The meaning of ψ !

An Interpretation of Schrödinger's Equation

by

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Abstract: In our derivation of Planck's Law (showing that this Formula is an exact mathematical identity that describes the interaction of measurement) the 'accumulation of energy' locally at time *t* was a key variable. By starting with this as the primary variable and defining energy, momentum and force in terms of it we are able to mathematically derive such basic laws of Physics as Conservation of Energy and Momentum, and Newton's Second Law of Motion. Following the same approach we demonstrate in this short note how Schrödinger's Equation relates to this formulation. This leads to a physical meaning of the wave-function ψ and a plausible explanation of the double-slit experiment.

Introduction: Elsewhere we prove the following *mathematical equivalences*:

I) $E(t) = E_0 e^{\nu t}$ **if and only if** $E_0 = \dfrac{\eta\nu}{e^{\eta\nu/\kappa\mathcal{T}} - 1}$ **(1)**

II) $E(t)$ is integrable, **if and only if** $\lim\limits_{\tau\to 0}\dfrac{\eta\nu}{e^{\eta\nu/\kappa\mathcal{T}} - 1} = E_0$ **(2)**

where $\eta = \int_0^\tau E(t)dt$ and $\mathcal{T} = \left(\dfrac{1}{\kappa}\right)\dfrac{\eta}{\tau}$

These purely mathematical derivations compare remarkably well with

Planck's Law: $E_0 = \dfrac{h\nu}{e^{h\nu/kT} - 1}$ **(3)**

Planck's constant *h* can be seen to compare to the quantity η , the 'accumulation of *E'*, in these mathematical equivalences. If we make this quantity the primary variable, we can define energy, momentum and force in term of it, as follows (for simplicity, we will consider direction along the x-axis only):

Definitions: Given $\eta\left(\vec{\mathbf{x}},t\right)$ **and for fixed** $\left(\vec{\mathbf{x}}_0,t_0\right)$

Energy : $E = \dfrac{\partial\eta}{\partial t}$ **(4)**

Momentum: $p_x = \dfrac{\partial\eta}{\partial x}$ **(5)**

Force: $F_x = \dfrac{\partial^2\eta}{\partial x\partial t}$ **(6)**

From these definitions we are able to derive the Conservation of Energy and Momentum, Newton's Second Law of Motion, Planck's Law and the Quantization of Energy Hypothesis, $\Delta E = nh\nu$. In this brief note we will consider comparisons to Schrödinger's Equation and to the wave-function ψ .

Comparisons to Schrödinger's Equation: Starting with $\eta\left(\vec{\mathbf{x}},t\right)$, we have

Definition of Energy:

$$\frac{\partial\eta}{\partial t} = E \quad , \qquad \text{for } \textit{fixed } \left(\vec{\mathbf{x}}_{\mathbf{0}},t_0\right) \tag{7}$$

Schrödinger's Equation:

$$\frac{\partial\psi}{\partial t} = H\psi \quad , \qquad \text{for } \textit{any } \left(\vec{\mathbf{x}},t\right) \tag{8}$$

where H is the 'energy operator' and $\psi\left(\vec{\mathbf{x}},t\right)$ is the 'wave-function' or 'state-function'

Note: Since we are looking for comparisons as to the quantities that appear in these equations, we can disregard the constants $\hbar i$ that appear in the Schrödinger's Equation.

Comparing E and $H\psi$ in **(7)** and **(8)** above we see that both of these are energy. E is energy at a *fixed* $\left(\vec{\mathbf{x}}_{\mathbf{0}},t_0\right)$, while $H\psi$ is energy at *any* $\left(\vec{\mathbf{x}},t\right)$. Likewise, η compares with ψ. Clearly these two equations are similar and related. From the meaning we have for eq. **(7)** we can infer analogous meaning to the Schrödinger's Equation **(8)**. We conclude with the following interpretation of Schrödinger's Equation and of the wave-function ψ.

I) Schrödinger's equation *'defines the energy of a system locally'* at any point and time $\left(\vec{\mathbf{x}},t\right)$.

II) The wave-function $\psi\left(\vec{\mathbf{x}},t\right)$ is the *'accumulation of energy locally'* at any point and time $\left(\vec{\mathbf{x}},t\right)$.

Since the probability that an 'event' occurs depends on the 'energy needed' for that event to happen, these interpretations of the Schrödinger's Equation and of the wave-function are compatible with the 'probability distribution' interpretation of the wave-function. We have the 'accumulation of energy' (the wave-function) and the 'manifestation of energy' (the observation). And as is so true with everything else in our experience, before anything is manifested there is a hidden and unobservable accumulation of events leading up to a manifest occurrence.

These comparisons are meant only as preliminary results and seek to trigger thought and new insight. Much work will of course be needed to develop these further.

In another paper we show how, based on these ideas, the double-slit experiment can be explained.

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