

Proposing the 'IN Sign' for Enhanced Interpretations of Schrödinger's Equation in Quantum Mechanics

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Abstract: This study proposes an addition to Schrödinger's equation by introducing the 'IN sign,' enabling the energy operator and wave function to interact dynamically and swap roles. This modification allows the energy operator to act within a field of waves and incorporates additional quantum states. The 'IN sign' is a step toward understanding wave function evolution across multiple variables, offering potential applications in quantum mechanics and topological studies. **Purpose:** This research aims to enhance Schrödinger's equation by integrating the 'IN sign,' allowing dynamic interaction between the energy operator and the wave function while extending its application to complex potentials and topological frameworks. **Significance:** The proposed modification has profound implications in quantum mechanics, enabling more comprehensive modeling of wave functions and their interactions across multidimensional systems.

Keywords: Quantum mechanics, Schrödinger equation, wave function, energy operator, topological manifolds.

1. Methodology

Max Planck quantized energies in multiples of $\hbar\omega$ then Einstein said the energy of a photon is $\hbar\omega$ and the momentum of the photon is $\hbar\vec{k}$. So $(E, \vec{p}) = \hbar(\omega, \vec{k})$. Then came De Broglie with the idea that even though this principle applied to photons, it was valid for particles as well, all particles and these particles are waves $\Psi(x, t) = e^{i(kx - \omega t)}$ Since k is positive, this is a wave moving to the right.

The operator that realizes the momentum would be $\hat{P} = \frac{\hbar}{i} \frac{\partial}{\partial x}$

The operator that realizes the energy would be $\hat{E} = i\hbar \frac{\partial}{\partial t}$

When the energy operator operates on the wave function $i\hbar \frac{\partial}{\partial t} \psi = \hbar\omega\psi$

$$i\hbar \frac{\partial}{\partial t} \psi(x, t) = E\psi(x, t)$$

This equation prescribes how a wave function of energy E evolves in time. It tells you if you know the wave function and it has energy E , the left side of the equation is how it looks later, and you can take the derivative on the left side of the equation and solve this differential equation. In this equation, E is a number. If you know you have a particle with energy E , that is how it evolves in time.

So came Schrodinger and looked at this equation, which is true for any particle that has energy E . Maybe I do not know what the energy E is. One single replacement was introduced to this equation, replacing the energy E with the energy operator \hat{E} . Schrodinger's equation does not assume that the energy is a number because you do not know it. In general, if the particle is moving in a complicated potential, you do not know what the possible energies are.

$$i\hbar \frac{\partial}{\partial t} \psi(x, t) = \hat{E}\psi(x, t)$$

This is symbolically what must be happening because if this particle has a definite energy, then the energy operator \hat{E} gives you the energy acting on the function.

- What if the particle (basically wave or, in other words, collapsed wave function) that the energy operator is operating on does not have a definite energy?
- What if the energy operator is operating on a complicated potential or, in other words, a field of waves, which is fundamentally how energy operates? It operates on a field of waves rather than a single wave.
- The energy operator requires the freedom to act on the operatee's multiple quantum states. Both the operator and the operatee can affect each other, so this requires the freedom to swap roles.
- Additionally, it would be required to include other operations being acted upon by the energy operator, not just position and time.

Introducing the "IN" sign

We need to do one single step, adding a sign that defines and enables this operation:

The "IN" sign, to describe it I will use this notation: ✖

$$i\hbar \frac{\partial}{\partial t} \psi(x, t) = \hat{E} \text{ ✖ } \psi(x, t)$$

- Here the equation is prescribing that the energy operator is acting "IN" a wave function, which is the operatee in this case, and the wave function, possibly a field of waves, lacks definite energy.
- This equation also prescribes that the energy operator and the wave operatee affect each other and can swap roles.
- So far, we are trying to understand how the wave function evolves in time. What if we want to understand how the wave function evolves relative to other factors, shape, for example? This shape could be itself evolving in time and could be time-independent; these are pre-defined conditions that we should define before carrying out the operation which will take us to our next concept, "Energy in shape = A wave function."

Energy in shape = A wave function.

This concept examines the energy as an operator on or rather "IN" shape. The energy will be the operator acting "in" shape, which is the operatee. However, they can swap roles. The "IN product" would be a wave function that could be defined in terms of position and time or any other parameters.

$$\hat{E} \mathcal{K} \hat{S} = f\hat{\Psi}(x, t)$$

This equation is how it potentially looks like. Where \hat{E} is the energy operator, \hat{S} is the shape operator and $f\hat{\Psi}(x, t)$ is the resulting wave function. This proposed equation prescribes that energy in shape gives a wave function. Which could be applied in principle to almost everything. However, more specific information would be required to solve more specific problems.

The concept of the shape as an operatee or even an operator in this proposed equation goes beyond the conventional shapes to topological spaces construction, construction of new topologies from given topologies, topological manifolds, and bundles, etc., which is a big area that could be explored. The idea is that shape/space acts as a container for energy. Energy can operate on the shape and change it, and vice versa shape can operate on energy and change it is frequencies. The shape's concept goes even further to the idea of the pattern.

The resulting wave function or “IN product” should be considered an operator. In this proposed equation, we have the freedom to swap the “IN product,” the operator, and the operatee. In other words, the energy operator could act on the wave function to give a specific shape or topological manifold, etc. In that case; the equation would be:

$$\hat{E} \mathcal{K} f\hat{\Psi}(x, t) = \hat{S}$$

Swapping the roles of the operator, operatee, and the “IN product” is a fundamental principle that could be useful in many conditions and various states.

This idea is not too exotic from superstring theory. T-duality is interchanging W (the winding number) and n (the momentum). In my proposed equation $\hat{E} \mathcal{K} \hat{S} = f\hat{\Psi}(x, t)$, the energy operator \hat{E} is comparable to momentum and the wave function is comparable to the winding number.

Can the shape of a drumhead be predicted from the sound that it makes, in other words, from the spectrum of vibrations? You can predict a lot of the shape of the drumhead. The same question applies to compactifications in string theory. From the spectrum of particles, in other words, the spectrum of vibrational energies, can you predict the shape and the size of the compact directions? The answer is yes to a large extent.

The question here goes beyond whether we can predict the drumhead's shape from the sound it makes. The question is whether the spectrum of vibration can form the drumhead's shape. And whether both the shape and the vibrational energies can form certain functions or rather certain wave functions. How would that wave function evolve in time? And how would it affect and get affected by the surrounding ecosystem?

If we understand what could be referred to as the spectrum of vibrational energies of a specific situation, somehow manage it & “tune it” to get specific results, we would be achieving one of the main goals of this approach. But how can we sort of “decode” this spectrum of vibrational energies? Do we need frequency modulation?

Back to the idea that the shape in $\hat{E} \mathcal{K} \hat{S} = f\hat{\Psi}(x, t)$ could go further to the idea of the pattern, where the movement or rather the fluctuations of energy or complicated potential of energy in a particular pattern creates a specific function or a wave function, it could as well written as follows :

$$\hat{E} \mathcal{K} \hat{P}\hat{A} = f\hat{\Psi}(x, t)$$

Where $\hat{P}\hat{A}$ refers to the pattern in which the energy operator moves; following the same logic, the operator can affect the operatee and vice versa.

Similarly, the freedom to swap the “IN product,” the operator, and the operatee. In other words, the energy operator could act on the wave function to give a certain pattern; in that case, the equation would be:

$$\hat{E} \mathcal{K} f\hat{\Psi}(x, t) = \hat{P}\hat{A}$$

An example of the geometrical pattern is what we can consider as the energy pattern in which the atoms are arranged in a molecule. This pattern is giving the molecule its function. The atom is formed of a specific pattern of electrons and more fundamental “particles,” the change in this pattern due to a change in energy can change the function and lead to a different molecule. Let's go back to the idea that a particle could be considered a collapsed wave function. Could the collapse of the wave function target a specific pattern to stabilize and carry out the targeted function?

Back to $\hat{E} \mathcal{K} \hat{P}\hat{A} = f\hat{\Psi}(x, t)$. Even the energy operator in this equation might not affect & could be considered negligible in some situations. This means that only the pattern can lead to a specific function. This is analogous to the atom & molecule story. When atoms are joined in specific geometrical patterns, we get a particular substance's molecule. If the same types of atoms are joined in a different geometrical configuration or pattern, we get different kinds of molecules of other substances. In this case, the energy of the atoms played no role and the specific function/substance was formed just based on the geometrical pattern or configurations. In other words, the pattern led to a certain function, which could be expressed as $\hat{P}\hat{A} = f\hat{\Psi}(x, t)$.

The effect of the patterns on the resulting molecule could be directly measured and understood as we can study which pattern of atoms leads to which molecules and hence which types of substance; accordingly, we can understand which patterns lead to which sort of “functions.” Studying the effect of patterns is pretty much what we are attempting to do with emotions. The analogy goes that if we manage to understand which patterns of emotions lead to which functions or effects, this will get us one giant step closer to effectively quantizing emotions.

Every electron's location and energy in an atom are determined by a set of four quantum numbers that describe different atomic orbitals. An orbital is a region of probability where an electron can be found. These four quantum numbers are:

- “n” is the principal quantum number telling us the energy level.

- “ ℓ ” is the azimuthal quantum number that tells us the orbital type and angular momentum.
- “ m_ℓ ” is the magnetic quantum number, which tells us which specific orbital amongst the set and the projection of the angular momentum.
- “ m_s ” is the spin quantum number that tells us the spin. Each electron in an atom has a unique set of quantum numbers. The quantum numbers describe the pattern and the effect of this pattern.

A small thought experiment considering two energy systems, for example, observer and observed energy system, are in resonance, exchange of information happens. Afterward, both will not return to their original state. They both keep part of the information, which causes change to both energy systems and in a sense, they stay connected or entangled. This kind of entanglement is pretty much comparable to the act of measurement on a quantum system, where quantum entanglement happens with the measuring tool.

2. Conclusion

The 'IN sign' introduces a transformative approach to Schrödinger's equation, allowing dynamic interactions and role-swapping between the energy operator and the wave function. This development extends its applicability to complex quantum states and multidimensional systems, opening avenues for advanced theoretical exploration.

After adding the “IN Sign” to Shrodinegr’s equation it will look like this:

$$i\hbar \frac{\partial}{\partial t} \psi(x, t) = \hat{E} \times \psi(x, t)$$

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