Interpretation of the Wave Equation

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Abstract

Our goal in this paper, is to provide an elegant interpretation of the wave equation. We provide several **trival** reasons to why our intrepretation is the best intepretation of the wave equation.

1 Introduction

Given a newtonian system

$$m\frac{d^2x_i}{dt^2} = -\frac{d}{dx_i}V(x_i) \tag{1}$$

We claim that suppose, a discrete approximation of this system was simulated using a finite state machine, just using a few number of varibale x_i , $x_{i,-1}$, $x_{i,-2}$ and t .Over time the error will compound and the results will stray away from original as time t progress. On the otherhand, one can invent a system, that can introduce many many degrees of freedom to the above system, such that the average of that system remains true to the above equation. We claim that such a system is the schrodinger's equation.

$$\left[-\frac{\hbar^2}{2}\frac{d^2}{d\mathbf{x}^2} + V(\mathbf{x})\right]\Psi(\mathbf{x},t) = E\Psi(\mathbf{x},t) \tag{2}$$

2 Important Reasons

2.1 Reason 1

Such an intpretation would imply economicity on part of the universe. There is just one history. According to Feyman and many others, the universe would have to feel other histories, and other histories would cancel out, rendering a path of least action. On one hand, the path of least action can be arrived directly from solving,

$$m\frac{d^2x_i}{dt^2} = -\frac{d}{dx_i}V(x_i) \tag{3}$$

without actually looking at other histories.

2.2 Reason 2

Take the wave equation, in its differential form

$$\left[-\frac{\hbar^2}{2}\frac{d^2}{d\mathbf{x}^2} + V(\mathbf{x})\right]\Psi(\mathbf{x},t) = \imath\hbar\frac{\partial\Psi}{\partial t}(\mathbf{x},t) \tag{4}$$

For some reason, people expect this system to simulated for every possible history, numerically. However, what they fail to realizes is that one can write this equation, in alegbraic form, it is simulated for all possible history in just 1 step. For example,

$$X + Y = Z \tag{5}$$

if restricted for reals X,Y, Z, would be true for all X , Y, Z, without actually simulating the system.

2.3 Reason 3

Take the differential equation of the harmonic osscilator

$$\left[-\frac{\hbar^2}{2}\frac{d^2}{d\mathbf{x}^2} + \frac{1}{2}m\omega^2\mathbf{x}^2\right]\Psi(\mathbf{x},t) = \imath\hbar\frac{\partial\Psi}{\partial t}(\mathbf{x},t) \tag{6}$$

Every kid who scored 100% in an introductory quantum mechanics class in college, has been able to find an "exact" solution in algebraic form. Does that mean that, he implicitly simulated all possible such systems, in just a few steps? Or is there, just one history because it would be economical ?

2.4 Reason 3

Commutation (or order of operations) make a lot of sense with discrete systems since the eventual answer will depend on the order, in which the operations are performed, if roundoff errors are part of that system.

2.5 Reason 4

When a particle is detected, it is just detected only and only once on the screen. The probabilistic nature of particles arises, if there are conditions, were are not aware of. Standard probability theory as a whole is a mechanism for accounting for unknown conditions.

2.6 Reason 5

Wave nature of particles $\exp(\imath x)$ is a natural consequence of requiring differential operators to be hermitian, so that their eigenvalues are real. This is statement of pure mathematics, and thus would apply to any interpretation.

3 Proof

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