated with "hidden" elements of reality: quantum channels (ER bridges or quantum wormholes or fermionic channels).

[4] Reminiscent of QCD fine-tuned to confine quarks, because it was postulated that they are free particles etc.

hence, the Network Model of QM is complete (QC as a math language; with a categorical flavor for Elementary Particle Physics).

4 Other Applications

We will briefly review entanglement, quantum tunneling and delayed choice experiments. Other phenomena, like water memory, telepathy, healing at distance may have other aspects involved, not explainable just by the Network Model.

4.1 AI and Network Model Evolution

The famous "As above so below" (duality) applies to Machine Learning and the evolution of the WWQW.

Indeed, the development of classical computers (classical logic) and pertinent software and games, parallel the understanding of Quantum World around us (Quantum Logic) and, if you like, the "Game of Life", with a hint towards the Simulated Universe Hypothesis.

Concretely, the way Machine Learning operates (AI), is similar to how our brain develops as a result of the learning experience, and as a quite universal process, how the Universe evolves.

As proposed above, the dynamics of the Quantum Network is based on reconfiguration of connections due to interactions. It is a learning process in a general sense.

The evolution of The Quantum Matrix, due to evolution on Earth, mankind and beyond, is of course of a different scale and magnitude ...

Nevertheless at the level of basic physical experiments the dynamics of the connections is present, explaining easily, together with the fermionic-bosonic tandem, the mysteries of the experiments enumerated above.

4.2 Entanglement

EPR article claimed QM is incomplete. Bell's inequalities were devised to test if hidden variables exist [16].

This is a similar situation when both camps claim there is more to this phenomenon. QM just implements non-locality via tensor products, in an abstract way. Is there an "element of reality" implementing this?

The spin concept also implements abstractly the behaviour of elementary "particles" in Stern-Gerlach like experiments. Is there an additional structure of particles, hence not just modeled as pointwise with internal degrees of freedom, which are in some sense "hidden"?

In both cases the author claims, that yes, the models can be refined to include "elements of reality" which clarifies the paradox; 1) ER or fermionic quantum channels connect entangled particles, which was determined experimentaly, yet indirectly. The channel was thought of as a wormhole in the sense of GR and negative energy propagating via the wormhole was detected [13]; 2) the spin for baryons is due to the quark structure asymmetry; for mesons and electrons there has to be an additional structure for the "path" of the electron and the nuclear bond represented by the meson (two-way $SU(2)$ channel).

4.3 Quantum Tunneling

Conjectural, this is also due to the presence (or formation of a) "short-cut" quantum wormhole ... It is a natural solution in view of the Network Model (there is no Space-Time, in a physical sense; except as a convenient model for embedding the Quantum Network).

4.4 Delayed Choice Experiments

These involve loops similar to those implemented by beam splitters in quantum optics experiments. Such a feedback loop involves the particle - antipartilcle alternative interpretation. [5].

5 Conclusions

The Network Model subsums the old disparate concepts of various QM theories, yet posses a question: what is the foamy fermionic channel "made off"? Is this just an intuitive model that works? ... or there is a deeper significance, in the context of the Universe Simulation Theory [7] and it does not matter how a QC is implemented [8] (no way to find out from "within" the simulation[5]) ...

A Essence of QM

"Pointwise" determinism is mathematically implemented via functions (particle Mechanics) and differential equations (fields / continuous media).

When complex dependencies are involved, i.e. one input affects several individual outputs, a graph depicts such a dependency and linearizing the model yields linear operators. Matrices are their representation in a basis (correlations $A_{ij} : i - node \to j - node$); see also quiver representations and Markov processes). The basis elements corresponds to classical sharp observations (Yes or No, i.e. classical logic) while their coefficients represent correlations, or weights / contributions.

In essence, a "quantum" state is in fact a more complex model for characterizing irreducible, yet interacting parts of a system, usually involving a superposition.

The real challenge is to understand why complex numbers are needed; but then, looking at electric circuits which use them (amplitude and phase), shows that "timing" (local time) is hidden in this way into the description of the I/O process, and the electric diagram provides the causality (space) component.

The presence of feedback via loops, e.g. in amplifiers, leads to resonance and discrete spectra, as long as we have a "clock" associated with every "particle": complex numbers $Ae^{it\omega}$. Similar feedback loops and resonance occurs in quantum processes that involve multiply-connected regions, as in the 2-slit experiment (non-homotopic Feynman paths).

See [11] for more information on this topic.

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