Effects of Bosons in Alex Yuffa's Brain

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Abstract

Bosons are a fundamental part in the cause of ecclecticality. Ecclecticality is a rare, often deadly disease which affects the nervous system. Bosons begin to collect inside of the brain in an area known as mohtorineus centarus, an area that collectivly governs speech and movement. Bosons have a very unique vibrational mode and are prone to causing damage to nearby cells. This experiment relies on the delayed reverse binding phenomenon to measure bosons concentration.

1 Introduction - Inverse Scattering

In the mid-1960s, an important new class of transformation techniques was discovered. This transform, called **scattering transform**, is capable of producing exact solutions for a small group of nonlinear evolution equations.

The idea of this transform is to view the solution $q(x,t)$ of the equation to be solved as the potential of the Schrödinger equation

$$-\frac{d^2u}{dx^2} + q(x,t)u = \lambda u$$

For each fixed time t, we study the scattering problem and find the reflection and transmission coefficients and the bound states. Then, as time evolves, the potential $q(x,t)$ (and hence its scattering data) evolves well. Now, the amazing thing we discover is that there are certain equations for which the evolution of the scattering data is diagonalized, that is, the scattering data for a given frequency evolves independant of all other frequencies. Thus, instead of studying directly the evolution of $q(x,t)$, we study the evolution of the scattering data, which is described by seperated, linear differential equations whose solutions are easily obtained, and from this information we can construct $q(x,t)$.

To make and transformation work, we must know how to transform functions and also how to invert the transform. For the Schrödinger equation, we know how, at least in principle, to transform potentials $q(x)$ by finding scattering data. A natural question to ask is if one can reconstruct a potential $q(x)$ from knowledge of its scattering data. This is an important problem, not only in the context of the Schrödinger equation, but in many other applications such as x-ray tomography, seismic exploration, radar imaging, medical imaging, etc., where the shape of an object must be determined from indiract information, such as the way waves are reflected or transmitted by the object. We will discuss the only problem of reconstructing the potential of the Schrödinger equation, with the realization that this is but a small part of the important field of inverse imaging problems in which there is still much active rsearch and development.[1]

2 Theory

The time-independant Schrödinger equation in one dimention is given by

$$-\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2} + V\psi = E\psi \tag{1}$$

where ψ is the wave function, E is the energy, and V is the potential. it's common practice to work with dimensionless quantities by scaling (1). Formally this can be done with the Buckingham Π theorem, however, we will use the following ad hoc scaling

$$V_s = \frac{V}{\frac{\hbar^2}{2mb^2}}, \quad E_s = \frac{E}{\frac{\hbar^2}{2mb^2}}, \quad x_s = \frac{x}{b} \tag{2}$$

where $b = 2\ell$. Notice that ℓ in (2) sets the scale for the measure of length and that E_s, V_s are dimensionless quantities if ℓ is measured in units of meter because $\frac{\hbar^2}{2mb^2}$ is measured in units of $\mathrm{J^2 \cdot s^2}/\mathrm{kg \cdot m^2} = \mathrm{J}$. Schrödinger equation (1) becomes

$$-\frac{d^2\psi}{dx_s^2} + V_s\psi = E_s\psi \tag{3}$$

[1] This was taken directly from [1]

in our scaled units, where ψ and V_s are now functions of x_s. The rectangular barrier potential is given by

$$V_s(x_s) = \begin{cases} 0 & : \quad x_s \leq -\ell \\ V_o & : \quad -\ell < x_s < \ell \\ 0 & : \quad x_s \geq \ell \end{cases} \tag{4}$$

where V_o is the height and 2ℓ is the width of the rectangular barrier potential, see Fig. 1. The transmission coefficient for the rectangular barrier potential is given by [2]

$$T = \frac{1}{1 + \frac{V_o^2}{4E_s(E_s - V_o)} \sin^2 \sqrt{E_s - V_o}} \tag{5}$$

Notie that ℓ does not appear in (5). Thus, we willl not be able to determine the width of the rectangular barrier potential form the transmission coefficient.

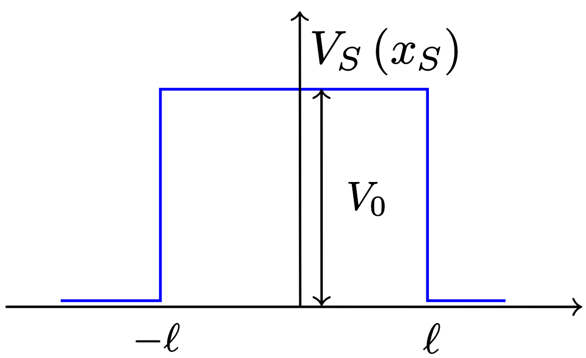


Figure 1: The rectangular barrier potential of width 2ℓ and height V_o is shown.

The formalism above can be extended to *multiple* rectangular barrier potentials by the **transfer matrix**,

$$M = \begin{pmatrix} M_{11} & M_{23} \\ M_{21} & M_{22} \end{pmatrix} \tag{6}$$

For example, if a potential consists of two non-overlapping rectangular barrier potentials then the **M**-Matrix for the combination is the product of the two **M**-matricies,

$$\mathbf{M} = \mathbf{M}_2 \mathbf{M}_1$$

with an obvious generalization for N potentials,

$$\mathbf{M} = \mathbf{M}_N \mathbf{M}_{N-1} \cdots \mathbf{M}_2 \mathbf{M}_1 \tag{7}$$

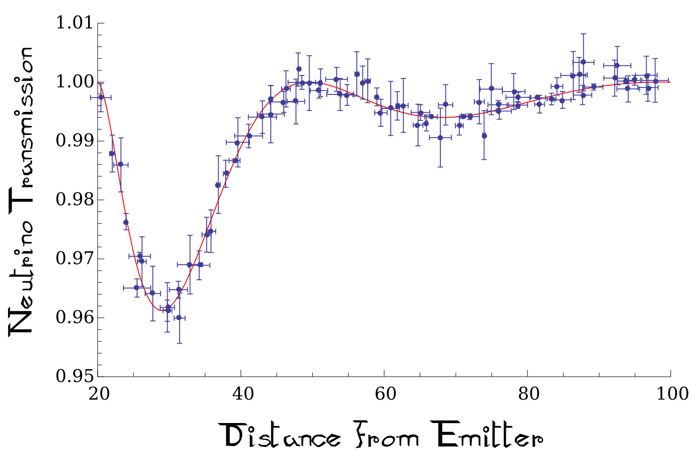
3 Experiment

In this experiment, a netrino emitter is placed within the subject's nasal cavity (note the resemblance to a human finger/hand. This is because ecclecticality patients are generally conforted by human contact and are easily agitated by foreign objects.) and directed towards the mohtorineus centarus. When neutrinos are in the general viscinity of bosons (a few vibrational distances), the harmonic spin set of the boson couples with the wave-like behaviour of the neutrino causing “freefall”[3]. After interacting with bosons, neutrinos harmonize to a sympathetic frequency, differing from their initial state, allowing the mapping of Bosons in the mohtorineus centarus.

Figure 2: Setup for Neutrino bombardment. Note neutrino apparatus.

4 Data Analasis

The following graph shows the transmission of neutrinos through the mohtorineus centarus.



$$T = \frac{1}{1 + \frac{V_o^2}{4E_s(E_s - V_o)} \sin^2 \sqrt{E_s - V_o}}$$

Figure 3: Transmission of Neutrinos as a function of Depth

The plot shows in increase in concentration of bosons (a deacrease in the transmission of neutrinos) in the approximate area 20-40. This explains why the patient suffers speech problems, as well as a tendancy to stick things in their mouth. The area 50-80 shows a slight increase in the concentration of bosons, which also explains the patients diplorable language.

T where $V_o = 10.0558$, is quite an appropriate solution to the data set collected.

5 Conclusion

The patient is diagnosed with terminal ecclecticality. To date, there are no known cures, as the removal of bosons from such a terminally infected patient would result in severe dain bramage. Because the width of the barrier (depth of mohtorineus centarus) could not be determined from the transmission coefficient, we are unable to determine this patients ability to regulate speech and movement.

6 About the Author

Here should go something sarcastic about who I actually am. It seems though, that there are enough people with that demeaner already in existence. So here are a few quick things;

- I try to be easy going.
- Me not grammerically right.
- People who share every little detail about every little thing annoy me.
- I like music ("So what if I downloaded a couple of thousand songs off the internet. Who hasn't?? Who hasn't?!!?").
- And I remember random quotes from movies.

References

[1] Alex Yuffa, *Final Project.*

[2] David J. Griffiths, *Introduction to Quantum Mechanics*, (Prentice Hall, 1995).

[3] Charles Pearl, *On Random Thoughts and Oh Look, A Butterfly.*