Quantum Approach to Correspondence Theory

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ABSTRACT

The cat paradox, which excites the physicists to this date, can be applied to a steady state system the other way round as the combination of exactness and randomness. Both the terms, exact and random, describe the accuracy with which the coordinates or trajectory or any other condition of the particle can be calculated. Actually this can be described as an extension of uncertainty principle further assuming the existence factor which tells the presence of equal probabilities of exactness and randomness in that state. When compared with Bohr's correspondence principle, what evolves is the bridge equation which actually gets its name from the fact that it is a bridge between quantum and classical state. It tells the conditions under which a quantum equation can break-down to a classical state or vice versa. This breakdown is formulated assuming that the wave-function is actually a matrix of those coordinates of space where the matter waves the most likely to disperse. This is accompanied with a dimensional inversion and finally how such a breakdown is associated with the generation of space drag. This eventually will find its way to the generation of the point of singularity where all functions would assume an equilibrium state. In totality, now, physicist can say, the gap between quantum mechanics and classical mechanics has been narrowed to a large extent which physicists have been trying to do for the past 80 years or so.

Keywords: Cat paradox, steady state system, exactness, randomness, Uncertainty principle, Bohr's correspondence principle, bridge equation, quantum-classical state, matrix coordinates, wave-function, dimensional inversion, singularity, Markov process, Weiner process, Chapman-Kolmogorov equation, stochastic approach, Ita-Stratsnovich calculus, Heisenberg's matrix mechanics, future state, past state, quantum-classical breakdown, transition constancy, sub dimensions, phase reversal and existence factor.

1. INTRODUCTION

"Everything we call real cannot be regarded as real."

-Prof. Neils Bohr.

Since the era of classical mechanics and later of the quantum mechanics, physicists all over the world have wondered whether the two aspects of physics could be combined. After the Copenhagen interpretation, Prof. Neils Bohr proposed a hypothesis which is known as the correspondence theory.

Correspondence Theory- For the higher energy levels of any matter taking into account the Planck's quantum formula, any equation in quantum state breakdown to classical state.

In other words, as value of n tends to infinity, quantum equation breaks down to a classical state. This notion had been in question for 80 years or so. Erwin Schrodinger, in the mean time, put forward his famous cat paradox.

Cat Paradox- Consider a cat trapped in a steel cage with a uniformly decaying harmful radioactive substance. There will a state of the cat when it will be half dead and half alive.

Mathematical working upon the paradox has been quite cumbersome. About few years after it, Jordan wrote in a paper that it is quite possible that the forgotten correspondence principle and the cat paradox are quite related to each other. Heisenberg, while working with his matrix mechanics during the last days of his life, spent entirely to find the relation between the two but in vain. Since, then both of these theories have been left without any further attempt to prove or discuss.

This is the basic aim of the theory. First, finding the mathematical expression of the Correspondence theory using Heisenberg's matrix mechanics and then relating it with cat paradox will lead us to long and some unexpected results.

The wave-function hypothesis. To start with, in order to mould the theory, we define a wave-function as- the matrix set of those values of space coordinates where the wave is most likely to propagate with minimum dissipation of its energy. As light travels through those space coordinates where least energy will move out of it, same is the case with waves. On the basis of these values, one can easily predict the future and the past states of the wave on the basis of its present state. Similarly, the definition of inverse wave-function can be articulated as- the matrix set of those values which have already been taken up or could be taken up the anti of the wave existing in the inverse dimension of its propagation. That means if wave exists in XYZ dimension, inverse wave will exist in –X-Y-Z dimensions. This can help us in assuming the future of the wave on the basis of its present and past. But the point to be noted is, in order to predict present or future state, the observer has to be present in front of the wave or at a point it is most likely to take up. The above conditions can be together formulated as-

$$\psi^2_{nm}(x, y, z, t) = \Sigma_k \psi_{nk}(x, y, z, t)\, \psi_{km}(x, y, z, t)$$

Where k is the matrix division factor, an intermediate value between primary orders n and m, the values which the wave function is most likely to take up. This defines the degeneracy condition of the probability density of the propagating wave.

Because, in being behind it, due to random wave distribution of it according to de Broglie, it will be difficult to pin point the state and this is where the terms exactness and randomness come into play.

Exactness and Randomness. Both these terms are quite related to Heisenberg's uncertainty principle and are inverse of each other. For any arbitrary function ϕ over given finite volume V and sample space Ω, its exactness can be calculated as-

$$E(\phi) = \int_\Omega e^{|\phi|}\, d\left(\int_V \psi^2 (x, y, z, t)\, dV\right)$$

For the same function ϕ propagating in space over a finite volume V and given sample space Ω, its randomness can be calculated as-

$$R(\phi) = \int_\Omega e^{-|\phi|}\, d\left(\int_V \psi^2 (x. y, z, t)\, dV\right)$$

The negative sign shows the dimensional inversion. Under normalizing conditions,

$$\int \psi^2 (x, y, z, t) = 1$$

It is clear from the above equations that multiplication of both the exact and random matrices are inverse of each other. In a broader prospective, more exactness means the function will tend more towards classical state and more randomness means the function will tend to quantum state. The probability of attaining a certain value depends on whether the function is towards quantum or classical state. Based on these observations, we can construct two states for the function of the wave, one its past state and the other its present state.

Future function determinant. During breakdown of quantum state to classical state or vice versa, transition of the function matrix occurs between dimensional with an inversion. If we make a stochastic approach to this problem, we will initially assume that this transition process is completely a Weiner process. But before making it, if we apply Ita-Stratsnovich calculus to any Markov process, the consequences are quite surprising and further explained if we take a step further. This means the function in native form would follow Chapman-Kolmogorov equation. This can be represented as-

$$\phi\ (x,\ t/x`,\ t`) = \int dx``\ \phi\ (x,\ t/x``,\ t``)\ \phi\ (x``,\ t``/x`,\ t`)$$

Where $t< t``<t`$ and $x``$ is any arbitrary intermediate value between initial coordinates (x, t) and final coordinates $(x`, t`)$. Now the future transition is a Markov process and exactness-randomness transition is Weiner. So combining both the process for the same function, we can formulate what I named as the Correspondence transformation between times t_{k-1} and t_{k+1} for nay intermediate coordinate (x_0, t_0) as-

$$\phi\ (x,\ t_{k-1}/x`,\ t_{k+1}) = \int dx_0\ \phi\ (x,\ t_{k-1}/\ x_0,\ t_0)\ \phi\ (x_0,\ t_0/\ x`,\ t_{k+1})$$

The equation to the wave-function degenerate equation. The intermediate value k where explains the degeneracy, similar case is with the transformation equation. If applied with stochastic approach, between final orders of wave matrix, there exists an intermediate coordinate between future and past coordinates which determines its state. It would be seen that in future, some part of present state is retained by the function and remaining would be changed and this affects the probability density. That means if function in present is in quantum state, it is not necessary it will remain in quantum state. But there will be retainment of some initial state of the function. However, if probability of occurring a certain state is taken into account, the inference is from Fokker-Planck equation as-

$$\partial/\partial t\ p\ (x,\ t/x_0,\ t_0) = [-\ \Sigma^n_{i=1}\ \partial/\partial x_i\ b_i\ (x,\ t) + \tfrac{1}{2}\ \Sigma^n_{i,j=1}\ \partial^2/\partial x_i\ \partial x_j\ (f\ f^T)_{i,j}\ ]\ p\ (x,\ t/x_0,\ t_0)$$

Retainment of some amount of present state is confirmed by the following equation in future state.

Dimensional inversion. The transition between exactness and randomness occurs with a dimensional inversion. There are actually primary dimensions and further sub dimensions. Our workings concentrate only on sub dimensions. In order to break down, the function has first to pass through the sub dimensions then further invert through the primary dimensions which are arbitrary and abstract. As for every dimension, there is an inverse dimension, so for sub dimensions there are further inverse sub dimensions and similarly for primary dimensions. The transition of function happens with a phase reversal of the wave function making the matrix in its skew form in respect with the original matrix as-

$$[E(\phi)] = -[R(\phi)]$$

The singularity hypothesis. During a function's transition between its quantum and classical state, it has to pass through in between the primary dimensions. So, there will a certain point in space time for the function when it will be in its mid way, in sense, when it will possess both characteristics of quantum and classical formulations. At that time, the matrix of the wave function would be partially determinant over classical sample spaces and the transition would depend on which values it takes up in future. The characteristic which will be dominant over the other will result into molding the function in its own way. In other words, we do not know what has happened and what will happen to the function in that state. Such a point is called as singularity. This is the point where the function assumes an equilibrium state. In this state, the singularity point can be related with the niche of time when constancy is achieved in the complete transition process as-

$$\partial/\partial t = 0$$

$$\therefore\ [-\Sigma^{n}_{i=1}\, \partial/\partial x_i\, b_i\,(x, t) + ½\, \Sigma^{n}_{i,j=1}\, \partial^2/\partial x_i\, \partial x_j\, (f\, f^T)_{i,j}\,]\ p\,(x, t/x_0, t_0) = 0.$$

Solving the equation we get the following inferences-

The probability of a wave in a finite volume to attain a certain coordinate cannot be zero.

The actual definition of wave-function and its inverse is obtained-

$$f = \psi \qquad\qquad \psi^* = 1/\, f^T$$

The final coordinates cannot change with time or with physical interferences in space time as b (x, t) = constant.

At singularity, both wave-function and its inverse are indeterminable.

Transition probability into any one state reduces.

The rise of the cat paradox. As the cat exists as half dead and half alive, similar case is with the steady state function, half classical and half quantum. So it probability distribution can be expressed by an existence factor C as-

$$C = 1/\sqrt{2}\ (\psi_{\text{classical}} + \psi_{\text{quantum}}).$$

This is the singularity. It can be thought of as an imaginary point in space where initially time started to run and all matter with waves came into existence. Transition first occurred and correspondence came into existence. Uncertainty flourished and exactness and randomness terms found their way in. this is how our universe came into existence.

2. CONCLUSION

The long forgotten correspondence principle solved one of the many unsolved questions of physics. The long lasting dream of physicists to unite Physics became possible. This can also help physicists to propose a united field theory. In other words, there is nothing as demarcation of physics existing from now on because of the emergence of the full fledged correspondence theory.

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