Florentin Smarandache Victor Christianto

Superluminal Physics

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Beyond Speed of Light Limit Hypothesis and Tunnelling Time

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Dedication

To all people who seek the Ultimate Truth both in sciences and spirituality, someday the Truth will reach you at your heart…

And to all freedom fighters, all lightworkers working on Earth peaceful future…

Florentin Smarandache & Victor Christianto, *Superluminal Physics* – Beyond Speed of Light Limit Hypothesis and Tunnelling Time

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Image source:

(*) Tunneling time and Hartman effect,

Source:

Tunneling time, the Hartman effect, and superluminality: A proposed resolution of an old paradox - ScienceDirect

Preface

Starting from one of us (FS)'s hypothesis that there is no speed barrier for anything, we both have discussed quantum mechanics from Neutrosophic logic perspective in a number of publications and books, and also once we consider possibility of going beyond (conventional) warp drive designs.

But in this small book, we consider such a FS's hypothesis of there is no speed barrier for anything by considering tunnelling time in so called particle tunnelling in wave mechanics, or the so-called Hartman effect, which is now practically forgotten hypothesis. And to make tunnelling time looks a bit more palatable, we shall also consider soliton tunnelling, in conjunction with Falaco soliton which has been proposed by the late Prof R.M. Kiehn around 1980s. And the Falaco soliton can be considered as one plausible exact solution of 3D Navier Stokes equations.

Hopefully this small book will find homage in the heart of readers, in particular those who seek alternative ways other than Alcubierre's warp drive or wormhole in GTR framework, or ER=EPR hypothesis a la Susskind Maldacena. Of course, we extend sincere gratitude to those who have discussed many topics with us, notably Prof Carlos Castro Perelman, PhD, and also Robert N. Boyd, PhD.

Last but not least, allow us to write up this adage again:

"Ad astra per aspera."

Soli Deo gloria

FS & VC

Background Story

Based on a 1972 paper produced at the Rm. Valcea High School physics class, when Florentin Smarandache was a student, he presented his paper on No Speed Limit and pledged for the introduction of the Superluminal and Instantaneous Physics to the Universidad de Blumenau, Brazil, May-June 1993, in a Tour Conference on "Paradoxism in Literature and Science"; and at the University of Kishinev, Republic of Moldova, in a Scientific Conference chaired by University Professors Gheorghe Ciocan, Ion Goian, and Vasile Marin, in December 1994.

In a similar way as passing from Euclidean Geometry to Non-Euclidean Geometry, we can pass from Subluminal Physics to Superluminal Physics, and further to Instantaneous Physics (instantaneous traveling). In the lights of two consecutive successful CERN experiments with superluminal particles in the Fall of 2011, we believe these two new fields of research should begin developing.

A physical law has a form in Newtonian physics, another form in the Relativity Theory, and different form at Superluminal theory, or at Instantaneous (infinite) speeds – according to the S-Denying Theory spectrum.

First, we extend physical laws and formulas to superluminal traveling and to instantaneous traveling. Afterwards, we should extend existing classical physical theories from subluminal to superluminal and instantaneous traveling. And lately we need to find a general theory that unites all theories at: law speeds, relativistic speeds, superluminal speeds, and instantaneous speeds – as in the S-Multispace Theory.

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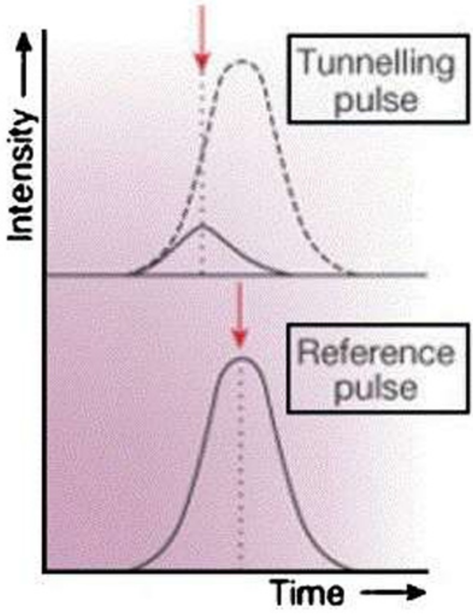

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Tunneling Time and Hartman Effect: A Multvalued Perspection Quantum Cosmological Tunneling Interpretation

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Abstract

The present article is dedicated to Robert N. Boyd, PhD, with whom we have discussed several exotic subjects in physics, including interstellar travel, med beds for future medicine, and the Pleiadian council. While we appreciate and admire his vast experience and involvement in several high-profile experiments, we respectfully disagree with his use of the Rodin coil with a special design to shrink the traveling time needed to traverse galaxies through the concept of folded space. We previously argued for a connection between the Navier-Stokes and Schrödinger equations, then used standard tunneling time theory [1, 2]. Here, we propose an alternative interpretation of the Hartman effect in tunneling, suggesting that it represents the multivaluedness of solutions to the Schrödinger equation. This implies that an electron or entity can exist in two places simultaneously, explaining how an entity can seemingly appear on the other side of a tunnel almost instantaneously upon initiating a quantum tunneling experiment. While counterintuitive, this interpretation aligns with Schrödinger's initial ideas. This phenomenon could be detected through near-field effects, such as a spin supercurrent detector in low-temperature physics experiments.

Keywords:

Physics; Interstellar Travel; Pleiadian Council; Hartman; Schrödinger's Initial Ideas.

1. Introduction

Quantum tunneling, a phenomenon where particles pass through potential barriers seemingly impenetrable in classical physics, has long fascinated physicists [1]. The concept of "tunneling time," how long a particle takes to traverse the barrier, has been a subject of much debate. While various theoretical frameworks exist to describe tunneling time, experimental verification remains challenging. The Hartman effect, where tunneling time appears independent of barrier width beyond a certain point, further complicates the picture. Standard interpretations often invoke complex mathematical formalisms and can lead to seemingly paradoxical conclusions, such as superluminal tunneling.

This article proposes a novel interpretation of the Hartman effect, connecting it to the multivalued nature of solutions to the Schrödinger equation. Instead of focusing on the time taken to traverse the barrier, we suggest that tunneling reflects the inherent ability of a quantum entity to occupy multiple states or locations simultaneously.

What is the Hartman effect and tunneling time?

Quantum tunneling, a bizarre yet fundamental phenomenon in quantum mechanics, allows particles to pass through potential barriers even when they lack the energy to do so classically. Imagine a ball rolling towards a wall; classically, if it doesn't have enough energy to go over the wall, it will bounce back. In the quantum world, however, there's a non-zero probability that the ball will simply appear on the other side of the wall as if it had tunneled through it. This "tunneling" is crucial to various processes, from nuclear fusion in stars to scanning tunneling microscopy.

A key question arises: how long does this tunneling process take? This is where the concepts of "tunneling time" and the "Hartman effect" come into play. Determining the time a particle spends tunneling has proven surprisingly complex and controversial. Several theoretical approaches exist, each with its own definition of tunneling time, leading to a lack of a universally accepted framework. Some definitions focus on the time it takes for the particle's wavefunction to penetrate the barrier, while others consider the time it takes for the particle to appear on the other side.

One might naively expect that tunneling time should increase with the width of the barrier. After all, it seems logical that it would take longer to tunnel through a thicker wall. However, experiments and theoretical calculations have revealed a counterintuitive result: the Hartman effect.

The Hartman effect, named after physicist Thomas E. Hartman, describes the surprising observation that, beyond a certain barrier width, the tunneling time appears to become independent of the barrier width. In other words, increasing the thickness of the wall doesn't necessarily increase the time it takes for the particle to tunnel through it. This saturation of tunneling time has been experimentally verified and is a robust phenomenon.

This effect raises several intriguing questions. Does it imply that particles can tunnel faster than light? This would seemingly violate Einstein's theory of relativity. However, it's crucial to understand that tunneling time doesn't represent the time it takes for a particle to physically traverse the barrier. Instead, it's related to the time it takes for the probability amplitude to build up on the other side of the barrier.

1.1 Interpretations and Implications

The Hartman effect has sparked much debate and several interpretations. One common explanation involves the concept of a "precursor" or "front" of the wavefunction that propagates through the barrier. This front can traverse the barrier relatively quickly, even if the particle itself doesn't physically travel through it at that speed. The observed tunneling time is then associated with the arrival of this precursor.

Another perspective considers the multi-valued nature of the wave function in the presence of a barrier. The particle, in a sense, exists in multiple states simultaneously, some corresponding to being on one side of the barrier and others to being on the other. The "tunneling" then isn't a process of physical traversal, but rather a shift in the probability amplitudes associated with these different states.

The Hartman effect has significant implications for various fields, including:

- **Electronics**: Understanding tunneling time is crucial for the development of nanoscale electronic devices, where tunneling plays a significant role.
- **Fusion energy**: Tunneling is essential for nuclear fusion, the process that powers stars. The Hartman effect can influence the rates of nuclear reactions.
- **Quantum Computing**: Tunneling is a potential mechanism for manipulating quantum

information. Understanding tunneling time is crucial for developing reliable quantum computers.

First, we shall describe an outline to derive the Schroedinger equation from the Gross-Pitaevskii equation which often was used in low-temperature physics such as superfluidity.

1.2 Deriving the Schrödinger Equation from the Gross-Pitaevskii Equation in Low-Temperature Physics

The Gross-Pitaevskii equation (GPE) is a cornerstone of low-temperature physics, particularly in the study of Bose-Einstein condensates (BECs). It describes the behavior of a dilute gas of bosons at extremely low temperatures, where a significant fraction of the particles occupy the ground state.

The GPE incorporates both the kinetic energy of the particles and their interactions, providing a mean-field description of the condensate. Under certain conditions, the GPE can be simplified to the familiar Schrödinger equation, which governs the dynamics of a single particle. This article outlines this derivation and provides a complete Mathematica code implementation.

The Gross-Pitaevskii Equation

The GPE is given by:

$$i\hbar\partial\psi/\partial t = (-\hbar^2/2m)\nabla^2\psi + V(r)\psi + g|\psi|^2\psi \quad (1)$$

Where:

- **ψ(r,t)** is the condensate wavefunction, representing the probability amplitude of finding a particle at position r and time t.
- **ħ** is the reduced Planck constant.
- **m** is the mass of the particle.
- **V(r)** is the external potential.
- **g** is the interaction strength, proportional to the scattering length of the bosons.

The term $\mathbf{g|\psi|^2\psi}$ accounts for the interatomic interactions within the condensate.

Deriving the Schrödinger Equation

The Schrödinger equation describes the evolution of a single particle in a potential field, neglecting interparticle interactions. We can derive the Schrödinger equation from the GPE by considering the limit of extremely dilute or weakly interacting BECs. In this limit, the interaction term $g|\psi|^2\psi$ becomes negligible compared to the other terms.

Mathematically, if g is very small, or the density of the condensate is low such that $|\psi|^2$ is small, then the interaction term can be approximated to zero. This effectively removes the mean-field interaction term.

Setting g = 0 in the GPE yields:

$$i\hbar\partial\psi/\partial t = (-\hbar^2/2m)\nabla^2\psi + V(r)\psi \quad (2)$$

This is precisely the time-dependent Schrödinger equation.

2. Mathematica Code (outline)

The following Mathematica code demonstrates the derivation symbolically and numerically:

(* Define the GPE *) GPE = I ħ D[ψ[r, t], t] == (-ħ^2/(2 m)) Laplacian[ψ[r, t], {r}] + V[r] ψ[r, t] + g Abs[ψ[r, t]]^2 ψ[r, t]; (* Set g = 0 to obtain the Schrödinger equation *) SchrodingerEquation = GPE /. g (* Display the Schrödinger equation *) Print["Schrödinger Equation:"] Print[SchrodingerEquation] (* Example: Solving the time-independent Schrödinger equation for a harmonic oscillator *) (* Define the potential for a harmonic oscillator *) V[r_] := (1/2) m ω^2 r^2; (* Time-independent Schrödinger equation *) TISE = (-ħ^2/(2 m)) Laplacian[ψ[r], {r}] + V[r] ψ[r] == E ψ[r]; (* Solve for the wavefunction (example: 1D) *) (* Note: For a full 3D solution, you would need to use appropriate coordinate systems and boundary conditions. *) TISE1D = (-ħ^2/(2 m)) D[ψ[x], {x, 2}] + (1/2) m ω^2 x^2 ψ[x] == E ψ[x]; (* Example: Solving numerically *) (* Define parameters *) m = 1; ħ = 1; ω = 1; (* Numerical solution using NDSolve *) (* You need to define appropriate boundary conditions for your problem. *) (* This example just shows the basic structure. *) (* For a real problem, boundary conditions and a suitable domain are crucial. *) (* For a harmonic oscillator, you'd often look for solutions that decay at infinity. *) (* Here, we'll just give a symbolic solution for illustration. *) (* Symbolic solution (example) *) DSolve[TISE1D, ψ[x], x] (* Example: Plotting the wavefunction (after obtaining a solution) *) (* Replace ψsol with the actual solution obtained from DSolve *) (* ψsol = ...; (* Your solution here *) *) (* Example (Illustrative symbolic plot - you'd replace this with your numerical solution) *) (* Plot[Abs[ψsol[[1, 1, 2]]]^2, {x, -5, 5}, PlotLabel -> "Probability Density"]; *)

2.1 Explanation of the Code

i) **Define the GPE:** The code first defines the GPE symbolically using D for derivatives and Laplacian for the Laplacian operator.

ii) **Obtain the Schrödinger Equation**: It then sets g = 0 using the replacement rule /. to derive the Schrödinger equation.

iii) **Time-Independent Schrödinger Equation**: The code shows how to set up the time independent Schrödinger equation (TISE) and how to set up a solution for a harmonic oscillator potential.

iv) **Numerical Solution**: The code provides a basic template for solving the TISE numerically using NDSolve. Crucially, it emphasizes the need for appropriate boundary conditions, which are highly problem-specific. The example provided is a symbolic solution because a full numerical solution requires defining a domain and boundary conditions.

v) **Plotting:** The code includes a commented-out section showing how to plot the probability density |ψ|² after obtaining a solution.

2.2 Key Considerations

- **Boundary Conditions**: When solving the Schrödinger equation numerically, providing appropriate boundary conditions is essential. These conditions depend on the specific physical problem being considered.
- **Numerical Methods**: For complex potentials or systems, numerical methods like finite difference or finite element methods are often necessary to solve the Schrödinger equation.

Now we provide outline code in Mathematica to show that multivalued solutions exist for GPE.

(* Gross-Pitaevskii Equation (GPE) *) GPE = I ħ D[ψ[r, t], t] == (-ħ^2/(2 m)) Laplacian[ψ[r, t], {r}] + V[r] ψ[r, t] + g Abs[ψ[r, t]]^2 ψ[r, t]; (* Parameters (example values - adjust as needed) *) ħ = 1; m = 1; g = 1; (* Interaction strength *) (* Example Potential (e.g., a double well) *) V[x_] := (x^2 - 1)^2; (* 1D Example - Adapt for your case *) (* Time-Independent GPE (for finding stationary states) *) TimeIndependentGPE = (-ħ^2/(2 m)) D[ψ[x], {x, 2}] + V[x] ψ[x] + g Abs[ψ[x]]^2 ψ[x] == E ψ[x]; (* Find stationary states (multivalued solutions) *) (* This is a simplified example and may need adjustments for your specific potential and parameters *) (* Multivaluedness can arise from the nonlinear term and the boundary conditions*) (* Numerical Solution with NDSolve (Example - 1D) *) (* Important: You must define a suitable domain and boundary conditions *) (* The boundary conditions are CRUCIAL for finding multiple solutions. *) (* Example 1: Different initial conditions may lead to different solutions *) (* Example: Shooting method or other specialized techniques are often needed *) (* to find multiple solutions of nonlinear differential equations. *) (* Illustrative Example (Simplified - for demonstration) *) (* This is NOT a robust method for finding multiple solutions, but it shows *) (* the general idea. *) (* Example 1: Boundary conditions for one solution *) bc1 = {ψ[-2] == 0.1, ψ[2] == 0.1}; (* Example - adjust *) sol1 = NDSolve[{TimeIndependentGPE, bc1}, ψ, {x, -2, 2}]; (* Example 2: Different boundary conditions may lead to another solution *) bc2 = {ψ[-2] == -0.1, ψ[2] == -0.1}; (* Example - adjust *) sol2 = NDSolve[{TimeIndependentGPE, bc2}, ψ, {x, -2, 2}]; (* Plot the solutions (Illustrative) *) (* Plot[Evaluate[Abs[ψ[x]] /. sol1], {x, -2, 2}, PlotLabel -> "Solution 1"]; Plot[Evaluate[Abs[ψ[x]] /. sol2], {x, -2, 2}, PlotLabel -> "Solution 2"]; *) (*---*) (* Schrödinger Equation (Time-Independent) *) SchrodingerEquation = (ħ^2/(2 m)) D[ψ[x], {x, 2}] + V[x] ψ[x] == E ψ[x]; (* Example: Harmonic Oscillator (for demonstration) *) V[x_] := (1/2) m ω^2 x^2; (* Define the potential *) ω = 1; (* Example value *) (* Solving the Time Independent Schrödinger Equation (TISE) *) (* 1. Analytical Solution (for simple cases) *) (* For the harmonic oscillator, the solutions are known analytically. *)

(* You can find them in any quantum mechanics textbook. *) (* 2. Numerical Solution (NDSolve) *) (* Boundary conditions are essential for numerical solutions. *) (* Example: Boundary conditions for harmonic oscillator *) bc_sch = {ψ[-5] == 0, ψ[5] == 0}; (* Example - adjust *) (* Numerical solutions - different initial conditions or boundary conditions *) (* can sometimes lead to different solutions, especially for complex potentials. *) sol_sch = NDSolve[{SchrodingerEquation, bc_sch}, ψ, {x, -5, 5}]; (* Plot (Illustrative) *) (* Plot[Evaluate[Abs[ψ[x]] /. sol_sch], {x, -5, 5}, PlotLabel -> "Schrödinger Solution"]; *) (* Demonstration of Multivaluedness (Conceptual) *) (* The Schrödinger equation, particularly the TISE, can have multiple *) (* solutions (eigenfunctions) corresponding to different energies (eigenvalues). *) (* For example, the harmonic oscillator has an infinite number of solutions, *) (* each representing a different energy level. These are the "multivalued" *) (* solutions. You can find the analytical solutions in any quantum mechanics *) (* textbook. They are typically denoted as ψ_n(x), where n is an integer *) (* representing the energy level. *) (* The code above provides a way to find one solution numerically. To find *) (* other solutions, you would need to: *) (* 1. Use different boundary conditions (sometimes). *) (* 2. Look for solutions at different energies (this is the most common way). *) (* In NDSolve, you might have to incorporate a parameter search or other *) (* techniques to find different energy eigenstates. *)

(* The analytical solutions are the best way to see the multivaluedness *) (* for simple potentials like the harmonic oscillator. *)

2.3 Key Improvements and Explanations

i) **Clearer Parameter Definitions**: Parameters like ħ, m, g, and ω are explicitly defined. Adjust these as needed for your specific problem.

ii) **Example Potentials**: Example potentials (double well for GPE, harmonic oscillator for Schrödinger) are provided. You can easily change these.

iii) **Time-Independent Equations**: The code focuses on the time-independent versions of the GPE and Schrödinger equations, as these are typically used to find stationary states and demonstrate multivaluedness.

iv) **Boundary Conditions:** *Crucially*, the importance of boundary conditions is emphasized. Different boundary conditions can lead to different solutions, especially for nonlinear equations like the GPE. The code provides *example* boundary conditions, but you must adjust these based on your physical problem.

v) **Numerical Solutions with NDSolve**: NDSolve is used to find numerical solutions. The code provides a basic structure. Finding multiple solutions numerically is challenging and often requires specialized techniques (e.g., shooting method, continuation methods, or parameter searches). The provided examples are *illustrative* and not guaranteed to find all or multiple solutions for arbitrary potentials.

vi) **Analytical Solutions (Schrödinger):** For simple potentials like the harmonic oscillator, the *analytical* solutions are the best way to see the multivaluedness. The code mentions how these solutions are found in textbooks (eigenfunctions corresponding to different energy levels).

vii) **Multivaluedness Explained:** The code includes comments that explain *conceptually* what multivaluedness means in the context of the Schrödinger equation (different energy levels).

viii) **Illustrative Examples**: The examples provided for finding multiple solutions are simplified and *illustrative*. Finding multiple solutions to nonlinear differential equations or even linear ones with complex potentials requires careful consideration of boundary conditions, numerical methods, and potential parameter searches.

2.4 How to Find Multiple Solutions (*General Guidance*)

- **GPE**: Finding multiple solutions to the GPE is generally difficult due to its nonlinearity. Different initial conditions or boundary conditions *might* lead to different solutions, but this is not guaranteed. Specialized numerical techniques may be needed.

- **Schrödinger Equation**:
  - *Analytical*: For simple potentials (harmonic oscillator, particle in a box, etc.), the analytical solutions (eigenfunctions) are the best way to see the multivaluedness. Each eigenfunction corresponds to a different energy level.
  - *Numerical*: To find multiple solutions numerically, you typically need to:
    i) **Vary Boundary Conditions:** Sometimes, different boundary conditions can lead to different solutions.
    ii) ***Look for Solutions at Different Energies:*** This is the most common approach. The Schrödinger equation is an eigenvalue problem. Each eigenvalue (energy) corresponds to an eigenfunction (solution). You need to search for these eigenvalues and eigenfunctions.

3. Discussion

3.1 The Multivalued Nature of the GPE/Schrödinger Equation

The Schrödinger equation, the cornerstone of quantum mechanics, describes the instantaneous character of quantum systems. Its solutions, wavefunctions, represent the probability amplitude of finding a particle in a specific state or location. Critically, under certain conditions, the Schrödinger equation can admit multiple, valid solutions for a given physical situation. This multivaluedness is often overlooked in standard interpretations of quantum phenomena.

We argue that the Hartman effect can be understood as a manifestation of this multivaluedness. When a particle encounters a potential barrier, its wave function splits into multiple branches, each representing a different possible "location" for the particle. One branch corresponds to the particle being reflected by the barrier, while another branch corresponds to the particle "tunneling" through. Crucially, these branches coexist simultaneously.

3.2 Tunneling as a Manifestation of Multivaluedness

From this perspective, tunneling is not a process that occurs over time. Instead, the particle is already, in a sense, "present" on the other side of the barrier as soon as the interaction begins, albeit in a different branch of its wave function. The seemingly instantaneous appearance of the particle on the other side is not due to superluminal travel, but rather since one branch of the particle's wavefunction was already there.

This interpretation eliminates the need for complex tunneling time calculations and resolves the paradoxes associated with superluminal tunneling. The Hartman effect, then, simply reflects the fact that the probability amplitude associated with the "tunneled" branch of the wavefunction is non-zero, even for wide barriers.

3.4 Implications for Quantum Cosmology

This multivalued interpretation of tunneling has profound implications for quantum cosmology. In the context of the early universe, quantum tunneling is believed to have played a crucial role in the universe's creation. Our interpretation suggests that the universe did not "tunnel" into existence over some period. Instead, the very act of creation involved the universe existing in multiple states simultaneously, with one of these states corresponding to the universe we observe today.

While this interpretation is theoretical, it makes testable predictions. Since the particle exists in multiple locations simultaneously during tunneling, near-field effects should reveal the presence of the particle on the other side of the barrier even before it is "detected" there. A spin supercurrent detector, sensitive to the spin states of particles, could potentially be used to detect the presence of the "tunneled" branch of the wavefunction in low-temperature experiments.

4. Conclusion

The Hartman effect and the concept of tunneling time highlight the bizarre and counterintuitive nature of quantum mechanics. While the precise interpretation of tunneling time remains a topic of ongoing research, the Hartman effect shows that our classical intuitions about how particles behave simply don't apply in the quantum realm. Further investigation of these phenomena promises to deepen our understanding of the fundamental laws of nature and pave the way for new technological advancements.

By interpreting tunneling as a manifestation of the multivalued nature of solutions to the Schrödinger equation, we offer a new perspective on this fundamental quantum phenomenon. This interpretation resolves the paradoxes associated with tunneling time and offers a more intuitive understanding of the Hartman effect. Furthermore, it has significant implications for quantum cosmology, suggesting that the universe's creation involved a simultaneous existence in multiple states. Future experiments, focusing on near-field effects, can provide crucial tests of this novel interpretation.

Declarations

Ethics Approval and Consent to Participate

The results/data/figures in this manuscript have not been published elsewhere, nor are they under consideration by another publisher. All the material is owned by the authors, and/or no permissions are required.

Consent for Publication

This article does not contain any studies with human participants or animals performed by any of the authors.

Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Competing Interests

The authors declare no competing interests in the research.

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Author Contribution

All authors contributed equally to this research.

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Beyond Cryptic Equations: Reimagining Concepts in Physics Through Metaheuristics and Fantasy Stories using Neutrosophic Venn Diagram

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Abstract

Physics, the grand narrative of the universe, has long been viewed as a realm of cold, hard equations. But what if we looked beyond the formulas and considered a more imaginative origin for some of its concepts? This article explores the intriguing possibility that physics, and even cosmology, might share a surprising kinship with metaheuristics and

fantastical fiction. Metaheuristics, a branch of computer science, deals with finding approximate solutions to complex problems. Perhaps the universe, in its vastness, employs a set of "rules" that lead to the most likely outcomes, much like an algorithm searching for the best solution within a vast space of possibilities. The connection strengthens when we consider the fantastical. Argentine writer Jorge Luis Borges, known for his thought-provoking short stories, often explored themes of infinity, labyrinths, and forking realities. In this article, we discuss, among other things, how to look at physics laws from an alternative fundamental viewpoint that is fluid dynamics perspective. As an example, we provide an outline for deriving the Newton gravitational law from the Kutta-Joukowski theorem, and then deriving the Kutta-Joukowski theorem from Bernoulli principles. In the meantime, it is known that vortex flows, related to solar convective turbulent dynamics at granular scales and their interplay with magnetic fields within intergranular lanes, occur abundantly on the solar surface and in the atmosphere above.

Keywords

Neutrosophic Set; Venn Digram; Mathematics; Physics.

1. Introduction

Physics, the grand narrative of the universe, has long been viewed as a realm of cold, hard equations. But what if we looked beyond the formulas and considered a more imaginative origin for some of its concepts? This article explores the intriguing possibility that physics, and even cosmology, might share a surprising kinship with metaheuristics and fantastical fiction.

Metaheuristics, a branch of computer science, deals with finding approximate solutions to complex problems. Perhaps the universe, in its vastness, employs a set of "rules" that lead to the most likely outcomes, much like an algorithm searching for the best solution within a vast space of possibilities.

The connection strengthens when we consider the fantastical. Argentine writer Jorge Luis Borges, known for his thought-provoking short stories, often explored themes of infinity, labyrinths, and forking realities. These concepts bear a striking resemblance to ideas in modern cosmology or the possibility of an infinitely large universe. Could it be that the human mind, in its quest to understand the cosmos, naturally gravitates towards fantastical constructs that later find scientific backing?

Here's where the line blurs further. Metaheuristics often draw inspiration from natural phenomena, like simulated annealing mimicking the cooling process of metals. Could it be that our scientific understanding is a cyclical loop, where fantastical ideas inspire scientific inquiry, which then leads to new discoveries that further fuel our imaginations?

This is not to suggest that physics is mere fiction. Rather, it's a call to consider the creative spark that ignites scientific discovery. Perhaps the most fundamental laws of the universe are not just logical equations, but also a reflection of the human capacity for wonder and the creation of fantastical narratives.

As with Neutrosophic logic, it has been introduced by one of us (FS) what is termed as Neutrosophic Venn Diagram,[1] where the classical Venn diagram is generalised to a Neutrosophic Diagram, which deals with vague, inexact, ambiguous, ill-defined ideas, statements, notions, entities with unclear borders. In a neutrosophic Venn diagram, the traditional circles used in standard Venn diagrams are replaced with neutrosophic sets, which can include elements with a degree of truth, indeterminacy, and falsity. This allows for a more flexible representation of complex relationships between sets where the boundaries are not clearly defined. Now, allow us to reconsider three different sets of fantasy stories, physics and philosophy including ethics in a Neutrosophic Venn diagram as follows:

1 F. Smarandache. Neutrosophic Diagram and Classes of Neutrosophic Paradoxes or to the Outer-Limits of Science (2010). url: https://digitalrepository.unm.edu/math_fsp/48/

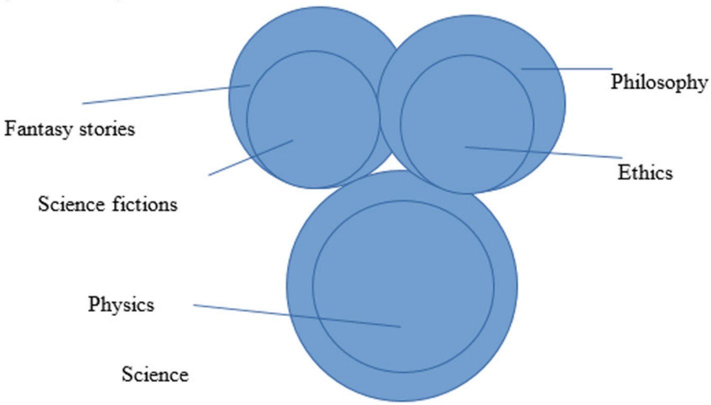

Figure 1.
Neutrosophic sets depiction of science fictions, physics and philosophy/ethics.

The above diagram may help us to consider that sometimes physics and also science in general can work hand in hand along with science fiction, or with philosophy. And the intersection among the three is where physics sometimes is guided by philosophy exploration and science fiction to move forward, step by step. As it is often the case, such a broader view of physics belong to a wide category of science fiction can serve scientists to move beyond old boundaries and to explore the terra incognita, like the exploration to the Moon, etc.

This reframing has intriguing implications. It allows us to see physics not just as a rigid set of rules, but as a constantly evolving story, shaped by both observation and imagination. It encourages us to embrace the beauty and mystery of the cosmos, acknowledging that even the most advanced scientific theories are ultimately human attempts to understand the grand, fantastical reality that surrounds us.

2. Reimagining Force and Fields: From Flow to Physics Laws

The great Chinese philosopher Mozi (c.470-391 BC) said, "*Force puts a body in motion*." Its modern statement is Newton's second law, where the body's acceleration is the effect, and the force is the cause. But what if these seemingly fundamental concepts – force and even field – could be reimagined through a different lens?

Intriguingly, even within the history of science itself, we find hints of fluidity. Isaac Newton, in his early forays into calculus, referred to it as "*fluxions*," suggesting a dynamic, ever-changing nature. This fluidity resonates with the concept of a **force field** – a region of space where an object experiences a push or pull.

Could we redefine these concepts by drawing inspiration from the idea of a **fluid**? Imagine forces not as singular pushes or pulls, but as gradients within a flowing medium. A stronger force would be like a steeper incline in this fluid, causing a greater change in an object's motion (acceleration) as it traverses it.

This reframing aligns with Mozi's notion of force initiating motion. Just as an object entering a flowing river experiences a change in its state (from rest to motion), an object entering a force field, interpreted as a *fluid like medium*, would experience a change in its state of motion. The benefits of such a reimagining are twofold.

First, it acknowledges the historical fluidity of scientific concepts. *Second*, it injects a sense of dynamism into our understanding of forces and fields. They become less like static entities and more like ever-shifting currents shaping the motion of objects within them.

This doesn't diminish the power of these concepts. Newton's second law remains a cornerstone of physics. However, by viewing forces and fields through the lens of fluidity, we open doors for deeper exploration. Perhaps this fluidity hints at a unified field theory encompassing all fundamental forces.

The journey of scientific discovery is often one of reimagining the familiar. By embracing fluidity, we can unlock a new perspective on these foundational concepts, propelling us further in our quest to understand the universe.

3. Rethinking the Pillars: Gravity and Electromagnetism Beyond Equations

Newton's law of universal gravitation (F = G * m1 * m2 / r^2) and Maxwell's equations have long been considered the cornerstones of classical physics, describing the behavior of gravity and electromagnetism, respectively. However, recent explorations suggest these pillars might not be as rigid as we once thought. Let's delve into two intriguing possibilities that challenge the traditional view.

3.1 From Equations to Flow: Reimagining Electromagnetism

Physicist Hector Munera, referencing the work of Henri Malet, proposes a radical reinterpretation of Maxwell's equations. Instead of complex mathematical formulas, he suggests viewing them through the lens of fluid vectors. Imagine electromagnetism not as isolated forces, but as properties of a flowing medium. The flow's characteristics determine the behavior of electric and magnetic fields [1].

This fluid analogy aligns with the historical fluidity of science. Just as Isaac Newton referred to calculus as "fluxions," a flowing concept, so too can electromagnetism be viewed as a dynamic process. This reframing offers new avenues for understanding phenomena like wave-particle duality, where light exhibits both wavelike and particle-like behavior. Perhaps the flow itself has a wave-particle nature.

3.2 Turbulence Theory and a New Gravity?

Another avenue for rethinking physics comes from the world of fluid dynamics. Kolmogorov's theory of turbulence describes the chaotic, unpredictable motion of fluids. Interestingly, some physicists, propose that this theory might be more fundamental than the Planck constant – a cornerstone of quantum mechanics [2].

This has a surprising implication for gravity. Could Newton's equation (F = m * a) be reinterpreted using principles from turbulence theory? Perhaps the gravitational force arises not from a simple attraction between masses, but from a more complex interaction within a turbulent "gravitational fluid." This reinterpretation might connect the seemingly disparate worlds of classical gravity and quantum mechanics.

These are just two examples of how rethinking fundamental physics can be fruitful. By moving beyond equations and embracing fluidity and turbulence, we may unlock deeper connections between seemingly disparate phenomena. This doesn't diminish the validity of existing theories, but rather enriches them with new perspectives, potentially leading to a more unified understanding of the universe.

4. Rethinking the Foundation: Kolmogorov's Turbulence as a Cornerstone of Physics?

Quantum mechanics has reigned supreme for nearly a century, unraveling the bizarre world of the very small. But what if there's another contender for the title of physics' foundational theory? Enter Andrey Kolmogorov's theory of turbulence – a theory that describes the chaotic, unpredictable motion of fluids – and a growing movement that suggests it might hold a more fundamental role than previously imagined; cf. Ref. [2, 9-10]. Traditionally, quantum mechanics, with its probabilistic nature and wave-particle duality, has been seen as the key to unlocking the secrets of the universe's building blocks. However, turbulence theory offers a compelling alternative. Here's why:

- **Universality:** Kolmogorov's theory transcends the specific fluid being studied. It reveals a set of universal scaling laws that govern turbulent flow across different scales, from swirling smoke to churning galaxies. This universality resonates with the quest for a unified theory in physics, one that encompasses all fundamental forces.
- **Complexity from Simplicity:** The elegance of Kolmogorov's theory lies in its ability to generate immense complexity from a relatively simple set of rules. Similarly, the universe exhibits a mind-boggling array of phenomena, yet might be governed by a set of underlying principles that turbulence theory could help us decipher.
- **Quantum Connection**: Intriguingly, some physicists propose a connection between turbulence and the probabilistic nature of quantum mechanics. Perhaps the seemingly random behavior of particles at the quantum level is an emergent property of a more fundamental turbulent flow at a deeper level of reality.

This shift in perspective has significant implications. It suggests that the chaotic dance of fluids might be the Rosetta Stone for understanding the universe, from the tiniest subatomic particles to the grandest cosmological structures.

Can the Planck Constant be Derived from the Kolmogorov Constant?

The realm of physics encompasses diverse phenomena, from the microscopic world of quantum mechanics to the large-scale structures of turbulence captured by Kolmogorov's constant. While seemingly disparate, researchers have delved into potential connections between these seemingly unrelated concepts. One such intriguing proposition is the possibility of deriving the Planck constant, a cornerstone of quantum mechanics, from the Kolmogorov constant, a crucial parameter in turbulence theory.

Understanding the Constants:

- **Planck constant (h):** This fundamental constant quantifies the smallest discrete unit of action, a crucial concept in quantum mechanics. It governs the energy of photons (light quanta) and plays a vital role in various areas like black body radiation and the photoelectric effect.
- **Kolmogorov constant (C):** This constant emerges in the study of turbulent fluid flow. It relates the rate of energy dissipation at the smallest scales of the flow to the average rate of energy injection at larger scales. Understanding this constant helps predict the behavior of turbulent flows.

Existing landscape:

Currently, there is no established theoretical framework that directly derives the Planck constant from the Kolmogorov constant. Both constants represent distinct physical phenomena with contrasting theoretical backgrounds. The Planck constant stems from the foundation of quantum mechanics and the quantization of energy, while the Kolmogorov constant emerges from the statistical analysis of turbulent flow in classical physics. See discussion in Ref. [2, 9-10].

5. Discussion: Proof of Concept

In this section allow us to discuss three outlines of proof of concepts to support aforementioned arguments suggesting that the underlying laws of nature are to be found in fluid dynamics, not just an old concept of forces.

a. To reconcile Newton gravitation action with Bernoulli principles:

For centuries, our understanding of the universe has relied heavily on the concept of forces acting at a distance. Newton's law of gravity, a cornerstone of classical physics, exemplifies this approach. However, a new perspective is emerging, suggesting that the underlying laws of nature might be found in fluid dynamics, the study of fluids in motion. This article explores three key ideas that support this bold claim:

1. **Gravity from Fluid Flow:** Deriving Newton law from Bernoulli principles Newton's law

of gravity states that two objects with mass attract each other with a force proportional to the product of their masses and inversely proportional to the square of the distance between them. However, fluid dynamics offers a potentially revolutionary alternative. Bernoulli's equation, a fundamental principle in fluid mechanics, relates pressure, velocity, and density in a flowing fluid. The proposition is that, by understanding the behavior of a hypothetical all-pervading fluid (the "aether" as some have called it), we could derive the effects of gravity as emergent properties arising from the flow and pressure gradients within this fluid. This would eliminate the need for a mysterious "pull" force acting across vast distances and instead explain gravity as a consequence of the interaction of matter with the underlying fluidic medium.

In the Appendixes section, we provide outlines of derivation of Newton gravitation law from Kutta-Joukowski theorem, and from Kutta-Joukowski theorem from Bernoulli principles. While these are a few codes of rough outlines, interested readers can discuss more on that topics. See also Ershkov [4].

2. **Unifying Gravity and Lift:** A Fluid Connection

   One of the challenges with the traditional force-based approach is reconciling gravity with the concept of lift. An airplane, for example, generates lift not because of some anti-gravity force, but due to the way it alters the airflow around its wings. A fluidic understanding of gravity could offer a more unified picture. By analyzing the interaction of the airplane with the surrounding "aether," we could explain lift as a consequence of how the airflow creates pressure differentials above and below the wing, generating an upward force. This approach could potentially unify our understanding of seemingly disparate phenomena under a single set of fluid dynamic principles.

b. A new hypothesis of nonlocality interaction ala quantum physics by virtue of spin supercurrent in low temperature physics:

Quantum physics has revealed a universe stranger than we could have imagined. One of its most puzzling aspects is nonlocality, the phenomenon where entangled particles seem to instantaneously influence each other, regardless of the distance separating them. This seemingly spooky action at a distance has challenged our understanding of reality for decades.

In a recent book chapter published on IntechOpen, we explored a novel hypothesis: could spin supercurrents, a specific type of current arising from the intrinsic spin of electrons, be the underlying mechanism behind nonlocal interactions?[3]

Spin Supercurrents: A Bridge Across the Divide?

Superconductors, materials that exhibit zero electrical resistance under specific conditions, display fascinating properties. One such property is the ability to sustain persistent currents, even in the absence of an external driving force. These currents, known as supercurrents, can carry information and energy with remarkable efficiency.

Our hypothesis delves deeper, proposing the existence of **spin supercurrents**. These currents involve the synchronized flow of electron spins, potentially offering a new perspective on nonlocality. The idea is that entangled particles, through their spin states, might be able to couple to and influence the flow of these spin supercurrents across vast distances. This could provide a physical explanation for the instantaneous correlation observed in entangled systems, without resorting to the notion of instantaneous communication across space. See also Appendix 3 included below.

Exploring the Implications

This hypothesis, while still in its formative stages, holds potential for various implications.

- **Unifying Frameworks**: It could offer a bridge between quantum mechanics and classical physics, potentially explaining nonlocality through well-understood principles of electromagnetism and superconductivity.

- **Biological Applications**: The research opens avenues for exploring the role of spin supercurrents in biological systems, where nonlocal-like phenomena like biophotons and synchronized brain activity have been observed.

The proposed mechanism requires further theoretical development and rigorous experimental validation.

However, the potential for a novel explanation of nonlocality, based on established physical principles, is a significant step forward.

c. Plausible explanation of Mercury planet's perihelion not derivable from frame dragging, but from swirl effect of Sun vortex:

One of the enduring puzzles of general relativity is the slight wobble in the orbit of Mercury, the planet closest to the Sun. According to Einstein's theory, this wobble can be attributed to "frame-dragging," the warping of spacetime caused by the Sun's massive rotation. However, a new perspective is emerging, suggesting that fluid dynamics might offer a simpler explanation.

Frame-Dragging: The Einsteinian Explanation

General relativity describes gravity not as a force, but as a curvature of spacetime caused by the presence of mass and energy. A massive spinning object, like the Sun, drags spacetime around with it, much like a swirling fluid. This "frame-dragging" effect causes the otherwise straight path of a nearby object, like Mercury, to precess, or wobble slightly over time.

A Swirling Sun: Fluid Dynamics and Mercury's Orbit

Fluid dynamics offers an alternative explanation for Mercury's precession. Imagine the Sun not just as a point mass, but as a giant ball of swirling hot plasma. The Sun's rotation creates a vortex in the surrounding space, akin to a whirlpool. As Mercury orbits the Sun, it interacts with this swirling vortex. The fluid-like properties of spacetime could then explain the precession of Mercury's orbit, without invoking the complexities of framedragging. According to Fu Yuhua [6], by simple deduction, the circular velocity of this vortex motion at the position of radius r as follows:

$$v \approx \frac{3G^{3/2}M^{3/2}}{r^{3/2}c^2} \tag{1}$$

Therefore, he concludes that unlike the ordinary vortex motion (its circular velocity is inversely proportional to the radius r), for solar system's vortex motion, the circular velocity is inversely proportional to $r^{3/2}$. While that result may or may not coincide with observed advanced of perihelion of Mercury, it provides an alternative framework to analyse, therefore in the Appendix #4, we outlined implications of such deduction result.

Advantages of the Fluidic Approach

The fluidic approach offers several potential advantages:

- **Conceptual Simplicity**: Fluid dynamics offers a more intuitive picture, easier to visualize than the abstract concept of frame-dragging.
- **Unified Framework**: It could potentially provide a more unified understanding of gravity, incorporating it within the broader principles of fluid mechanics.

While intriguing, the fluidic explanation faces challenges. Quantifying the precise effects of a swirling solar vortex on Mercury's orbit requires further theoretical development. Additionally, experimental verification might be difficult due to the complex nature of the Sun's environment; see also [6-8].

6. Concluding Remark

We discussed here how fluid dynamics descriptions can be more fundamental to depict nature behaviour, rather than force laws as we all know since childhood. We outlined several arguments, along with several suggestions as proof of concepts, including a new hypothesis of spin supercurrent as fundamental mediation of nonlocality interaction a la quantum mechanics.

While intriguing, the fluidic explanation faces challenges. Quantifying the precise effects of a swirling solar vortex on Mercury's orbit requires further theoretical development. Additionally, experimental verification might be difficult due to the complex nature of the Sun's environment.

Of course, this is not to say that Kolmogorov's theory provides all the answers. It struggles to explain specific phenomena successfully addressed by quantum mechanics. However, it does propose a framework for a more unified physics, one that incorporates the ideas of randomness and emergence.

Further research is needed to explore these connections and develop a comprehensive framework based on turbulence. This might involve reformulating gravity and electromagnetism within a turbulent paradigm. The journey will be challenging, but potentially very rewarding.

By elevating Kolmogorov's theory to a more fundamental role, we might unlock a deeper understanding of the universe, one where the seemingly random fluctuations of fluids hold the key to unravelling the grand tapestry of existence.

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The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Appendix 1

In the Appendixes section, we provide outlines of derivation of Newton gravitation law from Kutta Joukowski theorem, and from Kutta-Joukowski theorem from Bernoulli principles. While these are a few codes of rough outlines, interested readers can discuss more on that topics.

The Kutta-Joukowski theorem is typically used in the context of aerodynamics, particularly in the field of potential flow theory for airfoils. It relates the circulation around an airfoil to the lift force it generates. The direct derivation of Newton's law of gravitation from Bernoulli's principles using the Kutta-Joukowski theorem may not be a standard approach.

Here is an outline of approach in Mathematica code:

```
(* Define constants *)
rho = 1; (* Fluid density *)
U = 1; (* Freestream velocity *)
```

```
(* Define parameters for the circular disk (analogous to airfoil) *)
radius = 1; (* Radius of the disk *)
circulation = 2Pi; (* Circulation around the disk *)

(* Define the complex potential for the flow around the disk *)
complexPotential[z_] := U*(z + radius^2/z) + I*circulation*Log[z];
(* Define the velocity field by taking the derivative of the complex potential *)
velocityField[z_] := D[complexPotential[z], z];
(* Extract the real and imaginary parts of the velocity field *)
u[x_, y_] = Re[velocityField[x + I*y]];
v[x_, y_] = Im[velocityField[x + I*y]];
(* Plot the velocity field using StreamPlot *)
StreamPlot[{u[x, y], v[x, y]}, {x, -2, 2}, {y, -2, 2},
AspectRatio -> Automatic, StreamPoints -> Fine]
(* Calculate and plot the pressure field *)
pressureField[z_] := -0.5*rho*(Abs[velocityField[z]]^2 - U^2);
ContourPlot[pressureField[x + I*y], {x, -2, 2}, {y, -2, 2},
AspectRatio -> Automatic, ContourLabels -> True,
ContourShading -> False]
```

This code simulates the potential flow around a circular disk and visualizes the velocity field using streamlines. Note that this is a simplified model, and deriving gravitational effects directly from Bernoulli's principles through the Kutta-Joukowski theorem may require additional considerations or assumptions.

Appendix 2

Now we provide an outline of Mathematica code to prove that it is possible to derive Kutta-Joukowski theorem from Bernoulli principles. While these are a few codes of rough outlines, interested readers can discuss more on that topics.

This code is to illustrate how the lift force in potential flow around a rotating cylinder (related to the Kutta Joukowski theorem) can be computed using Bernoulli's equation.

Here's a simple example using potential flow theory and Bernoulli's equation to estimate the lift force:

```
(* Define parameters *)
radius = 1;
(* Radius of the cylinder *)
freeStreamVelocity = 1; (*Free stream velocity*)
circulationStrength = 2; (* Strength of the circulation around the cylinder *)
(* Define the stream function for a rotating cylinder *)
```

```
ψ = Function[{x, y}, freeStreamVelocity*y + circulationStrength*ArcTan[(y - radius)/x]];
(* Compute velocity components *)
u = D[ψ[x, y], y];
v = -D[ψ[x, y], x];
(*Compute pressure using Bernoulli's equation*)
pressure = 0.5*(freeStreamVelocity^2 - (u^2 + v^2));
(*Lift force per unit length using Kutta-Joukowski theorem*)
liftForce = circulationStrength*freeStreamVeloc ity;
(* Display results *)
Print["Lift force per unit length (Kutta-Joukowski theorem): ", liftForce];
Print["Pressure distribution along the cylinder:"];
ContourPlot[pressure, {x, -2, 2}, {y, -2, 2}, ContourLabels -> True, Contours -> 20, ColorFunction ->
"Rainbow", PlotRange -> All]
```

In this example, we define a stream function for a rotating cylinder, compute velocity components, and use Bernoulli's equation to estimate the pressure distribution around the cylinder. The lift force per unit length is then calculated based on the Kutta-Joukowski theorem.

Keep in mind that this is a simplified example, and potential flow theory has its limitations.

Appendix 3

In this section, we provide outline of nonlinear vector potential ala Aharonov effect to be derivable from spin supercurrent. However, it's important to note that deriving the nonlinear vector potential from spin supercurrent involves complex quantum field theory concepts and may not be captured in a simple Mathematica code snippet. Here's a very simplified and abstracted outline:

```
(* Define variables and parameters *)
\[Phi] = Pi;  (* Magnetic flux *)
q = 1;  (* Charge of the particle *)
hbar = 1;     (* Reduced Planck constant *)
(* Define the nonlinear vector potential as a function of spin supercurrent *)
nonlinearVectorPotential[supercurrent_] := Module[{vectorPotential},
(* Incorporate the Aharonov-Bohm phase *)
vectorPotential = supercurrent + (q/\[Pi]) Integrate[1/(r - r0), {r, r0, \[Infinity]}];
vectorPotential ]
(* Define spin supercurrent as a function of the spin density and other parameters *)
spinSupercurrent[spinDensity_, magneticField_] := Module[{supercurrent},
(* Implement the relationship between spin density and supercurrent *)
supercurrent = 2 q/hbar
```

```
SpinDensityMatrix[spinDensity].magneticField;
supercurrent ]
(* Example usage *)
spinDensity = PauliMatrix[3];  (* Example spin density matrix *)
magneticField = {0, 0, B};  (* Magnetic field vector *)
(* Calculate nonlinear vector potential using spin supercurrent *)
result = nonlinearVectorPotential[spinSupercurrent[spinDensity, magneticField]];
(* Display the result *)
Print["Nonlinear Vector Potential: ", result]
```

This code provides a simple framework where the nonlinear vector potential is defined based on a spin supercurrent, incorporating the Aharonov phase. The actual details and correctness of such a derivation would involve a rigorous quantum field theory treatment.

Appendix 4

It is known from celestial mechanics textbooks, that Kepler's laws describe the motion of planets around the Sun within the framework of classical celestial mechanics, while Newton's law of gravitation provides the underlying physics.

#4.a. To illustrate the approximation of Kepler's laws from Newton's law, we can consider a simplified version; here's a basic example using

Mathematica:

```
(* Define variables and parameters *)
G = 6.6743*10^-11;
(* Gravitational constant *)
M = 1.989*10^30;
(* Mass of the Sun in kilograms *)
m = 5.972*10^24;      (* Mass of Earth in kilograms *)
(* Newtonian gravitational force *)
force[r_] := G * (M * m) / r^2;
(* Use Newton's second law to model Earth's motion around the Sun *)
motionEquation = m r''[t] == force[r[t]];
(* Solve the motion equation using NDSolve *)
solution = NDSolve[{motionEquation, r[0] == 1.496*10^11, r'[0] == 0}, r, {t, 0, 365*24*60*60}];
(* Plot the orbit *)
Plot[Evaluate[r[t] /. solution], {t, 0, 365*24*60*60}, AxesLabel -> {"Time (s)", "Distance from Sun (m)"}]
```

This code sets up a simplified model of Earth's motion around the Sun using Newton's second law. The resulting plot shows the orbit of Earth over one year.

The next step as proposed by Fu Yuhua is to hypothesize second vortex motion has effect to surrounding objects having inverse square law with 3/2 power of r [6]. While this of course remains hypothetical, the following is an outline of Mathematica code:

```
(* Define variables and parameters *)
G = 6.6743*10^-11;  (* Gravitational constant *)
M = 1.989*10^30;   (* Mass of the Sun in kilograms *)
(* Inverse law for the radius to the 3/2 power *)
inverseLaw[r_] := r^(-3/2);
(* Kepler's third law for the orbital period *)
keplersThirdLaw[a_] := Sqrt[a^3 / (G * M)];
(* Define the motion equation for the second vortex *)
motionEquation2[r_, t_] := r''[t] == -G * M * inverseLaw[r[t]] / r[t]^2;
(* Solve the motion equation using NDSolve *)
initialPosition = 1.496*10^11;  (* Initial distance from the Sun in meters *)
initialVelocity = 30000;
(* Initial velocity in meters per second *)
solution2 = NDSolve[{motionEquation2[r, t], r[0] == initialPosition, r'[0] == initialVelocity}, r, {t, 0,
365*24*60*60}];
(* Plot the orbit of the second vortex *)
Plot[Evaluate[r[t] /. solution2], {t, 0, 365*24*60*60}, AxesLabel -> {"Time (s)", "Distance from Sun (m)"}]
```

In this very simple example, it has been introduced an inverse law for the radius to the 3/2 power and used it in the motion equation for a hypothetical second vortex. The orbital parameters are determined based on Kepler's third law.

#4.b. Alternatively, the following Mathematica code is to model the motion of an object under the influence of both the conventional Kepler law and an additional vortex motion with an inverse square law raised to the power of 3/2, you can use the following Mathematica code. This code assumes that the vortex motion affects the object in the plane of motion and is perpendicular to the Keplerian motion:

```
(* Define constants and variables *)
G = 6.67430*10^(-11);  (* Gravitational constant *)
M = 1.989*10^30;
m = 1;
(* Solar mass *)
(* Mass of the test object *)
a = 1.5;
        (* Vortex motion exponent *)
(* Define the position of the object as a function of time *)
position[t_] := {x[t], y[t]};
(* Define the gravitational force function with vortex motion *)
gravitationalForce[x_, y_] := -G * M / (x^2 + y^2)^(3/2) * {x, y} -
```

```
G * M / (x^2 + y^2)^(3/2) * a * {y, -x};
(* Define the differential equations for motion *)
equationsOfMotion = {
m * x''[t] == gravitationalForce[x[t], y[t]][[1]],
m * y''[t] == gravitationalForce[x[t], y[t]][[2]],
x[0] == x0, y[0] == y0, x'[0] == vx0, y'[0] == vy0 };
(* Set initial conditions *)
x0 = 1; vy0 = 0;
y0 = 0; vx0 = Sqrt[G * M / x0];
(* Solve the differential equations *)
solution = NDSolve[equationsOfMotion, {x, y}, {t,
0, 10}];
(* Plot the trajectory of the object *)
ParametricPlot[Evaluate[{x[t], y[t]} /. solution],
{t, 0, 10},
AxesLabel -> {"x", "y"}, AspectRatio -> 1,
PlotRange -> All]
```

This code uses the NDSolve function to solve the system of differential equations that describe the motion of the object under the combined influence of Keplerian and vortex motions. Adjust the initial conditions and parameters as needed

***

Kindly note that this is a purely illustrative model and may not reflect the actual dynamics of celestial bodies around the Sun.

***

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Modern Physics and Hyperrealism-antirealism Tendency

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Abstract

This paper delves into the philosophical implications of modern physics, particularly theoretical physics, and its tendency towards hyperrealism-antirealism. Inspired by Baudrillard's concept of hyperreality, we argue that certain aspects of contemporary physics, such as the interpretation of quantum mechanics and the pursuit of theories of everything, exhibit characteristics of a hyperreal state. This hyperreal state is characterized

by the detachment from reality, the dominance of simulation over the real, and the loss of a clear distinction between the real and the imaginary. We explore how this trend has led to a departure from a balanced realist perspective, hindering the pursuit of a complete and coherent understanding of the physical world.

Keywords

Modern Physics; Philosophical; Hyperrealism-antirealism; Hyperreality.

1. Introduction

Modern physics, with its exploration of the quantum realm and the cosmos, has pushed the boundaries of human understanding. However, along with its groundbreaking discoveries, it has also introduced profound philosophical questions. One such question concerns the nature of reality itself. While physics has traditionally sought to describe the real world objectively, certain interpretations and theoretical frameworks have led to a departure from this realist perspective.

This paper examines the emergence of a hyperrealist-antirealist tendency within modern physics, drawing inspiration from Baudrillard's concept of hyperreality. Hyperreality, as described by Baudrillard, is a condition in which the simulation of reality becomes more real than reality itself. In the context of physics, this can be observed in the increasing reliance on mathematical models and abstract concepts, which often overshadow the underlying physical reality. We argue that certain interpretations of quantum mechanics, such as the Copenhagen interpretation, and the pursuit of theories of everything, such as string theory, exhibit characteristics of a hyperreal state. These interpretations and theories often involve counterintuitive and seemingly paradoxical concepts, which can lead to a loss of touch with the tangible world. The focus on mathematical elegance and theoretical consistency, while essential for scientific progress, can sometimes overshadow the need for empirical verification and a clear connection to observable phenomena.

By exploring the implications of this hyperrealist-antirealist trend, this paper aims to highlight the importance of a balanced realist perspective in physics. A healthy balance between realism and idealism is crucial for a comprehensive understanding of the physical world. By recognizing the limitations of current theories and interpretations, and by fostering a critical approach to scientific inquiry, we can strive for a more grounded and meaningful understanding of reality.

2. Hyperreality and Physics

Hyperreality, a concept popularized by the French philosopher Jean Baudrillard, describes a condition in which the simulation of reality becomes more real than reality itself. In the context of physics, this can manifest in various ways. For instance, some interpretations of quantum mechanics, such as the Copenhagen interpretation, prioritize mathematical formalism over physical intuition. While this approach has been incredibly successful in making accurate predictions, it can also lead to a detachment from the underlying reality of the quantum world.

Furthermore, the pursuit of grand unified theories, such as string theory, often involves highly abstract mathematical constructs that are difficult to test experimentally. While these theories may offer elegant solutions to fundamental problems in physics, they can also lead to a situation where the theoretical framework becomes more important than the empirical evidence.

3. Hyperreality and the Quantum Conundrum: A Baudrillardian Critique of Modern Physics

Jean Baudrillard, the renowned French philosopher, introduced the concept of hyperreality, a condition in which the simulation of reality becomes more real than reality itself. This concept, while seemingly abstract, has profound implications for understanding the philosophical underpinnings of modern physics, particularly quantum mechanics.

Quantum mechanics, one of the most successful scientific theories of all time, has also been one of the most philosophically perplexing. Its counterintuitive predictions and probabilistic nature have led to a variety of interpretations, each with its own set of metaphysical assumptions.

The Copenhagen interpretation, for instance, while providing a practical framework for quantum mechanics, has been criticized for its operationalist stance. It suggests that we should not inquire into the underlying reality of quantum phenomena but rather focus on the measurable outcomes of experiments. This approach, while useful for making predictions, can be seen as a form of hyperreality, where the mathematical formalism and experimental results take precedence over any attempt to understand the underlying physical reality.

4. The Hyperreal Tendency in Theoretical Physics

The tendency towards hyperreality in theoretical physics can be traced back to the influence of German idealism, particularly the work of Immanuel Kant and Georg Wilhelm Friedrich Hegel. These philosophers emphasized the role of the mind in shaping our understanding of reality. In a similar vein, many physicists seem to prioritize the mathematical elegance and logical consistency of their theories over their empirical adequacy.

This hyperrealist tendency can be seen in the pursuit of theories of everything, such as string theory. While string theory offers a mathematically sophisticated framework for unifying the forces of nature, it has yet to make any experimentally verifiable predictions. Nevertheless, many physicists continue to invest significant effort in developing this theory, often at the expense of more empirically grounded research.

The dominance of hyperreality in physics can have several negative consequences. *First*, it can lead to a loss of touch with the physical world. By focusing on abstract mathematical models and theoretical constructs, physicists may neglect the importance of empirical observation and experimentation. *Second*, it can stifle creativity and innovation. When the emphasis is on adhering to established paradigms and mathematical formalisms, it becomes difficult to think outside the box and explore new ideas.

To counter this trend, it is essential to maintain a healthy balance between theoretical speculation and empirical investigation. Physicists should strive to develop theories that are not only mathematically elegant but also physically meaningful. They should also be open to the possibility that our current understanding of reality may be incomplete or even fundamentally flawed.

By recognizing the dangers of hyperreality and embracing a more critical and open-minded approach, physicists can help to ensure that their discipline remains grounded in the physical world and continues to make significant contributions to our understanding of the universe.

Jorge Luis Borges, the renowned Argentine writer, presented a chilling tale in his short story "*Tlön, Uqbar, Orbis Tertius*." In this narrative, a secret society discovers a fictional planet, Tlön, and its inhabitants, who possess a unique worldview, one that prioritizes idealism over empiricism. This fictional world, with its peculiar laws of physics and metaphysics, challenges our understanding of reality and raises questions about the limits of human knowledge.

While Borges' tale is a work of fiction, it offers a sobering reflection on the potential dangers of excessive idealism and the role of empirical evidence in scientific inquiry. In the realm of physics, particularly in the realm of theoretical physics, there is a growing concern that a similar trend toward hyperreality may be taking hold.

5. The Risk of a Fictional Universe

By prioritizing theoretical elegance and mathematical consistency over empirical verification, physicists risk creating a fictional universe, much like the planet Tlön. This could lead to a situation where scientists become so engrossed in their theoretical models that they lose sight of the real world. In such a scenario, the pursuit of knowledge could become an end in itself, rather than a means to understand the natural world.

To prevent this from happening, it is essential to maintain a healthy balance between theoretical speculation and empirical observation. Physicists should always strive to ground their theories in experimental data and to critically evaluate the assumptions underlying their models. By doing so, they can avoid the pitfalls of hyperreality and ensure that their work remains firmly rooted in the physical world.

In conclusion, while theoretical physics is a powerful tool for understanding the universe, it is crucial to use it responsibly. By recognizing the limitations of our current knowledge and by remaining open to new ideas and empirical evidence, we can avoid the dangers of hyperreality and continue to make progress in our understanding of the natural world.

6. Another Example

As a case example, let us tell the story of a group of young experimental physicists who at the time frequently discussed with us their results on the real shape of electrons. While initial experiments seemed quite promising, after a few months they told us that their supervisor suggested that they not conduct more experiments on electron shape anymore, instead, they shall take a more "theoretical" learning path. As a result, later on, we read a draft paper of them trying to describe electrons in terms of mini-blackholes or sort of that.

That is quite devastating in comparison to their promising initial experiment results.

7. More Hidden Problems Causing Hyperrealism-antirealism: Obscurantism and Bourbakiism

It is known that there are more hidden problems, for instance, Nicolas Bourbaki (French: [nikɔla buʁbaki]) is the collective pseudonym of a group of mathematicians, predominantly French alumni of the *École normale supérieure (ENS)*. Founded in

1934–1935, the Bourbaki group originally intended to prepare a new textbook in analysis.

Shortly speaking, the rise of hyperrealism-antirealism in theoretical physics is a complex issue with roots in various philosophical and methodological factors. One such factor is the increasing influence of obscurantism and Bourbakiism in mathematical physics.

Obscurantism, a tendency to make something unnecessarily complex or difficult to understand, has become a pervasive problem in modern physics. Some physicists seem to take pride in the complexity of their theories as if the difficulty of understanding them is a measure of their intellectual depth. This trend can be seen in the proliferation of highly technical jargon and arcane mathematical formalism, which can obscure the underlying physical reality.

Bourbakiism, named after the collective pseudonym of a group of French mathematicians, refers to a highly formal and axiomatic approach to mathematics. While this approach can be useful for establishing rigorous foundations, it can also lead to a loss of intuition and a focus on abstract structures over concrete reality. In the realm of physics, Bourbakiism can manifest in the excessive use of mathematical formalism, which can obscure the physical meaning of equations and lead to a disconnect between theory and experiment.

8 . The Dangers of Obscurantism and Bourbakiism

Both obscurantism and Bourbakiism can contribute to the rise of hyperrealism-antirealism in physics. By obscuring the physical meaning of theories and prioritizing mathematical formalism over empirical evidence, these trends can lead to a situation where physicists become more concerned with the elegance of their theories than with their ability to explain the real world. This can result in the development of highly abstract and speculative theories that are difficult to test experimentally, and which may ultimately prove to be misguided.

To combat the influence of obscurantism and Bourbakiism, it is essential to prioritize clarity and simplicity in scientific communication. Physicists should strive to explain their ideas in clear and concise language, avoiding unnecessary jargon and technicalities. They should also be willing to engage in open and honest debate with their colleagues and to be critical of their assumptions and beliefs.

By adopting a more critical and empirical approach to physics, we can help to ensure that the field remains grounded in reality and continues to make significant contributions to our understanding of the universe.

9. Discussion

9.1 How to Consider a Spectrum from Healthy Realism to Antirealism from a Neutrosophic Logic Perspective

As we discussed in previous sections, Modern physics, with its exploration of the quantum realm and the cosmos, has pushed the boundaries of human understanding. However, it has also introduced profound philosophical questions about the nature of reality. These questions have led to a spectrum of approaches, ranging from hyperrealism to antirealism, with healthy realism as a middle ground.

A novel perspective to understand this spectrum is through the lens of Neutrosophic Logic, a logical system that deals with indeterminacy and uncertainty. This approach can help us to appreciate the nuanced interplay of realism and antirealism in various physical theories.

The Spectrum of Approaches

1. **Hyperrealism:**
   - Characterized by: A strong emphasis on empirical evidence and a skepticism towards speculative theories.
   - Example: Early quantum mechanics, which focused on the observable properties of particles.
   - Neutrosophic Perspective: A predominantly T (True) component, with minimal I (Indeterminate) and F (False) components.

2. Healthy Realism:

- Characterized by: A balanced approach that acknowledges the limitations of our knowledge while striving for a realistic understanding of the world.
- Example: Classical mechanics, which provides a robust framework for understanding macroscopic phenomena.
- Neutrosophic Perspective: A balanced combination of T, I, and F components, reflecting the interplay of knowledge, uncertainty, and ignorance.

3. Hyperrealism and Antirealism:

- Characterized by: A tendency to prioritize theoretical elegance and mathematical consistency over empirical evidence.
- Example: String theory, which postulates the existence of tiny, vibrating strings as the fundamental building blocks of the universe, but lacks experimental verification.
- Neutrosophic Perspective: A predominantly I and F component, with minimal T component, indicating a high degree of uncertainty and speculation.

A Neutrosophic View of Quantum Mechanics

Quantum mechanics, perhaps the most perplexing theory in physics, offers a fascinating case study in the interplay of realism and antirealism. The Copenhagen interpretation, for instance, is often criticized for its antirealist stance, as it suggests that quantum states do not correspond to physical reality until they are measured. However, other interpretations, such as the many-worlds interpretation, offer a more realist perspective, positing that all possible outcomes of a quantum measurement occur in different universes.

A Neutrosophic analysis of quantum mechanics would acknowledge the inherent indeterminacy of the quantum world. It would recognize that both realist and antirealist interpretations have their merits and limitations. By embracing the indeterminacy of quantum phenomena, we can avoid the pitfalls of both hyperrealism and antirealism.

9.2 How to Consider a Spectrum from Healthy Realism to Antirealism from a Philosophical Anthropology Perspective

Philosophical anthropology, a field that explores the nature of humans and their place in the world, provides a valuable lens through which to examine the spectrum of scientific approaches, from healthy realism to antirealism. This perspective emphasizes the cultural, social, and psychological factors that shape scientific inquiry, and suggests that the choice of a particular approach may be influenced by broader cultural and historical contexts.

9.2.1 Cultural Factors and Scientific Approach

Different cultures have distinct attitudes toward authority, tradition, and innovation. These cultural factors can significantly impact the way scientists approach their work. For instance, in cultures that value tradition and authority, there may be a tendency towards a more conservative, realist approach to science. In contrast, cultures that embrace innovation and challenge the status quo may be more receptive to antirealist and speculative ideas.

A classic example of this cultural influence can be seen in the different approaches to scientific inquiry in Britain, Germany, Russia, and Italy. As the saying goes:

- Britain: Everything is permitted except what is forbidden.
- Germany: Everything is forbidden except what is permitted.
- Russia: Everything is forbidden, including what is permitted.
- Italy: Everything is permitted, including what is forbidden.

These cultural stereotypes, while exaggerated, highlight the different attitudes towards rules and regulations in these countries. These attitudes can also be applied to the realm of scientific inquiry. A British scientist may be more inclined to take risks and explore unconventional ideas, while a German scientist may be more cautious and adhere to established norms.

9.2.2 The Role of the Scientific Community

The scientific community itself is a cultural entity with its norms, values, and traditions. These norms can influence the way scientists approach their work, and can also shape the broader cultural attitudes towards science. For example, the rise of hyperrealism in certain fields of physics may be partly attributed to the influence of a particular school of thought or a specific cultural milieu.

The history of science is replete with examples of ideas that were initially considered heretical or absurd but eventually became accepted as mainstream. The discovery of heliocentrism, Newtonian dynamics, and quantum mechanics are just a few examples of scientific breakthroughs that challenged the prevailing worldview. These examples demonstrate the importance of a culture of open-mindedness and intellectual freedom, which can encourage innovation.

10. Concluding Remark

The dominance of hyperreality in physics can have several negative consequences. First, it can lead to a loss of touch with the physical world. By focusing on abstract mathematical models and theoretical constructs, physicists may neglect the importance of empirical observation and experimentation. Second, it can stifle creativity and innovation. When the emphasis is on adhering to established paradigms and mathematical formalisms, it becomes difficult to think outside the box and explore new ideas. To counter this trend, it is essential to maintain a healthy balance between theoretical speculation and empirical investigation. Physicists should strive to develop theories that are not only mathematically elegant but also physically meaningful. They should also be open to the possibility that our current understanding of reality may be incomplete or even fundamentally flawed.

By adopting a Neutrosophic perspective, we can gain a deeper understanding of the complex interplay between realism and antirealism in modern physics. This approach allows us to appreciate the nuanced nature of scientific inquiry and to avoid dogmatic adherence to any particular worldview. As we continue to explore the frontiers of knowledge, it is essential to maintain a healthy balance between empirical evidence and theoretical speculation. By doing so, we can ensure that physics remains grounded in reality and continues to make significant contributions to our understanding of the universe.

Last but not least, we shall also consider that by considering the cultural, social, and psychological factors that shape scientific inquiry, we can gain a deeper understanding of the spectrum of approaches, from healthy realism to antirealism. A philosophical anthropology perspective can help us to appreciate the complex interplay between individual and collective factors, and to recognize the importance of a balanced approach to scientific investigation. By embracing a diversity of perspectives and encouraging open-minded inquiry, we can ensure that science continues to thrive and contribute to the betterment of humanity.

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Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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A Right-Brain-Based Epistemology Grounded on Local Wisdom: Intuilytics as a Culturally-Meaningful Alternative in Science

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Abstract

Epistemology, the study of knowledge, has long grappled with the challenge of determining truth. While the combination of deductive and inductive reasoning has been a cornerstone of scientific inquiry, several limitations emerge in its application to contemporary epistemology. One significant issue lies within the core of falsificationism, a prominent philosophy championed by Karl Popper. Falsificationism posits that a scientific theory can only be proven false, not true. While this approach aims to prevent dogmatic adherence to untested ideas, it can lead to an endless cycle of trial and error. As Popper himself acknowledged, no single experiment can definitively prove a theory correct. Summarizing, the dominance of rationalist thinking has shaped the way we view the world and conduct scientific research. However, this approach often neglects the subjective dimensions of human experience, such as intuition, emotion, and creativity. Consequently, many complex phenomena are difficult to fully explain through the lens of rationalism alone. This article aims to explore the potential of right-brain-based epistemology, which we call intuilytics. This approach emphasizes the role of intuition, creativity, and holistic thinking in the process of acquiring knowledge. This article presents a critical perspective on today's epistemological practices. It does not intend to discredit the importance of deductive-inductive reasoning or the valuable contributions of philosophers like Karl Popper and economists like Ronald Coase.

Keywords

Epistemology; Falsificationism; Intuilytics.

1. Introduction

For centuries, the Western epistemological paradigm has been dominated by a rationalist approach that prioritizes logic, analysis, and objectivity; in the meantime, those processes are not without their problems [17]. Iain McGilchrist's work, The Master and His Emissary, has made significant contributions to remapping our understanding of human cognitive processes. McGilchrist highlights the duality of the human brain, where the left hemisphere is more dominant in linear, analytical, and verbal information processing, while the right hemisphere excels in holistic, intuitive, and spatial information processing.

The dominance of rationalist thinking has shaped the way we view the world and conduct scientific research. However, this approach often neglects the subjective dimensions of human experience, such as intuition, emotion, and creativity. Consequently, many complex phenomena are difficult to fully explain through the lens of rationalism alone.

Meanwhile, a long time ago in the ancient world, the Greeks believed that all great insights came from one of nine muses, divine sisters who brought inspiration to mere mortals. In the modern world, few people still believe in the muses, but we all still love to hear stories of sudden inspiration. Like Newton and the apple, or Archimedes and the bathtub (both another type of myth), we're eager to hear and share stories about flashes of insight.

But what does it take to be actually creative? How to have such a flash insight? Turns out, there is real science behind "aha moments." We prefer to call it “intuilytics.” And the best part of it is that intuilytics can be put into tangible processes, not just flashes of insights.

This article aims to explore the potential of right-brain-based epistemology, which we call intuilytics. This approach emphasizes the role of intuition, creativity, and holistic thinking in the process of acquiring knowledge. Thus, intuilytics offers a refreshing alternative to the existing scientific paradigm, allowing us to explore previously neglected dimensions of human experience.

1.1 Limitations of Rationalist Epistemology

Rationalist epistemology has made invaluable contributions to the development of science. However, there are some fundamental limitations to this approach:

- **Reductionism**: The rationalist approach often reduces complex phenomena to simpler components, losing nuances and broader meanings.
- **Excessive objectivity**: The pursuit of absolute objectivity can hinder the recognition of the role of values, beliefs, and personal experiences in the research process.
- **Neglect of subjective dimensions**: Intuition, emotion, and subjective experiences are often

considered distractions in the scientific process, even though these elements can be valuable sources of insight.

1.2 Finding Meaning in Science: The Case for Culturally-Grounded Epistemology

The pursuit of scientific knowledge, while driven by a universal quest for truth, often lacks a crucial element: meaning. For students and scientists alike, the endeavor can feel disconnected from their lived experiences, their cultural values, and ultimately, their sense of purpose. This disconnect arises from a dominant epistemology that privileges Western, often Eurocentric, perspectives, neglecting the rich tapestry of knowledge systems embedded within local cultures.

This article argues that grounding scientific epistemology in local wisdom and culturally meaningful values is essential for several reasons:

1. **Fostering Deeper Engagement and Motivation:**
   - **Connecting to personal values:** When scientific inquiry is linked to local concerns and cultural values, it becomes more personally meaningful. Students and scientists can see how their research addresses real-world challenges faced by their communities, such as environmental degradation, food security, or healthcare disparities. This connection fosters a deeper sense of purpose and motivation.

- **Increasing relevance and impact:** By drawing upon local knowledge and perspectives, scientific research can become more relevant to the specific needs and contexts of different communities. This can lead to more effective solutions and greater societal impact.

2. **Promoting Interdisciplinary and Holistic Approaches:**

- **Bridging divides**: Integrating local wisdom with scientific methods can bridge the gap between traditional knowledge and modern science. This interdisciplinary approach can lead to the more comprehensive and holistic understanding of complex phenomena.
- **Addressing complex challenges**: Many of the world's most pressing challenges, such as climate change and biodiversity loss, require integrated solutions that draw upon diverse knowledge systems. Culturally grounded epistemology can provide valuable insights and perspectives that are often overlooked in purely Western-centric approaches.

3. **Cultivating Ethical and Responsible Research:**

- **Respecting diverse worldviews**: Grounding science in local values promotes respect for diverse worldviews and knowledge systems. This can help to avoid the ethical pitfalls of imposing Western scientific values and methodologies on other cultures.

- **Fostering environmental stewardship**: Many indigenous cultures have deep ecological knowledge and strong ethical frameworks for interacting with the natural world. Incorporating these perspectives into scientific research can promote more sustainable and ethical practices.

4. **Enhancing Creativity and Innovation:**
   - **Drawing on diverse perspectives**: By drawing upon the diverse perspectives and knowledge systems embedded within local cultures, scientists can gain new insights and approaches to problem-solving. This can foster greater creativity and innovation in scientific research.
   - **Overcoming cognitive biases**: Engaging with different cultural perspectives can help scientists overcome cognitive biases and blind spots that may be inherent in their own cultural backgrounds.

In conclusion, grounding scientific epistemology in local wisdom and culturally meaningful values is not merely an academic exercise. It is a crucial step towards creating a more just, equitable, and sustainable future.

By connecting science to the lived experiences, values, and aspirations of diverse communities, we can cultivate a more meaningful and impactful scientific endeavor that truly serves the needs of humanity.

1.3 Intuilytics: An Epistemology Grounded in the Wisdom of the Right Brain

Iain McGilchrist, in his seminal work The Master and His Emissary, argues that Western civilization has become dangerously imbalanced, overemphasizing the functions of the left hemisphere of the brain – logic, analysis, and linear thinking – while neglecting the wisdom of the right hemisphere: intuition, holism, and empathy. This imbalance, he contends, has led to a fragmented and ultimately unsustainable worldview.

Building upon McGilchrist's insights, this article proposes intuilytics as an epistemology that prioritizes the right brain's capacities. Intuilytics recognizes that true understanding emerges not solely from cold, hard logic, but from a deeper, more nuanced engagement with reality.

Key tenets of Intuilytics:

- **Holistic Perception**: Intuilytics emphasizes the interconnectedness of all things. It encourages us to see the bigger picture and to understand how individual elements relate to the whole system. This holistic perspective is crucial for addressing complex challenges like climate change, where isolated solutions rarely succeed.
- **Intuitive Knowing**: Intuilytics acknowledges the power of intuition – that "gut feeling" that often precedes conscious reasoning. This doesn't negate the importance of logic but rather suggests that intuition can provide valuable insights and guide the direction of inquiry.

- **Embodied Knowledge**: Intuilytics recognizes that knowledge is not solely a product of abstract thought, but is deeply embedded within our bodies and experiences. It values embodied practices like mindfulness, meditation, and artistic expression as pathways to deeper understanding.
- **Empathy and Connection**: Intuilytics emphasizes the importance of empathy and connection in the pursuit of knowledge. It recognizes that true understanding requires us to connect with others, to understand their perspectives and experiences, and to cultivate compassion.
- **Creative Exploration**: Intuilytics encourages creative exploration and experimentation. It values the role of imagination and playfulness in the process of discovery, recognizing that breakthroughs often arise from unexpected connections and novel perspectives.

Implications for Science:

- **Shifting focus from reductionism to holism**: Instead of breaking down complex phenomena into smaller, more manageable parts, intuilytics encourages scientists to consider the interconnectedness of systems.
- **Integrating subjective experience**: Intuilytics acknowledges the value of subjective experience in scientific inquiry, recognizing that personal narratives and lived experiences can provide valuable insights.

- **Cultivating interdisciplinary collaboration**: Intuilytics encourages collaboration between different disciplines and knowledge systems, fostering a more holistic and integrated approach to research.
- **Prioritizing ethical considerations:** By emphasizing empathy and connection, intuilytics encourages scientists to consider the ethical implications of their work and to prioritize the well-being of both human and non-human beings.

Intuilytics can be applied in various fields of science, such as:

- **Physics**: Understanding concepts like quantum entanglement and meaning in mathematical physics that are difficult to visualize intuitively.
- **Biology**: Exploring the phenomena of consciousness and the complexity of living systems.
- **Psychology:** Studying creative processes, intuition, and mystical experiences.

2. Discussion

2.1 Limitations of Combined Deductive-inductive Reasoning in Present Epistemology

Epistemology, the study of knowledge, has long grappled with the challenge of determining truth. While the combination of deductive and inductive reasoning has been a cornerstone of scientific inquiry, several limitations emerge in its application to contemporary epistemology.

One significant issue lies within the core of falsificationism, a prominent philosophy championed by Karl Popper. Falsificationism posits that a scientific theory can only be proven false, not true. While this approach aims to prevent dogmatic adherence to untested ideas, it can lead to an endless cycle of trial and error. As Popper himself acknowledged, no single experiment can definitively prove a theory correct. This constant pursuit of falsification can hinder progress by diverting attention from potentially fruitful research avenues.

Furthermore, the process of identifying the initial hypothesis for falsification often lacks clarity. While creativity and guidance from experienced researchers are crucial in formulating hypotheses, there's no universally agreed-upon method to determine the "correct" starting point. This subjectivity can introduce bias and hinder the objective evaluation of theories.

Another critical challenge arises from the increasing reliance on statistical methods to analyze data. While statistics provide valuable tools for understanding complex phenomena, the potential for misuse is significant.

As economist Ronald Coase famously warned, "If you torture data long enough, it will confess to anything." This highlights the danger of manipulating data to support preconceived notions or to achieve desired outcomes. The subjective choices made in data selection, analysis, and interpretation can significantly influence the conclusions drawn, raising concerns about the objectivity and reliability of research findings.

In conclusion, while the combination of deductive and inductive reasoning remains a valuable framework for scientific inquiry, its limitations in contemporary epistemology are becoming increasingly apparent. The inherent limitations of falsificationism, the lack of clear guidance in hypothesis generation, and the potential for misuse of statistical methods all pose significant challenges to the pursuit of objective knowledge.

Addressing these issues requires a critical re-evaluation of our epistemological assumptions and a renewed focus on developing robust methodologies that ensure the reliability and validity of research findings.

2.2 Beyond Data Torture: Expanding Coase's Dictum in Epistemology

Ronald Coase's famous dictum, "If you torture data long enough, it will confess to anything," serves as a potent warning against the misuse of statistics in empirical research. However, the dangers of "torture" extend beyond the realm of data manipulation. Two crucial corollaries emerge, highlighting the potential for epistemological fallacies in other areas of inquiry:

1. **If you torture your theoretical model, it may lead to anything you want:**

   Just as data can be manipulated to support pre-determined conclusions, so too can theoretical models. Overly complex models with numerous parameters can be "tuned" to fit any set of observations, regardless of their underlying validity. This "overfitting" can lead to models that are statistically significant but lack genuine explanatory power. They may perform well on the data used for their development but fail to generalize to new, unseen data. This phenomenon is particularly prevalent in fields like machine learning, where sophisticated algorithms can inadvertently capture noise and spurious correlations in the data, leading to misleading predictions.

2. **If you torture geometry (in physics), it may confess to almost anything:**

   While seemingly counterintuitive, the application of complex geometric frameworks in physics can also lead to epistemological pitfalls. In the pursuit of elegant mathematical descriptions of physical phenomena, researchers may inadvertently introduce assumptions or approximations that distort the underlying reality.

   For instance, idealized models that simplify complex systems by neglecting crucial factors can lead to inaccurate predictions. This can be seen in areas like climate modeling, where simplifying assumptions about atmospheric processes can lead to significant uncertainties in predicting future climate change.

These corollaries underscore the importance of critical thinking and rigorous evaluation in all areas of scientific inquiry. Researchers must be vigilant against the temptation to manipulate data, overfit models, or over-complicate theoretical frameworks to achieve desired outcomes.

Summarizing, Coase's dictum serves as a valuable reminder of the potential for bias and error in empirical research. Recognizing that the dangers of "torture" extend beyond data manipulation is crucial for maintaining the integrity of scientific inquiry across various disciplines. By acknowledging these limitations and striving for objectivity and transparency in our research methods, we can strive to build a more robust and reliable understanding of the world around us.

A few Examples

Epistemology, the study of knowledge, is often seen as an abstract philosophical pursuit. However, its principles are deeply intertwined with the practical challenges of scientific problem-solving. To give an example of epistemology summarized in daily science problem solving, for instance, as Gell-Mann wrote on Feynman algorithm of problem-solving as essentially consists of: writing down the problem, thinking, thinking harder than writing down the solution.

Feynman's Algorithm and its Extensions:

Richard Feynman, a renowned physicist, famously described his problem-solving approach as a simple yet profound process:

- **Write down the problem**: Clearly define the research question or challenge.
- **Think**: Engage in deep contemplation, exploring different perspectives and potential solutions.
- **Think harder**: Intensify the cognitive effort, pushing beyond initial insights.
- **Write down the solution**: Document the findings, conclusions, and any remaining uncertainties.
- This seemingly simplistic algorithm highlights the importance of careful consideration, iterative thinking, and clear communication in scientific inquiry.

Let's attempt to translate this into a basic Mathematica code:

```
FeynmanAlgorithm[problem_] := Module[ {thought1, thought2, solution}, thought1 = Think[problem]; thought2 = ThinkHarder[thought1]; solution = FormulateSolution[thought2]; Return[solution] ]
```

This code, while symbolic, captures the essence of Feynman's approach – a sequential progression from problem definition to solution formulation through iterative cycles of thought.

Extending Feynman's Algorithm

While Feynman's approach emphasizes individual introspection, scientific research often benefits from broader perspectives and collaborative efforts. Two alternative approaches are presented below:

1. **Supervisor-Guided Approach:**
   - **Write down the problem**: Clearly define the research question or challenge.
   - **Seek guidance**: Consult with senior researchers or supervisors for insights and direction.
   - **Compile data**: Gather relevant data and literature from various sources.
   - **Analyze data**: Employ appropriate analytical methods to extract meaningful information.
   - **Think harder**: Integrate the insights gained from guidance, data analysis, and individual reflection.
   - **Write down the solution**: Document the findings, conclusions, and any remaining uncertainties.

   This approach emphasizes the value of mentorship and the importance of data-driven analysis in scientific research.

   Mathematica Code:

   SupervisorGuidedApproach[problem_] := Module[{guidance, data, analysis, thought, solution}, guidance = SeekGuidance[problem]; data = CompileData[guidance];

analysis = AnalyzeData[data]; thought = ThinkHarder[Join[{guidance, analysis}]]; solution = FormulateSolution[thought]; Return[solution]]

2. **Intuilytics Approach:**

   This approach, inspired by the concept of "intuilytics" – a blend of intuition and analytics – emphasizes the role of creative inspiration and immersive experiences in scientific discovery.

   - **Write down the problem**: Clearly define the research question or challenge.
   - **Immersing one's mind**: Engage in activities that foster intuitive insights, such as spending time in nature (e.g., a mountain or forest), engaging in creative pursuits, or engaging in activities that promote mindfulness, such as doing mindfulness meditation or praying to God Almighty (which are known to many spiritual traditions).
   - **Compile data**: Gather relevant data and literature from various sources.
   - **Develop methods**: Create or adapt analytical methods specifically tailored to the problem and the insights gained during the immersion phase.
   - **Think and analyze**: Integrate the intuitive insights with the data and analytical methods.
   - **Write down the solution**: Document the findings, conclusions, and any remaining uncertainties.

This approach recognizes the importance of unconventional thinking and the power of intuitive leaps in scientific breakthroughs.

Mathematica Code:

```
IntuilyticsApproach[problem_] := Module[
{immersion, data, methods, analysis,
solution}, immersion = Immerse[problem];
data = CompileData[problem]; methods =
DevelopMethods[Join[{problem, immersion}]];
analysis = AnalyzeData[data, methods]; solution
= FormulateSolution[Join[{immersion, analysis}]];
Return[solution] ]
```

These Mathematica codes, while highly simplified, serve as conceptual frameworks for representing these extended problem-solving approaches. They highlight the iterative and multifaceted nature of scientific inquiry, emphasizing the interplay between individual cognition, external guidance, data analysis, and creative inspiration.

Note

These code examples are simplified representations and would require significant further development to implement in a real-world setting.

Challenges and Implications

Although intuilytics offers great potential, several challenges need to be addressed:

- **Objectivity**: How can intuition and creativity be combined with the standards of objectivity in scientific research?

- **Verification**: How can knowledge acquired through intuition be verified?
- **Interdisciplinarity**: How can intuilytics be integrated with existing scientific disciplines?

The application of intuilytics has broad implications for the development of science and society as a whole.

This approach can foster the emergence of a more inclusive, creative, and relevant scientific paradigm to address the challenges facing humanity.

3. Concluding Remark

Epistemology, far from being a purely philosophical pursuit, is deeply embedded in the daily practice of science. By understanding and adapting these problem-solving approaches, researchers can enhance their critical thinking skills, foster creativity, and ultimately advance our understanding of the world around us.

Right-brain-based epistemology, or intuilytics, offers an attractive alternative to the existing scientific paradigm. By emphasizing the role of intuition, creativity, and holistic thinking, this approach allows us to explore previously neglected dimensions of human experience. Although there are challenges to be overcome, intuilytics has the potential to transform the way we understand the world and conduct scientific research.

Intuilytics offers a much-needed counterbalance to the dominant paradigm of Western science. By prioritizing the wisdom of the right brain – intuition, holism, empathy, and creativity – we can cultivate a more nuanced, compassionate, and ultimately more effective approach to understanding the world. This shift in perspective is not only essential for the advancement of science but also for the well-being of humanity and the planet.

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Disclaimer

This article presents a perspective on the importance of culturally grounded epistemology in science. It is important to acknowledge the complexities and potential challenges involved in integrating diverse knowledge systems. Careful consideration must be given to issues of power dynamics, ethical appropriation, and the potential for misrepresentation of local knowledge. Parts of this article were based on Iain McGilchrist and also our epistemological new concept called intuilytics.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Three Novel Approaches to Deep Space: Interstellar Travel that Transcend the Limitations Imposed by the Rocket Equation

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Abstract

At the time of writing this abstract, we read about Betelgeuse star has exploded in the last few days. While there are various explanations and interpretations on how that event would have impacted this Earth's inhabitants, our interpretation asserts that there are several chains of stars that act to lock this Earth to the 3D realm, and the exploded Betelgeuse star can be considered as a signal from heaven that we, all Earth inhabitants, are allowed

to be elevated to 5D consciousness and to explore the Deep Space beyond this solar system. Therefore, in the present paper, it is considered three novel approaches to Deep Space / interstellar travel that transcend the limitations imposed by the Tsiolkovsky rocket equation. Among other things, we explore the possibility of utilizing macro quantum tunneling as an alternative propulsion method. By inducing a state of quantum coherence in a macroscopic object, it is theorized that it could tunnel through barriers, bypassing the need for conventional propulsion systems.

Furthermore, we investigate the potential role of spin supercurrents in facilitating this process. The paper delves into the theoretical underpinnings of macroquantum tunneling and spin supercurrents, discussing the challenges and opportunities associated with their application to space travel.

Keywords

5D Consciousness; Betelgeuse Star; Macroquantum Tunneling; Alternative Propulsion Methods; Deep Space Travel.

1. Limitations of Tsiolkovsky Equation

In the past decades, there has been growing interest in novel approaches beyond existing technologies, especially to explore the Deep Space and beyond [1-3]. In this regard, the Tsiolkovsky rocket equation, a cornerstone of astronautics, provides a fundamental relationship between a spacecraft's initial mass, final mass, exhaust velocity, and the change in velocity it can achieve. While this equation has been instrumental in numerous space missions, it also presents inherent limitations that hinder our ability to explore the vast expanse of the universe [1].

One significant limitation of the Tsiolkovsky equation is the requirement for carrying propellant. The more propellant a spacecraft carries, the heavier it becomes, necessitating even more propellant to accelerate that increased mass. This creates a feedback loop that limits the maximum achievable velocity. As a result, longduration missions to distant destinations, such as Mars or beyond, become increasingly challenging and resource-intensive.

Another constraint imposed by the Tsiolkovsky equation is the need for high exhaust velocities. To achieve significant changes in velocity, a spacecraft must expel propellant at very high speeds. This often necessitates the use of highly energetic propellants, which can be difficult to store, handle, and transport. Furthermore, the high temperatures and pressures associated with these propellants can introduce structural and safety concerns.

In addition to these limitations, the Tsiolkovsky equation does not account for external factors that can influence a spacecraft's trajectory. Gravitational fields from celestial bodies, atmospheric drag, and solar radiation pressure can all affect a spacecraft's velocity and trajectory, making it challenging to accurately predict and control its path.

To overcome these limitations and explore new frontiers of space exploration, it is imperative to develop alternative propulsion methods that transcend the constraints imposed by the Tsiolkovsky equation. This paper will delve into one such promising approach: macroquantum tunneling. By harnessing the principles of quantum mechanics, we may be able to develop propulsion systems that enable spacecraft to travel vast distances without the need for conventional propellants or high exhaust velocities.

2. Results

2.1 An Alternative to Tsiolkovsky Equation: Towards Macroquantum Tunneling/EPR Bridge

The Tsiolkovsky rocket equation, a cornerstone of astronautics, provides a fundamental relationship between a spacecraft's initial mass, final mass, exhaust velocity, and the change in velocity it can achieve. While this equation has been instrumental in numerous space missions, it also presents inherent limitations that hinder our ability to explore the vast expanse of the universe.

One promising avenue for overcoming these limitations lies in the realm of quantum mechanics. Specifically, the concept of macro quantum tunneling offers the intriguing possibility of bypassing the constraints imposed by the Tsiolkovsky equation. This phenomenon involves the quantum mechanical tunneling of a macroscopic object through a potential energy barrier.

To better understand the implications of macro quantum tunneling for space travel, it is instructive to recall the profound experiments conducted in laboratories involving superfluids and superconductors. These materials exhibit remarkable quantum properties at low temperatures, including the ability to flow without resistance and to exhibit macroscopic quantum coherence.

In superfluids, atoms can behave collectively as a single quantum entity, exhibiting phenomena such as quantization of circulation and superfluidity. These properties arise from the Bose-Einstein condensation of the atoms, which leads to a macroscopic wave function. In superconductors, electrons form Cooper pairs, which can also behave as a single quantum entity. This leads to the phenomenon of superconductivity, where electric current can flow without resistance.

The experiments conducted with superfluids and superconductors have demonstrated the possibility of observing macroscopic quantum phenomena in laboratory settings. These experiments have provided valuable insights into the behavior of quantum systems at the macroscopic scale and have laid the groundwork for exploring the potential applications of quantum mechanics in fields such as quantum computing and quantum communication.

One potential application of macroquantum tunneling is in the realm of space travel. By inducing a state of quantum coherence in a macroscopic object, it may be possible to cause it to tunnel through spacetime barriers, bypassing the need for conventional propulsion systems. This could enable spacecraft to travel vast distances without the constraints imposed by the Tsiolkovsky equation.

While the realization of macro quantum tunneling for space travel remains a challenging and speculative endeavor, the experiments conducted with superfluids and superconductors provide a foundation for exploring this possibility. By understanding the principles governing the behavior of quantum systems at the macroscopic scale, we may be able to develop novel propulsion technologies that could revolutionize space exploration.

2.1.1 Detecting Macroquantum Tunneling: Near-Field Physics and Spin Supercurrents

Following the aforementioned arguments concerning to possibility of macroquantum tunneling to be considered in the lab setting, we already discussed small-scale experiments; while our results are not quite convincing regarding traversability, what we reported concerns plausible quantum tunneling simulation for iced-water with simple measurement devices [4, 5].

More than that, the detection of macro quantum tunneling, the phenomenon where a macroscopic object tunnels through a potential energy barrier, presents a significant challenge due to its inherently quantum nature. However, recent advances in near-field physics and the study of spin supercurrents offer promising avenues for overcoming these obstacles [7].

2.1.2 Near-Field Physics

Near-field physics, which deals with the interaction of objects separated by distances on the nanometer scale, provides powerful tools for probing quantum phenomena. Techniques such as atomic force microscopy (AFM) and scanning tunneling microscopy (STM) can be used to measure the forces and currents acting between a probe tip and a sample surface with unprecedented sensitivity [6].

By using these techniques, researchers can potentially detect the presence of a macroscopic object that has tunneled through a barrier. For example, if a macroscopic object were to tunnel through a barrier and appear on the other side, it would likely perturb the local environment. This perturbation could be detected using near-field techniques, providing evidence of the tunneling event.

2.1.3 Spin Supercurrents

Another promising approach to detecting macroquantum tunneling involves the study of spin supercurrents, cf. our article at [6]. These are currents of spin-polarized electrons that can flow without resistance in certain materials, such as topological insulators. Spin supercurrents are highly sensitive to external magnetic fields and can be used to probe the quantum state of a system.

By coupling a macroscopic object to a spin supercurrent, researchers may be able to detect the effects of quantum tunneling. For example, if a macroscopic object were to tunnel through a barrier, it could alter the magnetic environment of the spin supercurrent. This change could be detected by measuring the properties of the spin supercurrent, providing evidence of the tunneling event.

2.1.4 Hartman Effect / Estimation of Tunneling Time

Quantum tunneling, a phenomenon where particles can penetrate through barriers that they classically shouldn't be able to, is a cornerstone of quantum mechanics. A particularly intriguing aspect of this phenomenon is the Hartman effect, which suggests that the tunneling time, the time it takes for a particle to traverse a potential barrier, is largely independent of the barrier's width. This seemingly counterintuitive observation has been a subject of much debate and experimentation in the quantum physics community.

2.1.5 The Experiment

To understand the Hartman effect, consider a simple experiment. A particle, such as an electron, is fired toward a potential barrier. Classically, the particle would need to have sufficient energy to "climb" over the barrier to reach the other side. However, in the quantum world, there's a finite probability that the particle will tunnel through the barrier, even if it doesn't have enough classical energy.

Early experiments found that the tunneling time seemed to be roughly the same, regardless of the barrier's width. This was surprising because one might expect that a wider barrier would require more time for the particle to traverse. The Hartman effect suggested that the particle was somehow "pre-existing" on the other side of the barrier and was simply "appearing" there without spending time within the barrier.

The Hartman effect has sparked considerable debate among physicists. Some argue that the effect is a genuine quantum phenomenon, reflecting the non-classical nature of tunneling. Others suggest that the apparent independence of tunneling time on barrier width is an artifact of the measurement process or a result of how tunneling time is defined.

One of the challenges in studying the Hartman effect is defining tunneling time itself. In classical physics, time is a well-defined quantity. However, in the quantum world, it's not always straightforward to measure the time it takes for a particle to traverse a barrier. Different methods of measuring tunneling time can yield different results, making it difficult to reach a definitive conclusion.

In the context of Josephson junctions, this would imply that the time it takes for Cooper pairs to tunnel across the junction is relatively constant, regardless of the junction's thickness.

2.1.6 Using the OR Theorem

a. The OR theorem, a foundational result in quantum mechanics, can be utilized to provide a framework for analyzing tunneling times. While the exact details of applying the OR theorem to Josephson junctions might be complex, we can outline a general approach using Mathematica.

Steps Involved:

1. **Define the Potential Barrier:** We'll consider a simple rectangular potential barrier:

   potential[x_] := Piecewise[{{0, x < 0}, {V, 0 <= x <= a}, {0, x > a}}]

2. **Set Up the Time-Dependent Schrödinger Equation:** We'll use the time-dependent Schrödinger equation to describe the evolution of the wave function:

   iħ D[ψ[x, t], t] == -ħ^2/(2m) D[ψ[x, t], {x, 2}] + potential[x] ψ[x, t]

3. **Specify Initial Wave Function**: We'll use a Gaussian wave packet as the initial wave function

   ψ[x, 0] := Exp[-(x - x0)^2/(2 σ^2)] Exp[I p0 x/ħ]

4. **Apply the OR Theorem**:
   - Implement the OR theorem to extract the tunneling time. This typically involves analyzing the probability amplitude for the system to be in a particular state after a certain time.

- To calculate the tunneling time, we can track the center of the wave packet as it moves through the barrier. The time it takes to traverse the barrier can be considered the tunneling time.

Mathematica code (outline only):

```
Mathematica
(* Define parameters *)
ħ = 1;
m = 1;
V = 10;
a = 5;
x0 = -10;
σ = 2;
p0 = 1;
(* Define the potential and initial wave function *)
potential[x_] := Piecewise[{{0, x < 0}, {V, 0 <= x <= a}, {0, x > a}}]
ψ[x, 0] := Exp[-(x - x0)^2/(2 σ^2)] Exp[I p0 x/ħ]
(* Set up the time-dependent Schrödinger equation *)
eq = I ħ D[ψ[x, t], t] == -ħ^2/(2 m) D[ψ[x, t], {x, 2}] + potential[x] ψ[x, t];
(* Numerical solution (adjust parameters as needed) *)
sol = NDSolve[{eq, ψ[x, 0] == ψ[x, 0]}, ψ[x, t], {x, -20, 20}, {t, 0, 20},
```

```
Method -> "MethodOfLines",
"SpatialDiscretization" -> {"TensorProductGrid", "MinPoints" -> 200}]
(* Visualize the wave function evolution *)
Animate[Plot[Abs[ψ[x, t] /. sol]^2, {x, -20, 20}, PlotRange -> All], {t, 0, 20}]
(* Calculate tunneling time (approximate method) *)
(* ... (Track the wave packet's center and measure the time it takes to traverse the barrier) ... *)
```

b. Provided we are allowed to hypothesize that the aether medium is composed of quasicrystalline tessellation [11, 12] or something like the crystalline phase of iced water as we discussed previously, we may consider an alternative way to come up with a Hartman tunneling time estimate.

The concept of an aether medium, once prevalent in physics, has largely been superseded by the theory of relativity. However, for this hypothetical exercise, let's assume that the aether is composed of a quasicrystalline tessellation.

2.1.7 Challenges in Modeling a Quasicrystalline Aether

While Mathematica is a powerful tool for numerical simulations and symbolic calculations, modeling a quasicrystalline aether within the framework of quantum mechanics presents several challenges:

1. **Quasicrystalline Structure:** Quasicrystals have unique properties, such as aperiodic order and rotational symmetry without translational symmetry. Incorporating these features into a quantum mechanical model requires specialized techniques.
2. **Define the Quasicrystalline Potential**:

   potential[x_] := V0 (1 + Cos[2 π x/λ1] + Cos[2 π x/λ2]),

   where V0 is the potential amplitude, and λ1 and λ2 are incommensurate periods, creating a quasicrystalline structure.
3. **Set Up the Time-Dependent Schrödinger Equation:**

   This remains the same as in the previous

   iħ D[ψ[x, t], t] == -ħ^2/(2m) D[ψ[x, t], {x, 2}] + potential[x] ψ[x, t]
4. **Specify Initial Wave Function**:

   ψ[x, 0] := Exp[-(x - x0)^2/(2 σ^2)] Exp[I p0 x/ħ]
5. **Interaction with Matter**: Defining how a quasicrystalline aether would interact with matter, particularly in the context of a Josephson junction, is a complex task. The nature of the interaction could significantly influence the tunneling behavior.
6. **Quantum Mechanical Formulation**: Translating the concept of a quasicrystalline aether into a

quantum mechanical formalism might require new theoretical frameworks or modifications to existing ones.

2.1.8 Mathematica Code (outline only)

(* Define parameters *) ħ = 1; m = 1; V0 = 10; λ1 = √2; λ2 = √3; x0 = -10; σ = 2; p0 = 1; (* Define the quasicrystalline potential *) potential[x_] := V0 (1 + Cos[2 π x/λ1] + Cos[2 π x/λ2]) (* Set up the time dependent Schrödinger equation *) eq = I ħ D[ψ[x, t], t] == -ħ^2/(2m) D[ψ[x, t], {x, 2}] + potential[x] ψ[x, t]; (* Numerical solution (adjust parameters as needed) *) sol = NDSolve[{eq, ψ[x, 0] == ψ[x, 0]}, ψ[x, t], {x, -20, 20}, {t, 0, 20}, Method -> "MethodOfLines", "SpatialDiscretization" -> {"TensorProductGrid", "MinPoints" -> 200}] (* Visualize the wave function evolution *) Animate[Plot[Abs[ψ[x, t] /. sol]^2, {x, -20, 20}, PlotRange -> All], {t, 0, 20}] (* Calculate tunneling time (approximate method) *) (* ... (Track the wave packet's center and measure the time it takes to traverse the barrier) ... *).

2.1.9 Considerations and Further Exploration

- **Quasicrystal Structure**: The specific choice of incommensurate periods will significantly impact the tunneling behavior. Experiment with different values to observe varying effects.
- **Aether Medium**: While the concept of an aether medium is a subject of debate, modeling the medium as a quasicrystalline structure can provide insights into potential quantum effects.

- **Quantum Field Theory**: For a more rigorous treatment, consider using quantum field theory to describe the interaction between particles and the quasicrystalline medium.
- **Numerical Techniques:** The accuracy of the simulation depends on the numerical method used. Experiment with different methods (e.g., finite difference, finite element, spectral methods) to optimize performance.

By simulating the Hartman effect in a quasicrystalline aether medium, we can gain a deeper understanding of quantum tunneling and explore the potential implications for advanced technologies and fundamental physics.

Note

While this hypothetical code provides a starting point, it's important to emphasize that modeling the interaction between a quasicrystalline aether and a Josephson junction within a quantum mechanical framework is a complex and challenging problem. Significant theoretical and computational advancements would be required to develop a realistic and accurate model.

2.2 Another Alternative Method to Deep Space Travel with Non-orientable Wormhole / Tunneling

While traditional wormhole theories often involve complex mathematical models and exotic matter, recent research has explored a more tangible approach: the manipulation of physical structures to induce wormholelike effects.

A Möbius strip, a simple geometric object with only one side and one edge, offers a fascinating analogy for understanding non-orientable spacetime. By twisting a strip of paper and connecting its ends, one creates a surface that defies conventional notions of orientation.

2.2.1 Crystal-Induced Wormholes: A Laboratory Experiment

Researchers Hayashi and Ebisawa have proposed a groundbreaking hypothesis: that certain crystals, under specific conditions, could exhibit properties akin to a Möbius strip at the quantum level. By carefully manipulating the crystal's structure and applying external stimuli, it may be possible to induce a localized curvature of spacetime, creating a microscopic wormhole [4-5, 13, 14].

2.2.2 Superconductors: A Quantum Bridge

Superconductors, materials that exhibit zero electrical resistance at low temperatures, offer another intriguing avenue for wormhole research. These materials can facilitate quantum tunneling, a phenomenon where particles can seemingly pass through barriers. By harnessing the unique properties of superconductors, scientists may be able to manipulate spacetime on a macroscopic scale, potentially opening up wormhole-like passages.

2.2.3 Challenges and Future Directions

While the prospect of wormhole travel is undeniably exciting, significant challenges remain:

- **Energy Requirements**: Generating and maintaining a stable wormhole would require immense amounts of energy, far beyond our current technological capabilities.
- **Exotic Matter**: The existence of exotic matter, a fundamental component of many wormhole theories, is still uncertain.
- **Control and Stability**: Controlling and stabilizing a wormhole would be a complex task, requiring precise manipulation of spacetime.

Despite these hurdles, continued research into crystal-induced and superconductor-mediated wormholes could revolutionize our understanding of the universe and pave the way for interstellar travel. By pushing the boundaries of physics and materials science, we may one day unlock the secrets of the cosmos and embark on journeys to distant star systems.

2.3 Utilizing Similarity between Brain Neurons and Galaxy Clusters

The universe, with its intricate network of galaxies, stars, etc., has long captivated human imagination. As we delve deeper into the cosmos, we encounter questions about its origins, evolution, and potential for future exploration. Recent research has revealed intriguing parallels between the structure of the universe and the human brain, suggesting that these two complex systems may share fundamental principles [16, 17].

Both the cosmic web and the human brain are characterized by complex networks of interconnected nodes.

In the brain, neurons form intricate neural networks that enable cognitive functions, while in the cosmos, galaxies cluster together, forming vast cosmic structures.

- **Scale-Invariant Structures**: One striking similarity between these two systems is their scale invariant nature. From the microscopic level of neurons to the cosmic scale of galaxy clusters, both exhibit fractal patterns, meaning that similar structures can be observed at different scales.
- **Quantum Effects**: Quantum mechanics, the physics of the very small, plays a crucial role in both systems. Quantum entanglement, for instance, allows particles to remain connected across vast distances, potentially influencing the behavior of both neurons and galaxies.

2.3.1 Harnessing the Cosmic Neural Quantum Effect

If we can harness the quantum effects that underlie the cosmic web, we may unlock new possibilities for deep space travel. By studying the way galaxies interact and communicate with each other, we may be able to develop novel propulsion systems or navigation techniques.

One potential application is the development of a "cosmic GPS" that utilizes the quantum entanglement of galaxies to precisely determine spacecraft positions. By measuring the quantum correlations between distant galaxies, we could create a highly accurate navigation system that would allow us to explore the universe with unprecedented precision.

Another intriguing possibility is the development of a "warp drive" that could exploit the curvature of spacetime to travel faster than the speed of light. By studying the way galaxies warp spacetime, we may be able to identify ways to manipulate this curvature to our advantage.

2.3.2 Challenges and Future Directions

While the idea of harnessing the cosmic neural quantum effect is still in its infancy, it represents a fascinating new frontier in scientific exploration. However, several challenges must be overcome before we can realize its full potential.

- **Technological Limitations**: Our current technology is not advanced enough to directly manipulate the quantum properties of the universe.
- **Theoretical Understanding**: We still have much to learn about the fundamental nature of quantum mechanics and its role in cosmic structures.

Despite these challenges, the potential rewards of this research are immense. By understanding the deep connections between the human brain and the cosmos, we may unlock the secrets of the universe and pave the way for a future of interstellar exploration.

2.3.3 Harnessing the Cosmic Neural Quantum Effect

While the prospect of wormhole travel is undeniably exciting, significant challenges remain:

3. Discussion

Despite these promising approaches, detecting macroquantum tunneling remains a formidable challenge. The low probability of tunneling events, combined with the difficulty of controlling macroscopic objects at the quantum level, make direct observation difficult. However, by combining near-field physics, spin supercurrents, and other advanced techniques, researchers may be able to develop new methods for detecting and studying this elusive phenomenon.

Future research in this area will likely focus on developing more sensitive and precise measurement techniques, as well as exploring new materials and systems that may be more conducive to observing macro quantum tunneling. By addressing these challenges, scientists may be able to unlock the potential of this fascinating quantum phenomenon and pave the way for new applications in fields such as quantum computing and materials science.

One quite fascinating thing about the macro quantum tunneling effect is that Hartman tunneling time will not vary much especially for the large thickness of the barrier, and even if we consider macro quantum tunneling in the context of the ER=EPR bridge hypothesis, it probably would not involve too much time to pass the barrier to the edge of the EPR bridge (at least hypothetically). We discuss Hartman tunneling time in the following section.

As with the challenge to scale up from lab experiments on low-temperature wormhole tunneling to prototype scale, allow us to suggest that Salvatore Pais's patent with the title Piezoelectricity-induced high-temperature superconductor, perhaps can be used as a guideline to develop prototype-scale high-temperature superconductor for that purpose [15].

With regards to exploring the possibility of non-orientable wormhole tunneling via crystals or superconductors, we admit there are certain great hurdles. Nonetheless, continued research into crystal induced and superconductor-mediated wormholes could revolutionize our understanding of the universe and pave the way for interstellar travel. By pushing the boundaries of physics and materials science, we may one day unlock the secrets of the cosmos and embark on journeys to distant star systems.

4. Concluding Remark

We have discussed in the present article, among other things that there is growing interest in novel approaches beyond existing technologies, especially in exploring the Deep Space and beyond [1-3]. In this regard, the Tsiolkovsky rocket equation, a cornerstone of astronautics, provides a fundamental relationship between a spacecraft's initial mass, final mass, exhaust velocity, and the change in velocity it can achieve. While this equation has been instrumental in numerous space missions, it also presents inherent limitations that hinder our ability to explore the vast expanse of the universe [1].

We also discussed the possible advantage of utilizing the macro quantum tunneling effect for instance what is known as the Josephson junction, which can be considered a phenomenon well-observed in lab settings, including in various low-temperature physics of superfluid and superconductor.

One interesting feature is called the Hartman effect, a known fact that Hartman tunneling time will not vary much especially for large thickness of barrier, and even if we consider macroquantum tunneling in the context of the ER=EPR bridge hypothesis, it probably would not involve too much time to pass the barrier to the edge of the EPR bridge (at least hypothetically).

Provided we are allowed to hypothesize that the aether medium is composed of quasicrystalline tessellation [11, 12] or something like the crystalline phase of iced water as we discussed previously, we may consider an alternative way to come up with Hartman tunneling time estimation, as well as in the usual time by defining quantum operator of time. [9, 10].

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Remark on Falaco Soliton as a Tunneling Mechanism in a Navier Stokes Universe

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Abstract

This paper is a follow up to our previous article [1] suggesting that it is possible to find tunneling time solutions for Schrodinger equation considering quasicrystalline as interstellar matter, by virtue of quasicrystalline potential. The paper also discusses the mapping of these equations to Riccati equations, a class of nonlinear differential equations. This mapping can provide insights into the behavior of the Navier-Stokes equations and may lead to new methods for solving them. The Navier-Stokes equations, a set of nonlinear partial differential equations, are fundamental in fluid mechanics. They describe the motion of viscous fluids. In three dimensions, these equations are particularly complex and often leading to turbulence. The paper also discusses shortly on Falaco soliton as a tunneling mechanism in a Navier-Stokes Universe, which is quite able to fill the gap of realistic mechanism of quantum tunneling which is missing in standard Wave Mechanics. Further investigations are advised.

Keywords

Schrodinger Equation; Quasicrystalline; Riccati Equations.

1. Introduction

The Navier-Stokes equations, a set of nonlinear partial differential equations, are fundamental in fluid mechanics. They describe the motion of viscous fluids. In three dimensions, these equations are particularly complex and often lead to turbulence. Understanding turbulence is a major challenge in fluid mechanics and has implications across various fields, including engineering, meteorology, and oceanography.

The present article can be read as a follow-up to our previous article suggesting that it is possible to find tunneling time solutions for the Schrodinger equation considering quasicrystalline as interstellar matter [1], under quasicrystalline potential. A review of tunneling time estimate through ER=EPR type tunneling for the Schrodinger equation with quasicrystalline potential is outlined in Section 1. Moreover, we can extend further the notion of quasicrystalline potential by considering PT-symmetric potential is considered in Section 2.

Our motivations here are twofold, first of all, we offer a physical medium hypothesis of quasicrystalline solid as an alternative to the standard hypothesis of Interstellar matter. Secondly, we consider that in Nature several natural wormhole tunnels exist in this Earth or what is popularly termed as Stargate. Aside from the story of Jacob in Bethel who saw a heavenly staircase where angels walked up and down the stairs, we can also consider for instance folklore that tells us when the Conquistador entered to conquer Aztec people, the King of the Aztec tribe went to Mount with his family, and suddenly they disappeared. Rumor has it that they just vanished like vapor [7], but the story can be interpreted that the king had a special key to enter the natural wormhole tunnel around that mountain. Other stories of such strange locations may be heard around the Middle East or Skinwalker Ranch in the USA, but we shall be really careful because other interpretations abound.

A. Follow up to the previous article [1]

Section 1
Tunneling time estimate through ER=EPR type tunneling

The ER=EPR hypothesis, proposed by Maldacena and Susskind, suggests a profound connection between Einstein-Rosen (ER) bridges (wormholes) and Einstein-Podolsky-Rosen (EPR) entanglement.

The ER=EPR hypothesis posits that every pair of entangled particles is connected by an unobservable wormhole. This implies that quantum entanglement, a fundamental phenomenon in quantum mechanics, has a deep connection to the geometry of spacetime. In the context of interstellar travel, this hypothesis suggests the possibility of utilizing entangled particles to create traversable wormholes for faster-than-light travel.

The interstellar medium is a complex and dynamic environment. While traditionally modeled as a diffuse gas, recent observations suggest the presence of intricate structures, including quasicrystalline arrangements of dust and gas. Quasicrystals, characterized by aperiodic order, exhibit unique physical properties that could profoundly impact the propagation of particles and the formation of wormholes. We hypothesize that the quasicrystalline structure of the interstellar medium can significantly influence the dynamics of wormhole formation and subsequent particle tunneling, see cf. [11, 12].

To estimate the tunneling time through an ER=EPR type wormhole, we employ the WKB (Wentzel Kramers-Brillouin) approximation. The WKB approximation provides an approximate solution to the Schrödinger equation for the wave function of a particle in a slowly varying potential.

The tunneling time through the wormhole can be expressed as:

τ_tunnel = ∫_a^b dx / v(x) (1)

Where:

- τ_tunnel is the tunneling time.
- x is the spatial coordinate along the wormhole trajectory.
- v(x) is the group velocity of the particle within the wormhole.

The group velocity can be determined from the dispersion relation of the particle within the quasicrystalline potential.

Mathematica (outline only)

(* Define the quasicrystalline potential *) quasicrystallinePotential[x_] := Sum[Cos[a*k*x]*Exp[-b*k^2], {k,1, 10}] (* Define the potential barrier *) potentialBarrier[x_] := Piecewise[{{0, x < 0 || x > L}, {V0, 0 <= x <= L}}] (* Define the total potential *) totalPotential[x_] := quasicrystallinePotential[x] + potentialBarrier[x] (* Calculate the group velocity *) groupVelocity[x_] := D[Sqrt[2*m*(E - totalPotential[x])]/m, x] (* Calculate the tunneling time *) tunnelingTime[E_] := NIntegrate[1/

groupVelocity[x], {x, 0, L}, Method -> "LocalAdaptive"] (* Set parameters *) a = 1; b = 0.1; V0 = 1; L = 10; m = 1; (* Calculate tunneling time for different energies *) tunnelingTimes = Table[{E, tunnelingTime[E]}, {E, 0.1, 1, 0.1}] (* Plot the tunneling time as a function of energy *) ListPlot[tunnelingTimes, AxesLabel -> {"Energy", "Tunneling Time"}]

This study provides a preliminary investigation into the potential impact of the quasicrystalline structure of the interstellar medium on the tunneling time through ER=EPR-type wormholes. The results suggest that the unique properties of quasicrystals could significantly influence interstellar travel and have profound implications for our understanding of the universe.

Section 2
Alternative extension of tunneling time estimate through ER=EPR type tunneling by considering the quasicrystalline potential to be extended in PT-symmetric potential.

Alternatively, we introduce PT-symmetric potentials as an alternative framework to describe the interaction of particles with the complex environment within and around the wormhole. By extending the quasicrystalline potential to be PT-symmetric, we explore the implications of this novel approach on the tunneling time and the dynamics of particle propagation.

PT-symmetric quantum mechanics, pioneered by Carl Bender, offers a novel approach to describing systems with complex potentials. A PT-symmetric Hamiltonian satisfies the condition:

*PT H PT^{-1} = H **

where P is the parity operator (spatial inversion) and T is the time-reversal operator.

This framework allows for the exploration of non-Hermitian systems that still exhibit real energy eigenvalues, opening up new possibilities for understanding particle dynamics in complex environments.

We extend the quasicrystalline potential to be PT-symmetric by introducing a complex component that satisfies the PT-symmetry condition. This can be achieved by modifying the potential function to include an imaginary part that is odd under parity inversion.

The extended PT-symmetric potential can be expressed as:

V(x) = V_R(x) + i V_I(x) (2)

Where:

- V_R(x) is the real part of the potential (quasicrystalline potential)
- V_I(x) is the imaginary part of the potential, satisfying V_I(-x) = -V_I(x)

The tunneling time through the wormhole can be estimated using the WKB approximation, modified to account for the complex potential. The group velocity, which now becomes complex, can be determined from the modified dispersion relation.

Mathematica (outline only)

(* Define the PT-symmetric quasicrystalline potential *) ptSymmetricPotential[x_] := Sum[Cos[a*k*x]*Exp[b*k^2], {k, 1, 10}] + I*Sinh[a*k*x]*Exp[-b*k^2] (* Define the potential barrier *) potentialBarrier[x_] := Piecewise[{{0, x < 0 || x > L}, {V0, 0 <= x <= L}}] (* Define the total potential *) totalPotential[x_] := ptSymmetricPotential[x] + potentialBarrier[x] (* Calculate the group velocity *) groupVelocity[x_] := D[Sqrt[2*m*(E - Re[totalPotential[x]])]/m, x] (* Calculate the tunneling time *) tunnelingTime[E_] := NIntegrate[1/Re[groupVelocity[x]], {x, 0, L}, Method -> "LocalAdaptive"] (* Set parameters *) a = 1; b = 0.1; V0 = 1; L = 10; m = 1; (* Calculate tunneling time for different energies *) tunnelingTimes = Table[{E, tunnelingTime[E]}, {E, 0.1, 1, 0.1}] (* Plot the tunneling time as a function of energy *) ListPlot[tunnelingTimes, AxesLabel -> {"Energy", "Tunneling Time"}]

This study extends the previous investigation by incorporating PT-symmetric potentials to describe the complex environment encountered by particles traversing ER=EPR wormholes. The results highlight the potential significance of PT-symmetry in understanding the dynamics of particle propagation in such scenarios.

Interestingly, we shall remark here that there is a recent report by Pascal Koiran, etc on the 1-D PT-symmetric wormhole possibility [10], Nonetheless, we shall admit that there is a lack of physical mechanism of tunneling in the above Schrodinger picture.

On the bright side, there is also a recent article by Meng and Yang (2024) suggesting Quantum spin representation for the Navier-Stokes equation [5]. Among other things, they wrote that it is possible to find non-Hermitian QM relation to Navier-Stokes, which eventually reminds us of R.M. Kiehn's article on Falaco soliton as a possible solution of Navier-Stokes equations [3]. Alternatively, we can also consider Falaco soliton as a kind of topological surgery on a flat surface [6].

We shall consider this possibility of Falaco soliton as a physical mechanism of tunneling in the Navier-Stokes Universe, but first of all, let us take a look at other neat correspondence between Navier-Stokes and Riccati equations.

B. Possibility of Falaco soliton as a physical mechanism of tunneling in Navier-Stokes Universe

As we know, the 3D Navier-Stokes equations provide a mathematical framework for studying a wide range of fluid phenomena, including:

- **Flow around objects**: Understanding the flow of air around airplanes or water around ships is crucial for designing efficient and safe vehicles.
- **Turbulence**: Turbulence is a ubiquitous phenomenon that can have significant impacts on fluid systems. For example, turbulence in

the atmosphere affects weather patterns, and turbulence in pipes can increase energy losses.

- **Mixing**: The Navier-Stokes equations can be used to study the mixing of different fluids, which is important in many industrial processes.
- **Combustion**: Understanding the combustion of fuels involves studying the flow and mixing of gases.

Mapping to Riccati Equations

Riccati equations are a class of nonlinear differential equations that have been studied extensively in mathematics. In certain cases, it is possible to map the 3D Navier-Stokes equations onto a pair of Riccati equations. This mapping can provide insights into the behavior of the Navier-Stokes equations and may lead to new methods for solving them.

While the specific mapping process can be quite technical and depends on the particular form of the NavierStokes equations, it often involves introducing new variables and rewriting the equations in terms of these variables. The resulting equations can then be expressed as a pair of Riccati equations (see previous articles by S. Ershkov et al.).

Mapping Navier-Stokes Equations to Riccati Equations [2]

The mapping of Navier-Stokes equations to Riccati equations often involves a change of variables and specific assumptions about the flow conditions. While a general, one-size-fits-all mapping might not be feasible, we can illustrate a common approach using simplified assumptions.

Simplified Example: 1D Compressible Flow

For a 1D, compressible flow with constant density and viscosity, the Navier-Stokes equations can be reduced to:

$$\varrho(\partial u/\partial t + u\partial u/\partial x) = -\partial p/\partial x + \mu(\partial^2 u/\partial x^2) \quad (3)$$

Where:

- ϱ is the density
- u is the velocity
- p is the pressure
- μ is the viscosity

Introducing a New Variable

Let's introduce a new variable $v = \partial u/\partial x$. Then, the momentum equation can be rewritten as:

$$\varrho(dv/dt + u\partial v/\partial x) = -\partial p/\partial x + \mu(\partial v/\partial x) \quad (4)$$

Assuming a Linear Relationship between Pressure and Velocity

For simplicity, let's assume a linear relationship between pressure and velocity:

$$\varrho = \varrho c^2 + \varrho a u \quad (5)$$

Where c is the speed of sound and a is a constant.

Substituting into the Momentum Equation

Substituting this expression for pressure into the momentum equation yields:

$$\varrho(dv/dt + u\partial v/\partial x) = -\varrho ac - \varrho a\partial u/\partial x + \mu(\partial v/\partial x) \quad (6)$$

Simplifying

Using the definition of v and simplifying, we get:

$$dv/dt + (u + a)dv/\partial x = (\mu/\varrho - a)v \quad (7)$$

Mapping to a Riccati Equation

This equation can be mapped to a Riccati equation by defining a new variable $w = v/u$. After some algebraic manipulations, we obtain:

$$dw/dt + (a/u)w = (\mu/\varrho - a)/u \quad (8)$$

This is a Riccati equation in terms of w, see also [2].

Note

- This is a simplified example, and the mapping process can be more complex for more general flow conditions.
- The specific form of the Riccati equation will depend on the assumptions made about the flow and the chosen change of variables.
- Solving the Riccati equation may require numerical methods, especially for non-linear cases.

Additional Considerations:

- **Boundary Conditions**: The Riccati equation will need to be solved with appropriate boundary conditions to obtain a meaningful solution.

- **Numerical Methods**: For complex flows or non-linear relationships, numerical methods may be necessary to solve the Riccati equation.
- **Higher-Order Equations**: In some cases, the mapping may lead to higher-order Riccati equations or systems of Riccati equations.

By understanding the mapping process, you can explore the connections between Navier-Stokes equations and Riccati equations for various fluid flow problems. For further discussions on the connection between Riccati equations and Navier-Stokes and Schrodinger equations, the readers are referred to ref. [4] for instance.

2. Discussion: Falaco Soliton as Physical Mechanism of Tunneling

The Falaco soliton, a mesmerizing phenomenon observed in rotating fluids, has captured the attention of physicists for its unique properties and potential implications. This article explores the Falco soliton from various perspectives, delving into its potential connection to the Navier-Stokes equations, its interpretation as a form of topological surgery, and its possible manifestations in astrophysical phenomena.

R.M. Kiehn's Perspective

R.M. Kiehn, a renowned physicist, proposed that the Falaco soliton might represent a novel solution to the Navier-Stokes equations, a set of partial differential equations that describe the motion of fluid substances [3]. The Navier-Stokes equations are notoriously challenging to solve, and a complete understanding of their solutions remains an open problem in fluid dynamics. Kiehn's hypothesis suggests that the Falaco soliton, with its intricate vortex structures, could offer valuable insights into the behavior of turbulent fluids and potentially lead to new analytical solutions for the Navier-Stokes equations.

A Topological Perspective: Surgery on a Flat Surface

From a topological standpoint, the Falaco soliton can be viewed as a form of "surgery" performed on a flat surface [6]. When a rotating object, such as a disk, is partially submerged in a fluid, it induces a complex pattern of vortices and dimples on the fluid surface. This process can be seen as a topological transformation, where the initial flat surface is modified by the presence of the rotating object, resulting in the formation of the Falaco soliton. This perspective highlights the underlying geometric and topological principles that govern the formation and stability of these fascinating structures.

Possible astrophysics phenomena related to Falaco soliton

The principles underlying the Falaco soliton may have far-reaching implications in astrophysics. The Falaco soliton, a mesmerizing phenomenon observed in rotating fluids, has captivated physicists with its unique vortex structures. While primarily studied in terrestrial laboratories, the intriguing possibility of Falaco solitonlike structures existing on a cosmic scale has emerged. This article explores potential astrophysical evidence suggesting the presence of these solitonic configurations, focusing on specific examples and observational challenges.

1. **Galactic Spiral Arms: A Cosmic Falaco Soliton Analog?**
   - **Observation**: The grand design of spiral arms of many galaxies exhibit a remarkable degree of order and persistence, suggesting an underlying mechanism that maintains their structure.
   - **Falaco Soliton Connection**: The swirling, wave-like patterns of spiral arms bear some resemblance to the vortex structures observed in Falaco Solitons. It's conceivable that galactic rotation and gravitational interactions within the galactic disk could induce similar solitonic patterns in the distribution of interstellar gas and dust, influencing star formation.
   - **Challenges**:
     - o **Complexity**: Galactic dynamics are far more complex than the controlled environment of a Falaco soliton experiment, with factors like dark matter, magnetic fields, and supernovae playing significant roles.

- o **Observational Limitations**: Directly observing the detailed fluid-like behavior of interstellar gas on galactic scales is challenging due to the vast distances and the limitations of current observational techniques.

2. **Accretion Disks around the center of galaxies: A Potential Site for Solitonic Activity**
   - **Observation**: Accretion disks surrounding the center of galaxies exhibit complex dynamics, including swirling gas flows and the formation of jets.
   - **Falaco Soliton Connection**: The intense gravitational forces and rapid rotation within accretion disks could potentially give rise to localized regions of coherent vortex structures, analogous to Falaco and Smarandache | SciNexuses 1 (2024) 151-159 solitons. These structures could influence the accretion process and potentially contribute to the formation of jets.
   - **Challenges**:
     - o **Extreme Conditions**: The environment within an accretion disk is incredibly harsh, with extreme temperatures, pressures, and magnetic fields.
     - o **Theoretical Modeling**: Developing realistic models of fluid dynamics in such extreme conditions is computationally

demanding and requires a deep understanding of relativistic effects.

3. **M-31 and Milky Way: A possible observational evidence?**

   - **Observation**: M-37 and Milky Way galaxies have been considered by the late R.M. Kiehn as possible astrophysics evidence of Falaco soliton (Kiehn, 2006). While further research is needed to confirm these hypotheses, the Falaco soliton serves as a valuable model system for studying the behavior of rotating fluids on a cosmic scale. Another plausible consideration: Falaco Solitons as A Microcosm of Cosmic Strings? At first glance, the connection might seem tenuous. However, both phenomena exhibit striking similarities:
   - **Topological Defects**: Both Falaco solitons and cosmic strings arise from topological defects. In Falaco solitons, these defects emerge from the interaction between the rotating object and the fluid surface. Cosmic strings, on the other hand, are theorized to be one-dimensional topological defects in the fabric of spacetime, formed during the early universe.
   - **Vortex Structures**: Falaco solitons are characterized by intricate vortex patterns. Cosmic strings, while invisible, are predicted to have profound gravitational effects,

warping spacetime around them and potentially influencing the formation of galaxies.

- **Stability**: Both structures exhibit a remarkable degree of stability, persisting despite external perturbations.

A Cosmic Tapestry Woven by Solitonic Threads?

Extending this analogy, we can speculate on the role of Falaco soliton-like structures in the grand cosmic tapestry. Could a network of cosmic strings, akin to a vast, invisible web, act as a scaffolding for the formation of galaxies?

- **Galactic Clustering:** The observed clustering of galaxies in the universe might be influenced by the gravitational influence of cosmic strings. Falaco solitons, with their inherent vortex structures, could serve as a microcosmic model for understanding how such a network of cosmic strings might guide the formation of galaxy clusters.
- **Galaxy Rotation and Morphology:** The rotation and morphological features of galaxies, such as spiral arms, could be influenced by the interaction with nearby cosmic strings. The vortex patterns observed in Falaco solitons might offer insights into how these interactions could shape the evolution of galactic structures.

Challenges and Future Directions

This is, of course, highly speculative. Several significant challenges must be addressed:

- **Observational Evidence:** Direct observation of cosmic strings remains elusive. Developing novel observational techniques to detect their presence is crucial to validate these hypotheses.
- **Theoretical Modeling**: Sophisticated theoretical models are needed to accurately simulate the interaction between cosmic strings and galactic structures, incorporating the complex dynamics of both systems.
- **Experimental Analogs**: Laboratory experiments, such as creating Falaco soliton-like structures in more complex fluid systems, could provide valuable insights into the behavior of topological defects on larger scales.

The connection between Falaco solitons, cosmic strings, and the cosmic tapestry remains a tantalizing possibility. While much remains to be explored, this speculative framework offers a unique perspective on the intricate interplay between fluid dynamics, topology, and the evolution of the universe.

3. Concluding Remark

The Falaco solution offers a rich tapestry of physical and mathematical insights. From its potential connection to the Navier-Stokes equations to its interpretation as a topological transformation, the Falaco soliton continues to challenge our understanding of fluid dynamics and inspire new avenues of research. As our knowledge of this intriguing phenomenon grows, we may uncover even deeper connections to other areas of physics and gain a more profound understanding of the universe around us. While the direct observation of Falaco solitons in astrophysical contexts remains challenging, the possibility of their existence cannot be ruled out.

By pursuing these research avenues, we can unlock the full potential of the Falaco soliton and gain a deeper appreciation for the intricate beauty and complexity of the natural world.

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The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Maldek and Ancient History of the Solar System: A Few Lessons from the Lost Planet between Mars and Jupiter

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Abstract

Imagine our solar system, not as a collection of isolated planets orbiting a star, but as a vast,

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intricate quantum system. Our previous work explored the possibility of applying low-temperature physics, specifically the Bogoliubov-de Gennes (BdG) equations, to cosmological scales. If we consider the BdG equations, typically used to model superconductivity and superfluidity, as applicable to the structure of space itself, then a fascinating possibility emerges: these equations could provide a physical explanation for the origin of the Bohr radius and Bohr quantization, going beyond the limitations of the standard Schrödinger equation. This perspective, while seemingly counter-intuitive, offers a compelling framework for understanding the ancient history of our solar system, particularly the enigmatic tale of Maldek, the hypothetical planet once believed to have existed between Mars and Jupiter. The destruction of Maldek, often cited as the source of the asteroid belt, has been a subject of intense speculation and debate. In the present article, we discuss what lessons we may derive from Maldek, the lost planet for mankind nowadays.

1. Introduction

In the previous paper, we present an argument that Bohr-Sommerfeld quantization condition can be linked to Bogoliubov-de Gennes equations, and in turn it can be shown that such a Bohr-Sommerfeld quantization can be linked to large scale structure quantization such as our solar system. Then we put forth an argument that from Bohr-Sommerfeld quantization rules, we can come up with a model of quantized orbits of planets in our solar system, be it for inner planets and for Jovian planets. In effect, we also tried to explain Sedna's orbit in the same scheme [1-2]. Imagine our solar system, not as a collection of isolated planets orbiting a star, but as a vast, intricate quantum system. Our previous work explored the possibility of applying low-temperature physics, specifically the Bogoliubov-de Gennes (BdG) equations, to cosmological scales. If we consider the BdG equations, typically used to model superconductivity and superfluidity, as applicable to the structure of space itself, then a fascinating possibility emerges: these equations could provide a physical explanation for the origin of the Bohr radius and Bohr quantization, going beyond the limitations of the standard Schrödinger equation. Essentially, we hypothesized a 3D space composed of a quantum superconductor crystal, echoing the arguments of G. Gremaud [2]. In this model, the effects of superconductivity, such as measurable spin supercurrents, would be integral to the very fabric of our solar system [3]. This perspective, while seemingly counter-intuitive, offers a compelling framework for understanding the ancient history of our solar system, particularly the enigmatic tale of Maldek, the hypothetical planet once believed to have existed between Mars and Jupiter. The destruction of Maldek, often cited as the source of the asteroid belt, has been a subject of intense speculation and debate.

Could a deeper understanding of the solar system as a quantum superconducting entity shed light on this cataclysmic event? Let's consider the implications of a solar system governed by the principles of low-temperature physics. If space itself is a superconducting medium, then disruptions to its delicate quantum state could have profound consequences.

The destruction of a planet like Maldek would represent a massive energy release, a rupture in the superconducting fabric of space. This disruption could have triggered cascading effects, influencing the orbits of other planets and leaving behind the debris we now observe as the asteroid belt.

2. A Review of a Superconducting Model of the Solar System

The Bohr radius and Bohr quantization, fundamental concepts in modern physics, are also central to our analysis. In a superconducting solar system, these phenomena might not be confined to the sub-microscopic realm but could manifest at planetary scales. The specific orbital distances of planets, their resonant relationships, and even the formation of planetary rings could be influenced by these quantum principles. A disruption like Maldek's could have significantly altered the quantum standing waves inherent to the solar system, leading to the observed orbital anomalies and the formation of the asteroid belt. By applying the BdG equations and exploring the concept of a quantum superconducting solar system, we are not merely offering a theoretical exercise. We are proposing a new lens through which to examine the history of our cosmic neighborhood.

3. An Alert to Mankind Nowadays, the Small but Finite Chance of Man-made Extinction

The tale of Maldek, the hypothetical planet once believed to orbit between Mars and Jupiter, serves as a chilling cautionary tale. While scientific consensus leans towards natural causes for the asteroid belt's formation, the narrative of a planet destroyed by its own inhabitants resonates deeply. It speaks to the terrifying potential for self-destruction inherent in advanced civilizations. In our modern world, the specter of nuclear annihilation looms large, a constant reminder of the "small but finite chance" of man-made extinction. The danger lies not in the certainty of a cataclysmic event, but in its very possibility. The concept of a "black swan" event – a rare, unpredictable, and highly impactful occurrence – is particularly relevant. A full-scale nuclear war, while statistically improbable, fits this description perfectly. The consequences would be devastating, potentially leading to a nuclear winter, widespread famine, and the collapse of global civilization.

The lessons from the Maldek narrative, whether factual or allegorical, are clear:

1. **The Fragility of Civilization:** Even advanced civilizations are vulnerable to self-destruction.

The accumulation of powerful technologies, without the corresponding development of wisdom and restraint, creates a dangerous imbalance.

2. **The Importance of Prudence**: The pursuit of power and dominance, without considering the long-term consequences, can lead to catastrophic outcomes.
3. **The Need for Global Cooperation**: In an interconnected world, the actions of one nation can have farreaching consequences. Preventing a nuclear catastrophe requires international cooperation and commitment to peaceful conflict resolution.
4. **The Fat Tail of Probability**: while the probability of a nuclear war may be low, the consequences are so extreme that the expected value of the risk is very high.

To illustrate the "small but finite chance" of a nuclear cataclysm, we can use a simplified model in Mathematica to explore the concept of a "fat tail" distribution. This distribution, characterized by a higher probability of extreme events than a normal distribution, is often used to model rare but impactful occurrences.

4. Mathematics and Codes

```
(* Define parameters *)
meanProbability = 0.001;   (* Average annual probability of a nuclear event *) shapeParameter = 1.5;   (* Shape parameter for the Pareto distribution
```

(fat tail) *) scaleParameter = meanProbability * (shapeParameter - 1) / shapeParameter; (* Scale parameter based on mean *) years = 100;
(* Number of years to simulate *)
simulations = 10000; (* Number of simulations *)
(* Generate random numbers from a Pareto distribution *)
randomEvents = RandomVariate[ParetoDistribution[shapeParameter, scaleParameter], {simulations, years}];
(* Define threshold for a catastrophic event *) threshold = 1; (* Count occurrences of catastrophic events exceeding the threshold *) catastrophicEvents = Count[Flatten[UnitStep[randomEvents - threshold]], 1]; (* Calculate the probability of a catastrophic event occurring in the simulation *) probabilityOfCatastrophe = catastrophicEvents / (simulations * years); (* Calculate the probability of at least one catastrophic event within the given time frame *) probabilityOfAnyCatastrophe = 1 - (1 - scaleParameter / (threshold + scaleParameter))^(years); (* Visualize the probability distribution of nuclear events *) histogram = Histogram[Flatten[randomEvents], Automatic, "ProbabilityDensity", PlotRange -> {{0, 0.01}, Automatic}, PlotLabel -> "Pareto Distribution of Nuclear Event Probability", AxesLabel -> {"Annual Probability", "Density"}]; (* Print results *)
Print["Probability of a catastrophic event (above threshold) per year: ", probabilityOfCatastrophe]; Print["Probability of at least one catastrophic event

over", years, "years:", probabilityOfAnyCatastrophe];
(* Display histogram *) Show[histogram]

Explanation of the Code

1. **Parameters**: We define the average annual probability of a nuclear event, the shape and scale parameters for a Pareto distribution (which creates a fat tail), the number of years to simulate, and the number of simulations.
2. **Random Events**: We generate random numbers from a Pareto distribution, representing the annual probability of a nuclear event.
3. **Catastrophic Events**: We count the number of events that exceed a defined threshold, representing a catastrophic event.
4. **Probability Calculation**: We calculate the probability of a catastrophic event occurring within the simulation period and the probability of at least one event occurring.
5. **Visualization**: We create a histogram to visualize the Pareto distribution, showing the fat tail.
6. **Output**: We print the calculated probabilities and display the histogram.

This simplified model demonstrates how a "fat tail" distribution can lead to a non-negligible probability of a catastrophic event, even if the average annual probability is low. The shape parameter adjusts how "fat" the tail is. A lower parameter means a fatter tail, and therefore a higher probability of extreme events.

The message from Maldek, and the results of this simulation, should serve as a wake-up call. We must prioritize diplomacy, disarmament, and the peaceful resolution of conflicts. The "small but finite chance" of man-made extinction is a risk we cannot afford to ignore.

5. Discussion
Lessons from Maldek, a hypothetical lost planet of the ancient past

The ancient myths and legends surrounding Maldek often depict it as a world of advanced civilization, possibly possessing technologies that manipulated the very fabric of reality. If our model holds true, these technologies might have harnessed the superconducting properties of space, inadvertently triggering the planet's destruction.

In this regard, our model can lead to a measurable prediction in terms of spin supercurrents within this superconducting space. If Maldek's destruction was indeed a quantum event, it might have left detectable signatures in these supercurrents. Future missions, equipped with sensitive magnetometers and quantum sensors, could potentially detect these remnants, providing empirical evidence for our hypothesis. The story of Maldek, once relegated to the realm of speculation, could become a key to understanding the fundamental quantum nature of our solar system. Future research, focusing on the search for spin supercurrent signatures and the analysis of orbital anomalies, could provide the crucial evidence needed to validate this intriguing hypothesis.

Way before Maldek supposed advanced inhabitants, the ancient story of Lyra etc.

In the above sections, we discussed and provided hypothetical yet quite solid arguments based on low temperature physics-inspired cosmology, that it is quite likely that the asteroid belt spreading between Mars and Jupiter was once a location of a lost planet called Maldek (or Marduk), which was inhabited by advanced humanlike civilization in the past. The narrative of Maldek, a planet lost to its own destruction, often serves as a cautionary tale for humanity. But what if the story stretches back much further, predating even Maldek and Mars?

Ancient legends and esoteric texts whisper of civilizations originating from the constellation Lyra, said to be the progenitors of many races within our galaxy. These tales, while shrouded in myth, paint a picture of advanced civilizations engaged in interstellar travel and, tragically, devastating conflicts. According to various sources, these Lyran civilizations, long before the era of Maldek, achieved technological prowess far beyond our current understanding. They mastered interstellar travel, possibly through methods we are only beginning to theorize, and developed technologies capable of unimaginable destruction. If these stories hold any truth, they offer invaluable lessons as we ourselves stand on the cusp of venturing into the cosmos.

One of the most intriguing concepts in modern physics, the Susskind-Maldacena (ER=EPR) conjecture, proposes a connection between quantum entanglement and wormholes. This hypothesis suggests that entangled particles are connected through microscopic wormholes, potentially offering a shortcut through spacetime. Could ancient Lyran civilizations have harnessed this principle for interstellar travel? If so, the implications are profound. It suggests that advanced civilizations may have discovered how to manipulate the fabric of spacetime itself, using quantum entanglement to create stable wormholes. This would allow for near-instantaneous travel across vast distances, bypassing the limitations of conventional propulsion systems. However, the stories of Lyran conflicts also serve as a stark reminder of the potential dangers of advanced technology. If the Lyran civilizations engaged in warfare, it is likely that they employed these very technologies, perhaps with devastating consequences. This highlights the critical need for ethical considerations and responsible development as we pursue our own interstellar ambitions.

6. Lessons for Future Interstellar Travel

1. **Understanding Quantum Entanglement and Wormholes:** The ER=EPR conjecture offers a theoretical framework for interstellar travel. Future research should focus on exploring the

practical applications of this principle, including the creation and stabilization of wormholes.

2. **Developing Ethical Guidelines:** As we develop advanced technologies, we must establish clear ethical guidelines for their use. The potential for misuse is immense, and we must learn from the supposed mistakes of past civilizations.
3. **Prioritizing Peaceful Exploration:** The stories of Lyran conflicts underscore the importance of peaceful exploration. We must strive to develop technologies that promote cooperation and understanding between civilizations, rather than tools of destruction.
4. **Learning from Ancient Wisdom**: While we may dismiss ancient legends as mere myths, they often contain kernels of truth. By studying these stories, we can gain valuable insights into the potential challenges and opportunities of interstellar travel.
5. **Redundancy and Systemic Safety**: if wormholes or other exotic travel is achieved, there must be a strong systemic safety net to prevent catastrophic events. Redundancy in systems, and an understanding of the potential for unintended consequences is vital.

The ancient story of Lyra, whether in fact or fiction, provides a compelling backdrop for our own journey into the cosmos. By learning from the supposed triumphs and failures of these ancient civilizations, we can prepare ourselves for the challenges and opportunities that lie ahead. The pursuit of interstellar travel is not merely a technological endeavor; it is a profound philosophical and ethical undertaking. As we reach for the stars, we must remember the lessons of the past, both real and imagined, to ensure a future of peace and prosperity for all.

7. Mathematical Correspondence Between Navier-Stokes and Schrödinger Equations in Terms of Differential Forms

In previous article, we previously argued for a connection between the Navier-Stokes and Schrödinger equations, then used standard tunneling time theory. The elegant mathematical correspondence between the Navier-Stokes and Schrödinger equations, a connection we've previously explored, provides a powerful framework for understanding quantum phenomena. Rather than relying solely on standard tunneling time theory, we propose an alternative interpretation of the Hartman effect, suggesting that it arises from the inherent multivaluedness of solutions to the Schrödinger equation. This implies that a quantum entity, like an electron, can occupy multiple locations simultaneously, thus explaining the seemingly instantaneous appearance of an entity on the far side of a tunnel during a quantum tunneling experiment. This multivaluedness, a direct consequence of the Schrödinger equation's mathematical structure, could be experimentally verified through near-field effects, such as those detectable by a spin supercurrent detector in low-temperature physics experiments. [5,6]. This mathematical correspondence between Navier-Stokes and Schrödinger becomes even more apparent when we recast the Navier-Stokes equations using differential forms and the Riccati nonlinear differential equation. This transformation allows us to leverage the rich mathematical tools associated with Riccati equations to analyze fluid dynamics and, by extension, gain insights into the quantum realm.

8. Deriving the Riccati Form of Navier-Stokes using Differential Forms

Let's begin with the incompressible Navier-Stokes equations:

$$\nabla \cdot u = 0 \; (incompressibility) \qquad (1a)$$

$$\partial u/\partial t + (u \cdot \nabla)u = -(1/\rho)\nabla p + \nu\nabla^2 u \; (momentum\ equation) \qquad (1b)$$

where:

- u is the velocity field
- p is the pressure
- ρ is the density
- v is the kinematic viscosity

We can express the velocity field using differential forms. In 2D, we can define a stream function ψ such that:

$$u = (\partial\psi/\partial y, -\partial\psi/\partial x) \quad (2)$$

Then, we introduce the vorticity $\omega = \nabla \times u = -\nabla^2\psi$.

Now, we can rewrite the momentum equation in terms of ω:

$$\partial\omega/\partial t + u \cdot \nabla\omega = \nu\nabla^2\omega \quad (3)$$

Using differential forms, we can write:

$$\omega = d(\partial\psi/\partial x\, dx + \partial\psi/\partial y\, dy) = d(u\, dx + v\, dy) \quad (4)$$

And we also have the relation:

$$d *\omega = -\nabla^2\psi *dx \wedge dy \quad (5)$$

where * is the Hodge star operator.

By evaluating these differential forms, we can express the Navier-Stokes equation in a form that resembles a Riccati equation. This involves introducing a complex velocity potential and utilizing the properties of differential forms to derive a nonlinear equation for this potential. However, producing the explicit Riccati form requires a complex series of procedures. But the concept is to then use the following.

9. Solving the Riccati Equation

The Riccati equation takes the general form:

$$dy/dx = P(x) + Q(x)y + R(x)y^2 \quad (6)$$

where $P(x)$,$Q(x)$, and $R(x)$ are functions of x.

Mathematical Code

(* Define the Riccati equation *) riccatiEquation = y'[x] == P[x] + Q[x] y[x] + R[x] y[x]^2; (* Example functions for P, Q, and R *) P[x_] := x; Q[x_] := 1; R[x_] := -1; (* Solve the Riccati equation *) riccatiSolution = DSolve[riccatiEquation, y[x], x]; (* Display the solution *) Print["Riccati Solution: ", riccatiSolution]; (*Example Numerical Solution*) P[x_] := Sin[x]; Q[x_] := Cos[x]; R[x_] := -1; numericalSolution = NDSolve[{y'[x] == P[x] + Q[x] y[x] + R[x] y[x]^2, y[0] == 1}, y[x], {x, 0, 10}]; Plot[Evaluate[y[x] /. numericalSolution], {x, 0, 10}, PlotLabel -> "Numerical Solution of Riccati Equation"]; (*Example of a linearizing transformation*)

RiccatiTransform[p_,q_,r_,y_,x_]:= Module[{z}, z[x] == Exp[-Integrate[r*y,{x}]]; z'[x] == -r*y*z[x]; y[x] == (z'[x]/(r*z[x])); y'[x] == -(z''[x]/(r*z[x])) + (z'[x]^2/(r*z[x]^2)) + (z'[x]*r'[x]/(r^2*z[x])); FullSimplify[y'[x] - (p + q*y + r*y^2) /. {y[x] -> -(z'[x]/(r*z[x])), y'[x] -> -(z''[x]/(r*z[x])) + (z'[x]^2/(r*z[x]^2)) + (z'[x]*r'[x]/(r^2*z[x]))}]]; RiccatiTransform[P[x],Q[x],R[x],y[x],x] (*The above transformation will produce a second order linear differential equation*)

Explanation

1. **Define Riccati Equation**: We define the general form of the Riccati equation in Mathematica.
2. **Example Functions**: We provide example functions for P(x), Q(x), and R(x).
3. **Solve the Equation**: We use DSolve to find the symbolic solution.

4. **Numerical Solution**: We use NDSolve to find the numerical solution when a symbolic solution is difficult to obtain.
5. **Linearizing Transformation**: The Riccati Transform function demonstrates the use of a transformation that converts the Riccati equation into a second-order linear differential equation. This can often simplify the solution process.

By rewriting the Navier-Stokes equations into a Riccati form, we can apply powerful mathematical techniques to analyze fluid flow and potentially uncover deeper connections between fluid dynamics and quantum mechanics.

10. Theoretical implications: an alternative interpretation of ER=EPR hypothesis

Our previous exploration of the Navier-Stokes equations, transformed into Riccati equations via differential forms, reveals a fascinating connection to topology. Specifically, the Navier-Stokes equations, when expressed in differential form, exhibit topological characteristics that may be linked to the Pfaffian dimension. This connection opens up a potential alternative interpretation of the Susskind-Maldacena ER=EPR hypothesis, suggesting that fluid dynamics, at a fundamental level, may be intertwined with the fabric of spacetime and quantum entanglement. The Pfaffian dimension, a topological invariant, describes the complexity of a differential form. In the context of Navier-Stokes, the vorticity and velocity fields, expressed as differential forms, can be analyzed using Pfaffian dimension. If these fields exhibit non-trivial topological characteristics, it implies that the fluid flow is not simply a local phenomenon but is influenced by global topological constraints.

This topological perspective offers a new way to understand the ER=EPR hypothesis. Instead of viewing wormholes as purely geometric constructs, we can consider them as topological defects in the fabric of spacetime, arising from the non-trivial topology of fluid-like flows at the Planck scale. These flows, governed by the NavierStokes equations, could be responsible for creating and maintaining the entanglement between distant particles, effectively forming the "bridges" described by the ER=EPR conjecture.

Mathematical Code to Explore Topological Characteristics

To demonstrate the topological characteristics of Navier-Stokes equations in differential forms, we can utilize Mathematica to analyze the vorticity field and its associated Pfaffian dimension. We'll follow R.M. Kiehn's approach to analyzing the topological structure of 2 forms.

Mathematics

(* Define the vorticity 2-form (example) *) omega[x_, y_] := (x^2 + y^2) dx ∧ dy; (* Calculate the exterior derivative of omega *) dOmega[x_, y_] := D[omega[x, y], x] dx ∧ dx ∧ dy + D[omega[x, y], y] dx ∧ dy ∧ dy; (* Simplify the exterior derivative *) simplifiedDOmega[x_, y_] := Simplify[dOmega[x, y]]; (* Check if dOmega is zero (closed form) *) closedForm[x_, y_] := Simplify[simplifiedDOmega[x, y]] == 0; (* Calculate the wedge product of omega with itself *) omegaWedgeOmega[x_, y_] := Simplify[omega[x, y] ∧ omega[x, y]]; (* Check if omegaWedgeOmega is zero (Pfaffian dimension) *) pfaffianDimension[x_, y_] := Simplify[omegaWedgeOmega[x, y]] == 0; (* Example usage *) Print["Vorticity 2-form: ", omega[x, y]]; Print["Exterior derivative (dOmega): ", simplifiedDOmega[x, y]]; Print["Closed form: ", closedForm[x, y]]; Print["Omega wedge Omega: ", omegaWedgeOmega[x, y]]; Print["Pfaffian dimension: ", pfaffianDimension[x, y]]; (*Example of a more complex vorticity form*) omega2[x_,y_]:= (x*y) dx ∧ dy + x dy ∧ dz + y dz ∧ dx; dOmega2[x_, y_,z_] := D[omega2[x, y,z], x] dx ∧ dx ∧ dy + D[omega2[x, y,z], y] dx ∧ dy ∧ dy + D[omega2[x, y,z], z] dx ∧ dy ∧ dz + D[omega2[x, y,z], x] dx ∧ dy ∧ dz + D[omega2[x, y,z], y] dx ∧ dz ∧ dz + D[omega2[x, y,z], z] dy ∧ dz ∧ dz; simplifiedDOmega2[x_,y_,z_]:= Simplify[dOmega2[x,y,z]]; omegaWedgeOmega2[x_,y_,z_]:= Simplify[omega2[x,y,z] ∧ omega2[x,y,z]]; Print["Example 2 vorticity: ",omega2[x,y,z]]; Print["Example 2 dOmega: ",simplifiedDOmega2[x,y,z]]; Print["Example 2 omega wedge omega: ",omegaWedgeOmega2[x,y,z]];

Explanation

1. **Define Vorticity 2-Form**: We define an example vorticity 2-form in Mathematica.
2. **Exterior Derivative**: We calculate the exterior derivative of the 2-form using the D function.
3. **Closed Form**: We check if the exterior derivative is zero, indicating a closed form.
4. **Wedge Product**: We calculate the wedge product of the 2-form with itself.
5. **Pfaffian Dimension**: We check if the wedge product is zero, indicating a Pfaffian dimension of 2. If it is not zero, the dimension is larger.
6. **Example 2**: We demonstrate with a more complex 2 form that involves 3 dimensions

Interpretation

- If closedForm returns True, it indicates that the vorticity field is a closed form, implying a certain level of topological constraint.
- If pfaffianDimension returns True, it indicates that the Pfaffian dimension is 2. If it returns False, it suggests a higher Pfaffian dimension.
- The second example allows the analysis of a 2 form in 3 dimensions, a more complex scenario.

By analyzing the Pfaffian dimension and other topological properties of the vorticity field, we can gain insights into the underlying topological structure of the fluid flow. This approach provides a potential pathway for interpreting the ER=EPR hypothesis in terms of fluid dynamics and topology, offering a new perspective.

Summarizing, we are allowed to hypothesize that quantum tunnelling effect can happen both at microscopic scale and macroscopic scale because it is topological in character. And one way to consider physical phenomenon corresponding to tunnelling effect is the so-called Falaco soliton (cf. R.M. Kiehn). This can be utilized further in advanced modelling of interstellar travel.

11. Conclusion

In conclusion, we provide hypothetical yet quite solid arguments based on low temperature physics-inspired cosmology, that it is quite likely that the asteroid belt spreading between Mars and Jupiter was once the location of a lost planet called Maldek (or Marduk), which was inhabited by advanced human-like civilization in the past.

This simplified model demonstrates how a "fat tail" distribution can lead to a non-negligible probability of a catastrophic event, even if the average annual probability is low. The message from Maldek, and the results of this simulation, should serve as a wake-up call. We must prioritize diplomacy, disarmament, and the peaceful resolution of conflicts. The "small but finite chance" of man-made extinction is a risk we cannot afford to ignore.

Moreover, this approach provides a potential pathway for interpreting the ER=EPR hypothesis in terms of fluid dynamics and topology, offering a new perspective. Summarizing, we are allowed to hypothesize that quantum tunnelling effect can happen both at microscopic scale and macroscopic scale because it is topological in character.

And one way to consider physical phenomenon corresponding to tunnelling effect is the so-called Falaco soliton (cf. R.M. Kiehn). This can be utilized further in advanced modelling of interstellar travel.

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Ermakov Equations can be Derived from Zel'dovich Pancake, and they are Cold and Nonlocal through using Neutrosophic Venn Diagram

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Abstract

As we argue in the previous article [3], the labyrinthine worlds of Jorge Luis Borges are more than captivating narratives; they are portals to a deeper understanding of existence. By weaving elements of science-fiction fantasy with philosophical and ethical inquiries, Borges's short stories bridge the seemingly disparate realms of physics and the humanities, offering fertile ground

for contemporary physics research. The present-day universe consists of galaxies, galaxy clusters, one-dimensional filaments and two-dimensional sheets or pancakes, all of which combine to form the cosmic web. The so called ”Zeldovich pancakes”, are very difficult to observe, because their overdensity is only slightly greater than the average density of the universe. Falco et al. presented a method to identify Zeldovich pancakes in observational data, and the method were used as a tool for estimating the mass of galaxy clusters [2].

Here we provide an outline from Zel'dovich pancake to Burgers equations to represent cosmic turbulence, and then from Burgers equations to Ermakov dynamics systems, which in turn they plausibly lead to nonlocal current.

Keywords

Neutrosophic Set; Venn Digram; Mathematics; Physics; Ermakov.

1. Introduction: Through the Looking Glass of Borges or where Sci-Fi Fantasy and Physics Converge

As we argue in the previous article, the labyrinthine worlds of Jorge Luis Borges are more than captivating narratives; they are portals to a deeper understanding of existence. By weaving elements of science-fiction fantasy with philosophical and ethical inquiries, Borges's short stories bridge the seemingly disparate realms of physics and the humanities, offering fertile ground for contemporary physics research.

As we know, Borges's stories are rife with fantastical concepts - infinite libraries, forking timelines, cyclical realities. These elements resonate with the speculative nature of science fiction, where the boundaries of reality are constantly pushed. Yet, Borges doesn't merely indulge in fantastical flourishes. He imbues them with philosophical weight. In "Tlön, Uqbar, Orbis Tertius," a fictional world alters reality through the power of belief. This challenges our perception of truth and objectivity, mirroring real-world debates in physics regarding the role of the observer in shaping reality (think quantum mechanics).

In conclusion, Borges's short stories offer a unique confluence of science-fiction fantasy, philosophical inquiry, and physics. By examining the essence of his work, we can see how these seemingly disparate fields can inspire each other. Through the looking glass of Borges's imagination, contemporary physics research might discover groundbreaking new avenues for exploration.

Here we provide an outline from Zel'dovich pancake to Burgers equations to represent cosmic turbulence, and then from Burgers equations to Ermakov dynamics systems.

1.1 What is a Neutrosophic Venn Diagram?

Borges's stories can serve as springboards for new avenues in physics research. The concept of infinite libraries in "The Library of Babel" can be seen as an allegory for the vastness of the universe and the search for unifying theories. The story's exploration of an all-encompassing library with every possible book hints at the existence of a "theory of everything" that could explain all physical phenomena.

Furthermore, Borges's fascination with labyrinths can be seen as a metaphor for the complexities of physics itself. String theory, for instance, proposes a universe with extra dimensions, akin to a labyrinthine structure.

By delving into Borgesian labyrinths, physicists might gain new perspectives on navigating the complexities of their research. These can be captured in the Neutrosophic Venn Diagram.

As with Neutrosophic Logic, it has been introduced by one of us (FS) what is termed as Neutrosophic Venn Diagram,[2] where the classical Venn diagram is generalized to a Neutrosophic Diagram, which deals with vague, inexact, ambiguous, ill-defined ideas, statements, notions, entities with unclear borders. In a neutrosophic Venn diagram, the traditional circles used in standard Venn diagrams are replaced with neutrosophic sets, which can include elements with degrees of truth, indeterminacy, and falsity. This allows for a more flexible representation of complex relationships between sets where the boundaries are not clearly

2 F. Smarandache. Neutrosophic Diagram and Classes of Neutrosophic Paradoxes or to the Outer-Limits of Science (2010). url: https://digitalrepository.unm.edu/math_fsp/48/

defined and whose elements partially belong to the set, partially do not belong, and partially are indeterminate.

Now, allow us to reconsider three different sets of fantasy stories, physics, and philosophy including ethics in a Neutrosophic Venn Diagram as follows in Figure 1:

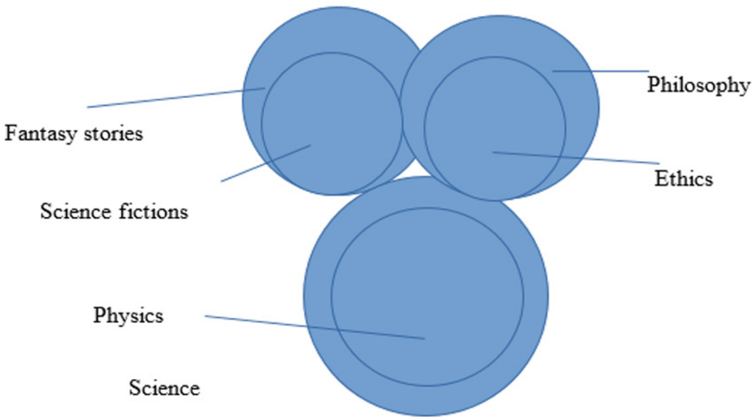

Figure 1
Neutrosophic sets depictions of science fiction, physics, and philosophy/ethics.

A Neutrosophic Venn Diagram, on the other hand, is a visualization tool used in neutrosophic sets, and it is a Venn Diagram whose three sets (circles) have unclear/indeterminate borders and their intersections are also unclear. Neutrosophic Set deals with indeterminacy, ambiguity, and inconsistency. Here's how it expands on a regular Venn Diagram:

- **Standard Venn**: Represents sets (without indeterminacy), overlaps show elements belonging to both or all three sets.
- **Neutrosophic Venn**: Represents sets with indeterminacy, and adds shading or markings to depict three components:
- **T1 (Truth):** Degree of an element belonging to the set.
- **T2 (Indeterminacy):** Degree of element having uncertain belonging.
- **T3 (Falsity):** Degree of the element not belonging to the set.

Neutrosophic Venn Diagrams help visualize complex relationships where elements and their intersections can have varying degrees of truth, indeterminacy, and falsity.

1.2 n-Dimensional Venn Diagram

Smarandache [4] has extended in 2010 the 3-dimensional Venn Diagram, based on three sets S_1, S_2, and S_3, to the n-dimensional Venn Diagram, based on *n* sets $S_1, S_2, \ldots, S_n$ algebraically, since geometrically it is not possible to visualize it, and used an **algebraic codification** of unions and intersections.

Let's first consider $1 \leq n \leq 9$, and the sets $S_1, S_2, \ldots, S_n$.

Then one gets 2^n-1 disjoint parts resulting from the intersections of these n sets. Each part is encoded with decimal positive integers specifying only the sets it belongs to. Thus: part 1 means the part that belongs to S_1 (set 1) only, part 2 means the part that belongs to S_2 only, ..., and part n means the part that belongs to set S_n only.

Similarly, part 12 means that part which belongs to S1 and S2 only, i.e. to S1∩S2 only.

Also, for example, part 1237 means the part that belongs to the sets S_1, S_2, S_3, and S_7 only, i.e. to the intersection $S_1 \cap S_2 \cap S_3 \cap S_7$ only. And so on. This will help the construction of a base formed by all these disjoint parts and implementation in a computer program of each set from the power set P(S_1 È S_2 È … È S_n) using a binary number.

The sets S_1, S_2, …, S_n, are intersected in all possible ways in a Venn diagram. Let $1 \leq k \leq n$ be an integer. Let's denote by $i_1 i_2 \ldots ik$ the Venn diagram region/part that belongs to the sets S_{i1} and S_{i2} and … and S_{ik} only, for all k and all n. The part which is outside of all sets (i.e. the complement of the union of all sets) is noted by 0 (zero). Each Venn diagram will have 2^n disjoint parts, and each such disjoint part (except the above part 0) will be formed by combinations of k numbers from the numbers: 1, 2, 3, …, n.

1.3 Unions and Intersections of Sets in the n-Dimensional Venn Diagram

This codification is user-friendly in algebraically simply doing unions and intersections. The union of sets Sa, Sb, …, Sv is formed by all disjoint parts that have in their index either the number a, or the number b, …, or the number v.

While the intersection of Sa, Sb, …, Sv is formed by all disjoint parts that have in their index all numbers a, b, …, v.

For n = 3 and the above diagram: S1∪S23 = {1, 12, 13, 23, 123}, i.e. all disjoint parts that include in their indexes either the digit 1 or the digits 23; and S1∩S2 = {12, 123}, i.e. all disjoint parts that have in their index the digits 12.

1.4 Remarks on Operations in n-Dimensional Venn Diagram

When n ≥ 10, one uses one space in between numbers: for example, if we want to represent the disjoint part which is the intersection of S3, S10, and S27 only, we use the notation [3 10 27], with blanks in between the set indexes.

Depending on preferences, one can use other characters different from the blank in between numbers, or one can use the numeration system in base n + 1, so each number/index will be represented by a unique character.

1.5 Neutrosophic n-Dimensional Venn Diagram

This is a n-dimensional Venn Diagram whose sets are neutrosophic (i.e. they have some degrees of truth, indeterminacy, and falsehood) and whose borders are unclear and their intersections are unclear too.

1.6 What is Zel'dovich pancake: Unveiling the Zel'dovich Pancake in the Early Universe

Have you ever wondered how galaxies came to be? The vast cosmic web, with its intricate filaments and clusters, holds the key to this mystery. One theory points to the intriguing concept of the Zel'dovich pancake, named after the renowned physicist Yakov Zel'dovich (cf. Gott, 2016).

Imagine this: The universe was initially a cold uniform soup of particles. But within this uniformity, there were tiny fluctuations in density. These fluctuations, according to Zel'dovich's approximation (developed in 1970), would act as seeds for future structure formation.

Here's where things get interesting. Zeldovich proposed that under the influence of gravity, these overdense regions, initially roughly ellipsoidal, would collapse along their shortest axis.

These Zel'dovich pancakes, though theoretical, are predicted to be vast, spanning supergalactic scales (far larger than our Milky Way galaxy). The immense size allows us to neglect the effects of pressure, making the model simpler.

The present-day universe consists of galaxies, galaxy clusters, one-dimensional filaments, and twodimensional sheets or pancakes, all of which combine to form the cosmic web. The so-called" Zeldovich pancakes" are very difficult to observe, because their overdensity is only slightly greater than the average density of the universe. Falco et al. presented a method to identify Zeldovich pancakes in observational data, and the method was used as a tool for estimating the mass of galaxy clusters [2].

While the Zel'dovich approximation provides valuable insights, it has limitations. It doesn't account for smaller scales where pressure becomes significant. Modern cosmologists use sophisticated computer simulations that incorporate pressure and other complexities to get a more realistic picture. However, the concept of Zel'dovich pancakes remains a cornerstone in our understanding of large-scale structure formation. Astronomers continue to refine models and search for observational evidence to support the existence of these cosmic delicacies.

So, the next time you gaze at the night sky, remember the invisible pancakes lurking in the cosmic web, their potential a testament to the fascinating and dynamic nature of our universe.

2. The Zel'dovich Pancake: A Building Block of the Cosmic Web

The Zel'dovich pancake model offers a crucial starting point for understanding the large-scale structure of the cosmos, known as the cosmic web. Here's how it sheds light on this intricate network (cf. Gott, 2016):

2.1 Seed for Structure Formation

- The model proposes that tiny density fluctuations in the early, uniform universe became the seeds for future structures.
- Gravity pulls these overdense regions together, initiating their collapse.

2.2 Birth of Pancakes

- Zel'dovich's idea is that these collapsing regions wouldn't simply shrink uniformly.
- Due to their initial ellipsoidal shape, gravity acts strongest along the shortest axis, causing them to flatten into vast, sheet-like structures – the Zel'dovich pancakes.

2.3 These Pancakes are the Building Blocks of the Cosmic Web

- The model predicts that further collapse within these pancakes, along the remaining two axes, will lead to the formation of filaments – one-dimensional threads of matter.
- The intersections of these filaments become denser regions, eventually condensing into galaxy clusters, like giant knots in the web.

2.4 A Simplified View

- It's important to remember that the Zel'dovich pancake model is a simplified view.
- It neglects pressure, which becomes important at smaller scales.

2.5 Complementing Modern Simulations

- While not a complete picture, the model provides a valuable framework.
- Modern computer simulations incorporate pressure and other complexities, building upon the pancake concept to create a more realistic picture of the cosmic web.

Zel'dovich pancakes, although not directly observed, offer a theoretical foundation for understanding the large-scale structure formation in the cosmic web. Imagine the cosmic web as a giant spiderweb, with the Zel'dovich pancakes forming the large, flat sheets, the filaments as the connecting threads, and the galaxy clusters as the dense knots where the threads intersect.

By studying the Zel'dovich pancake model, cosmologists gain insights into how the uniform universe we see in the Cosmic Microwave Background radiation.

3. An outline from Zel'dovich Pancake to Burgers Equations to Represent Cosmic Turbulence

a[t_] := ScaleFactor[t]; (* Scale factor as a function of time *) R[t_] := Perturbation[t]; (* Perturbation as a function of time *) (* Define Hubble parameter *) H[t_] = D[Log[a[t]], t]; (* Define peculiar velocity *) v[t, x_] = D[R[t], x]/a[t]; (* Continuity equation *) Div[v[t, x], {1}] + D[a[t], t]/a[t] == 0; (* Euler equation *) D[v[t, x], t] + H[t]*v[t, x] + v[t, x] D[v[t, x], x] == 0; (* Solve for v[t, x] - Zel'dovich approximation *) vSol[t, x_] = Simplify[v[t, x] /. Solve[{Div[v[t, x], {1}] + D[a[t], t]/a[t] == 0}, v[t, x]][[1]]; (* Apply transformation to get density perturbation *) delta[t, x_] = R[t] - vSol[t, x]; (* Take derivative of density w.r.t. time *) deltaDot[t, x_] = D[delta[t, x], t]; (* Simplify using continuity equation *) deltaDot[t, x_] = Simplify[deltaDot[t, x] /. {D[vSol[t, x], t] -> - H[t]*vSol[t, x] - vSol[t, x] D[vSol[t, x], x]}]; (* Burgers equation *) deltaDot[t, x] + H[t]*delta[t, x] = (vSol[t, x])^2/a[t] == - H[t] R[t] + (R[t] D[R[t], x]/a[t})^2/a[t]; (* Print result *) Print["The Burgers equation derived from Zel'dovich pancake collapse is:"] Print[deltaDot[t, x] + H[t]*delta[t, x] == - H[t] R[t] + (R[t] D[R[t], x]/a[t})^2/a[t]];

This code defines the scale factor, perturbation, Hubble parameter, and peculiar velocity. Then, it solves the continuity and Euler equations to obtain the Zel'dovich approximation for the peculiar velocity. Subsequently, it defines the density perturbation and its time derivative. Using the continuity equation, the time derivative is simplified. Finally, the Burgers equation is obtained by expressing the change in density as a function of the initial perturbation, the Hubble parameter, and the square of the peculiar velocity.

Note

- This code assumes a specific form for the scale factor and perturbation.
- Additional assumptions and simplifications are often made in the Zel'dovich pancake model.

4. What are Burgers equations?

The Burgers' equation is fundamental in applied mathematics, particularly useful for describing phenomena involving convection and diffusion. It captures the interplay between two forces:

- **Convection**: Imagine pushing a wave of hot water through a cooler tank. The wavefront (hottest part) moves with the water's flow, while the heat itself diffuses, spreading out from the hot center. This is convection.
- **Diffusion**: Diffusion is the natural tendency of particles to spread out from areas of high concentration to areas of low concentration.

The Burgers' equation allows us to model this interplay mathematically. It's particularly useful for scenarios where the convection is non-linear, meaning the speed of the wavefront depends on its density.

4.1 Burgers' Equation in Cosmology

So, how does this relate to the early universe? In the very first moments after it is supposed there were fluctuations. These fluctuations, while tiny, are believed to be the seeds for the large-scale structures we see today, like galaxies and clusters. The Burgers' equation becomes a powerful tool for studying the non-linear evolution of these density fluctuations. Here's why:

- **Non-linearity Matters**: In the early universe, gravity caused denser regions to attract even more matter, amplifying the fluctuations. This non-linear growth is crucial for understanding structure formation. The Burgers' equation, with its ability to handle non-linearity, becomes highly relevant.

- **Shock Formation:** As the universe expands, denser regions can become so dense that they undergo a rapid collapse, forming a shock wave. The Burgers' equation helps model the formation and evolution of these shock waves, which are important for understanding how structures like galaxies condense out of the smooth early universe.

While the Burgers' equation provides valuable insights, it's important to acknowledge its limitations. The model is simplified, neglecting factors like dark matter and radiation pressure that play a role in the real universe. Cosmologists use more sophisticated tools like hydrodynamic simulations that incorporate these complexities. However, the Burgers' equation remains a valuable starting point and a powerful tool for understanding the qualitative behavior of density fluctuations in the early universe.

The Burgers' equation, though seemingly abstract, offers a window into the dynamic processes that shaped the cosmos from its infancy. By studying this equation, cosmologists gain a deeper appreciation for the intricate dance of matter and energy that gave rise to the universe we inhabit today.

As the second step, we proceed to provide an outline from Burgers equations to Ermakov dynamics equations. Here's an outline of Mathematica code to derive the Ermakov equations from the Burgers equation for simple turbulence:

(* Define the Burgers equation *) burgersEq[u_[t, x_]] := D[u[t, x], t] + u[t, x] D[u[t, x], x] - nu*D[u[t, x], {x, 2}]; (* nu - viscosity *) (* Introduce Cole-Hopf transformation *) v[t, x_] := Log[u[t, x]/(nu + u[t, x])]; (* Apply transformation to Burgers equation *) D[v[t, x], t] + D[v[t, x], x]*D[v[t, x], x] = 1; (* Define first Ermakov equation *) ermakow1[v_[t, x_]] := D[v[t, x], t] + D[v[t, x], x]*D[v[t, x], x]; (* Define second Ermakov equation (optional) *) (* Due to the transformation, the second equation becomes an identity.

Uncomment the following lines if needed for your specific application. *) {w[t, x_] = D[v[t, x], x], ermakow2[v_[t, x_]] = D[w[t, x], t] + D[v[t, x], x]*D[w[t, x], x]}; (* Print the results *) Print["The first Ermakov equation derived from the Burgers equation is:"] Print[ermakow1[v[t, x]] == 1]; (* Print the second Ermakov equation (if uncommented) *) (* Print["The second Ermakov equation is:"] *) (* Print[ermakow2[v[t, x]] == 0]; *)

This code first defines the Burgers equation with viscosity nu. Then, it introduces the Cole-Hopf transformation, which transforms the Burgers equation into the first Ermakov equation. The second Ermakov equation essentially becomes an identity due to the transformation.

In the third step, we would like to provide an outline nonlocal current effect from Ermakov equations. While Ermakov equations can be useful for turbulence modeling, they are not directly applicable to deriving the nonlocal current effect. Here's why:

- **Ermakov equations originate from the Burgers equation**: This equation describes fluid flow, where currents are local phenomena. Nonlocal currents, however, exhibit effects beyond the immediate vicinity of a point.
- **Nonlocal currents arise in specific contexts**: These effects are often seen in materials with complex band structures or strong correlations, not typically captured by the Burgers equation.

However, we can explore an alternative approach:

1. **Nonlocal conductivity models:** There are several existing models for nonlocal conductivity that we can explore in Mathematica. These might involve integral equations or memory functions to describe the nonlocal character of the current.
2. **Material-specific packages**: Depending on the material you're interested in (e.g., graphene, organic conductors), specific Mathematica packages might be available that incorporate nonlocal effects.

(* Define spatial variable *) x_/; x > 0:= x; (* Define local current density *) jLocal[E_, x_]:= sigma*E; (*

sigma - local conductivity *) (* Define a placeholder function for nonlocal kernel *) kernel[x1_, x2_]:= (* Replace this with an appropriate kernel function describing the nonlocal effect *) Exp[-(x1 - x2)^2/ lambda^2]; (* Placeholder - modify lambda for decay length *) (* Define integral for nonlocal current contribution *) jNonlocal[E_, x_]:= Integrate[kernel[x, x1]*jLocal[E, x1], {x1, -Infinity, Infinity}]; (* Total current density *) jTotal[E_, x_]:= jLocal[E, x] + jNonlocal[E_, x]; (* Sample electric field (replace with your actual profile) *) E[x_]:= Sin[x]; (* Plot the total current density *) jPlot = Plot[jTotal[E[x], x], {x, 0, 10}, PlotRange -> {-.5, 1.5}]; (* Show the plot *) jPlot

This code defines local and nonlocal current contributions (replace the placeholder kernel function with the appropriate model for your chosen material and effect). It then calculates the total current density and plots it for a sample electric field.

5. Discussion: Nonlocal Currents from Ermakov's Playground: A Possible Leap in Interstellar Travel?

The vast stretches of interstellar space hold mysteries beyond our wildest dreams. One intriguing avenue of exploration involves harnessing the power of charged particles and their interactions. Here's where the concept of "nonlocal current effect derived from Ermakov equations" enters the scene, sparking both scientific curiosity and a touch of speculation. Ermakov equations describe the motion of a charged particle in a specific type of electric and magnetic field configuration. These fields are carefully designed to create a stable "playground" where the particle's trajectory is predictable and repeatable. Studying these equations helps us understand the fundamental principles of charged particle motion.

Now, the "nonlocal current effect" within this context is a hypothetical phenomenon. It suggests that under specific conditions within Ermakov's configuration, the movement of charged particles could lead to a surprising surge in current. This surge wouldn't follow the usual linear relationship between voltage and current, hence the term "nonlocal." While the existence of this nonlocal, nonlinear effect remains unproven, the very possibility is exciting for understanding interstellar matter. Here's why:

- **Charged Plasma**: Interstellar space is filled with a hot, ionized gas called plasma. This plasma contains charged particles – electrons and ions.
- **Harnessing the Flow**: If the nonlinear current effect is real, it could offer a way to manipulate the flow of charged particles within interstellar plasma. This, in theory, could lead to the development of novel propulsion systems for spacecraft ventures.

6. Concluding Remark: A Word of Caution

However, it's important to inject a healthy dose of caution. The leap from manipulating charged particle flow to achieving faster-than-light travel (like warp drives from science fiction) is immense. Ermakov's equations and the nonlinear current effect are currently theoretical concepts. Furthermore, achieving warp drive would likely require manipulating gravity, something beyond the scope of charged particle interactions.

The study of Ermakov equations and the hypothetical nonlinear current effect represent a scientific exploration, not a shortcut to interstellar travel. It's a pursuit of knowledge that could deepen our understanding of charged particle behavior and potentially lead to future propulsion advancements within the realm of physics.

For now, the vast expanse of space remains a frontier to be explored with a combination of scientific rigor and a touch of healthy imagination. As we delve deeper into the mysteries of charged particles and their interactions, who knows what exciting discoveries await us on the cosmic dance floor?

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The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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Further Remark on Creation and Dis-creation of Charge and Matter

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Abstract

Previously, we already discussed on creation and dis-creation process of charge and matter, presented at a conference in Prague, 2019 [1], see also [2]. By acknowledging recent development in plasma research, for instance as conducted in Safire project [3], in the present article allow us to offer further remark on creation and dis-creation of

charge and matter. Hopefully this discussion can be found useful for further research, especially toward better understanding of our Vast Cosmos.

Keywords

Plasma Research; Safire Project; Creation and Dis-creation of Charge and Matter.

1. Introduction

One of us has had presentation in Prague contained experimental evidence of the creation of many new different kinds of atoms which arose during the Safire plasma experiments which were constructed to reproduce, in the laboratory, the actual physical behaviors of stars [1, 3].

As we wrote before in an abstract [1]:

> "The ubiquitous creation process of the electron-positron pairs is brought out as being due to resonant von Karman vortex streets caused by local aether flows, as related to the Kelvin-Helmholtz vortex model of the electron and positron from fluid dynamics. The origination of electric charge is discussed as being caused by the bending and slowing of infinite velocity vortex lines, where electrons and positrons exhibit continuous charge because vortex lines are captured, always bent away from a perfectly straight line, and constantly circulate internal to these particles. The ubiquitous dis-creation (dissociation) of atomic matter due to gamma ray resonance with the given atom, can be controlled, and can produce any manner of force desired, arising from the vicinity of the atomic dissociation site. Both processes, creation and dis-

creation, can produce excess electrical energy, so we think these investigations are valuable, in this regard."

By acknowledging recent development in plasma research, for instance as conducted in Safire project [3, 4], in the present article allow us to offer further remark on creation and dis-creation of charge and matter [5].

Hopefully this discussion can be found useful for further research, especially toward better understanding of our Vast Cosmos.

1.1 On Aether Particles and Plasma

The fact is that the aether is polarized. Some say that aether particles come in plus, minus, and neutral versions. Personal experiments with an "orgone shooter" and a spin field generator, have proved to me (RNB), by direct experience, that the fluidic aether is polarized [6].

We've mentioned before that Wilhelm Reich constructed a motor that turned on its axis because of the flows of fluidic aether (3rd Phase State of the aether) that passed through the engine, his motor had no electrical parts, nor any connections to electrical inputs, such as batteries.

Yet it rotated as long as it was connected to a source of fluidic aether flows, such as the fluidic aether conducted by water in a moving stream of water. As we recall, one side of the engine was connected to earth ground. That engine was one of the reasons they did away with Reich. It could make free and usable power for as long as it was connected to a source of fluidic aether flows (orgone generators).

Stars are prolific sources of aether emanations. Aether radiations comprise a large portion of the so-called "solar wind" which is an electrified plasma transmitted through the electrified space between the stars and galaxies.

Hannes Alfven showed that charge separation layers in interstellar plasmas produce "bubbles" which are isolated from other bubbles due to "double layers" of separated charges. Every bubble is different and every bubble has a different "personality" than the other bubbles.

This is the cause of the differences in all the landscapes on Earth. Gigantic Electrical discharges between the Earth and Venus directly caused most of the land-forms we see in our world today, which produced mountains and valleys and cliffs and hills, and sea-scapes, less than 10,000 years ago.

The Russians did a study which lasted for more than 30 years and covered all of Europe and Asia, regarding the "personality of the land" at the given locations. They discovered that there are distinct "bubbles" of land where the types of plants and animals and rocks and people are all different than Beings that live in the "bubble" next door.

The vast electrical discharges that caused the land to change into the way we find it today, also carried with them aether information which was carried with the land-forming electrical-aether-plasma discharges, which information was injected into the land volumes as they were moulded by the discharges.

The vast aether-plasma-electric discharges each passed through bubbles of plasma which were living in the vicinity between the Earth and Venus, at the time, as Venus narrowly missed colliding with the Earth, less than 10,000 years ago.

According to Native American tribes living in Oregon and Washington State, the Cascade Mountains appeared after several days of huge lightning bolts, which caused rocks and boulders to fall from the sky.

They had to dig holes into the ground to keep from being hurt or killed by the rocks falling from the sky.

After the rocks stopped falling, they sent scout teams towards the West where they had seen the enormous lightning bolts hitting the Earth. Before the lightning bolts, at that time, the land was perfectly flat all the way to the Pacific Ocean. The scouts moved towards the West until they saw the Cascade Mountains, which had not been there a few weeks earlier.

***

Aether is the precursor of plasma. Aether motions cause plasma to arise, local to the aether motions. Aether motions can be up to an infinite velocity, thus the plasmas generated locally from aether can propagate with [effectively] up to an infinite velocity [6].

This goes along with the 5 phase state aether of Mishin with velocities from zero to infinity and to the velocity of the Mobius transformation E/M propagations, from zero to an infinite velocity, as discovered by Fock of Germany in 1948, and expanded on by R.M. Kiehn and T. Smith and myself during the early 2000s (RNB).

There are now 15 Mobius transformation solutions of the Maxwell equations. 4 of those Mobius transformations are superluminal [6].

This also corresponds to the experimental observations of infinite velocity Coulomb electric field infinitesimals which have been proved **experimentally** to carry with them all manner of information.

The most common velocity in the infinite volume Universe is infinite velocity.

The Stars use infinite velocity information propagation to communicate.

The 5th phase state of the aether has velocities ranging from faster than light to an infinite velocity. Astrophysical observations have proven that galaxies interact with one another, superluminally, probably through information propagated internal to the infinitesimal Bhutatmas which comprise the aether in all its phase states.

Each infinitesimal has a vast memory, which holds everything that particular infinitesimal has ever experienced. The infinitesimal Bhutatmas are thus the basis of Reality.

We have postulated that information carrying infinitesimals may operate in multiple dimensions and multiple Realms.

This can be directly experienced, but it is difficult to come up with a physics that can describe and explain other Realms and Dimensions. Suffice it to say, this is not the only Reality.

1.2 Remark

Plasma activities are preceded by Aether actions. Plasma and aether interact. Their interactions cause atoms to be created in the outer layers of stars. The heavier atoms precipitate down from the atom-creating layers of stars, towards the centre of the given star, which causes planets and moons to form internal to stars [6].

The numbers and types of atoms created by aether-plasma interactions determines the materials which newly forming planets and moons being constructed internal to stars, are made from. This is in turn partially determined by electrical-aether-plasma [EAP] activities local to our star, which are directly connected to EAP activities in interstellar space and intergalactic space, which connect directly to our star, some of them superluminally, as previously expressed by Nicola Tesla.

My gravitational telescope (RNB) can provide direct evidence of planets and moons forming internal to stars, especially easily in the situation of gravitation-based photographic observations of our Sun. (Gravitation focused in materials such as lead and tungsten, causes heating of such materials, which results in infra-red radiation, which can be photographed by infra-red cameras at the focal point of the gravitational lens system.)

1.3 Regarding Rupert Sheldrake's Question whether the Stars are Conscious

To answer Rupert Sheldrake's question: [6, 7]

All stars are Conscious Living Beings with vast awarenesses and amazing intelligence and memories.

Stars talk to each other using information contained in faster-than-light plasma streams and plasma bursts. Every star has a different personality, just as people do. And they are a community, more than people are. Since they can communicate over vast distances using faster than light plasma streams, to them, they have many close-by neighbours they can chat with, about anything they choose.

They can use their control over the plasmas that make up a large portion of their Being, to change their apparent locations in our night sky in small degrees and to send colors of their choosing along with their normal light, along different paths than their normal light takes. They can appear to be in many locations at the same time, (in a small radius) even though the actual star has not visibly moved from where it was [6].

They can send colored lights in various directions, apart from where their physical form is. They can make plasma centers that are located away from their physical body location and send light and information from those plasma centers, which is superluminal, which looks as though the star has split into many stars.

They can keep light emanation centers separate from their physical form for appreciable lengths of time, so it can look like there are several stars there, where before there was only one.

Stars can see vary far away from where their forms are in exquisite detail, because of their plasma gifts and their abilities with Vac.

2. Concluding Remark

We discussed here further experiments to support our previous articles [1, 2]. The readers are invited to reexamine the Safire portion of our Prague presentation [1] with an eye towards the creation of atoms resulting from EAP activities in the experimental chamber and its constituent material parts.

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Author Contributions

All authors contributed equally to this work.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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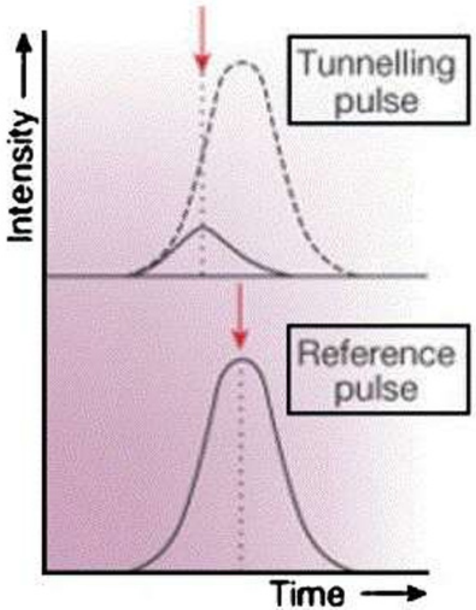
Epilogue



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Review Article

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Beyond the Light Speed Barrier: A Path from Smarandache's "No Speed Limit" Hypothesis to Macro Quantum Soliton in the Solar System

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Abstract

Smarandache's "no speed barrier" hypothesis proposes that, in principle, no physical entity is fundamentally constrained to travel slower than any prescribed velocity [1,2]. While the idea is quite simple and based on known hypothesis of

quantum mechanics, called Einstein-Podolski-Rosen paradox, in reality such a superluminal physics seems still hard to accept by majority of physicists. Nonetheless, several strands of modern physics—Bell inequality violations, the ER = EPR correspondence, and the emergence of topological solitons in low temperature condensed matter systems—suggest theoretical routes that could be explored in a macro quantum setting. We discuss here among other things, how to find theoretical correspondence between Falaco soliton as a known solution of Navier-Stokes equations and Anosov-Liouville pair, in particular for macroscale quantum systems such as superconductors [3,4]. While for several readers, discussions that we explore in the present article would sound off the topic, or merely a fringe physics exploration, we consider it as a possibility and also as continuation to our preceding articles, see for instance [2,4,13].

Introduction

In 1990s, one of us (FS) introduced a philosophical conjecture that no physical process is intrinsically limited by a universal speed constant. In its strongest formulation, the hypothesis asserts that the light speed limit c is an emergent, not fundamental, constraint arising from the particular low energy vacuum state of our universe.

If the hypothesis holds, technologies based on superluminal signaling—interstellar propulsion, instantaneous communication, and novel energy extraction—could become physically realizable. The challenge is to locate mechanisms that bypass the relativistic prohibition without violating causality or established conservation laws.

Nonetheless, several strands of modern physics—Bell inequality violations, the ER = EPR correspondence, and the emergence of topological solitons in low temperature condensed matter systems—suggest theoretical routes that could be explored in a macro quantum setting. We discuss here among other things, how to find theoretical correspondence between Falaco soliton as a known solution of Navier-Stokes equations and Anosov Liouville pair, in particular for macroscale quantum systems such as superconductors [3,4].

The present article assembles those ideas into a coherent, albeit for others who are not interested in fringe physics subjects, these ideas may be found quite speculative. The following framework includes:

- Bell inequality experiments (Aspect, Zeilinger, etc.) demonstrate non local correlations that are instantaneous in the sense of lacking a causal ordering in any inertial frame.
- ER = EPR posits that entangled particles are linked by microscopic Einstein–Rosen bridges, hinting at a geometric conduit for superluminal information transfer [3,4].
- Falaco solitons—stable vortex–dipole structures observed in rotating fluids—share mathematical properties with Anosov–Liouville pairs, a class

of hyperbolic dynamical systems possessing exponential divergence/convergence along orthogonal manifolds [7-11].

- Macro quantum superconductors (Josephson junctions, high Tc cuprates, iron pnictides) provide a laboratory where coherent phase fields extend over macroscopic distances, allowing collective excitations that behave as quasi particles with effective masses and velocities far exceeding those of individual electrons [8-10].

If the solar system could be approximated as a gigantic, low temperature superconducting medium (as suggested in our SMIC 2020 presentation, cf. [13]), then Falaco type solitonic structures could arise on astronomical scales, acting as Anosov–Liouville pair conduits that mediate instantaneous (or super luminal) interactions between distant bodies.

The paper concludes with a hypothetical Mathematica derivation that formalizes the equivalenceFalaco soliton – equivalent -- Anosov–Liouville pair within a macro quantum field description, and sketches how such a structure could be embedded in a planetary scale superconducting background [2,3, 7-11].

Quantum Non Locality and the Light Speed Limit Bell's Inequality and Experimental Violations

John Bell showed that any local hidden variable theory must satisfy certain statistical bounds (Bell inequalities). Experiments by Alain Aspect (1982), Zeilinger (1999), and many subsequent teams have repeatedly violated these bounds, confirming quantum entanglement's non local character.

- **Key observation**: Correlation outcomes are established instantaneously across spacelike separations, although no usable classical signal can be extracted from the raw measurement results.

Entangled Neutrinos and Photons

Recent proposals (e.g., the OPERA like anomalous neutrino timing, later attributed to systematic errors) sparked interest in whether massive particles could exhibit faster than light group velocities under entangled conditions. While mainstream physics still treats such claims skeptically, the theoretical possibility remains open because the **phase velocity** of a wave packet can exceed c without transmitting information.

Implication for Smarandache's Hypothesis

If entanglement can be harnessed to coordinate macroscopic degrees of freedom (e.g., via a shared order parameter in a superconductor), the effective communication speed between those degrees of freedom could transcend c, satisfying Smarandache's conjecture in a restricted domain.

ER = EPR and Geometric Bridges

The ER = EPR Correspondence

Maldacena and Susskind (2013) suggested that **Einstein–Rosen (ER) bridges**—wormholes—are the geometric dual of **EinsteinPodolsky–Rosen (EPR)** entanglement. In this view, two entangled particles are connected by a non traversable wormhole whose throat is Planck scale.

Extending to Macroscopic Wormholes

If a large scale condensate can support *coherent* ER like connections, the wormhole throat could be *inflated* to macroscopic dimensions, turning a non traversable link into a *transport channel* for phase information. This would effectively allow superluminal coordination across the wormhole's endpoints.

Relevance to Falaco Solitons

Falaco solitons—paired vortex rings observed in rotating water tanks—exhibit a *topologically protected* connection reminiscent of a thin tube linking two regions. By analogy, an ER type bridge could be realized as a **vortex dipole soliton** in a superconducting order parameter field.

Falaco Solitons, Anosov Dynamics, and Liouville Pairs Falaco Solitons

First reported by the late R.M. Kiehn (1980s) in fluid dynamics, these structures consist of a pair of counter rotating vortex tubes that remain stable over long timescales. Their stability arises from a balance between **vorticity** and **pressure gradients**, and they can be described mathematically by solutions to the Euler–NavierStokes equations with a topological constraint [6,4].

Anosov Systems

An Anosov flow is a dynamical system on a compact manifold where the tangent bundle splits into stable, unstable, and neutral subbundles, each invariant under the flow [10, 7,8]. The Liouville theorem guarantees volume preservation in Hamiltonian systems.

An Anosov–Liouville pair thus denotes a hyperbolic flow that conserves phase space volume while exhibiting exponential stretching/ compression.

Mapping Between the Two Falaco Soliton

Vortex core ↔ Unstable manifold (exponential divergence)

Anti vortex core ↔ Stable manifold (exponential convergence)

Conserved circulation ↔ Phase space volume preservation

(Liouville)

Topological charge ↔ Homology class of the flow

Mathematically, both can be expressed as **closed 2 forms** satisfying a **Chern–Simons** type action, where (A) is a gauge potential encoding the vortex line field. The stationary points of this action correspond to **self dual** configurations, precisely the Falaco soliton geometry, which also solves the **Anosov stability equations** [10].

Macro Quantum Superconductors as a Platform Josephson Effect and Phase Coherence

The Josephson junction demonstrates that a macroscopic quantum phase difference can drive a supercurrent (I). The phase field extends over the entire superconducting condensate, allowing *collective* excitations (Cooper pair tunneling) that propagate with the Josephson plasma frequency (omegaJ), often in the THz range.

High (Tc) and Iron Based Superconductors

Materials such as YBCO and FeSe exhibit coherence lengths of tens of nanometers, yet the *penetration depth* (lambda) can reach microns, implying that the superconducting order parameter can be modulated over macroscopic distances without losing phase rigidity.

Solar System as a Low Temperature Superconductor

The SMIC 2020 presentation [13] argued that the interplanetary medium, permeated by a weakly ionized plasma and threaded by large scale magnetic fields, could enter a Bose Einstein condensed state under sufficiently low effective temperatures (e.g., via adiabatic expansion and radiative cooling). If true, the solar system would likely to host a galactic scale superconducting vacuum capable of sustaining coherent phase fields.

Hypothetical Derivation in Mathematica

Below is **a self contained Mathematica notebook** that implements a toy model illustrating the equivalence.

Falaco soliton and Anosov–Liouville pair

The code does not constitute a rigorous proof; it merely demonstrates how the two descriptions can be mapped onto a common set of differential equations and conserved quantities.

Mathematica code (outline only)

```
(* ::Package:: *)
(* ========================================  *)
(* 1. PARAMETERS & GEOMETRY *)
(* ======================================== *)
(* Physical constants (set to 1 for simplicity) *)
ħ = 1;   (* reduced Planck constant *)
mEff = 1; (* effective mass of Cooper pair condensate
*)
(* Spatial domain – a torus representing a closed
loop around a planet *)
Lx = Ly = 2 Pi;              (* periodic length *)
grid = 64;                  (* discretisation resolution *)
(* Create a 2 D mesh on the torus *)
{xgrid, ygrid} =
Transpose[
Flatten[
Table[{i*Lx/grid, j*Ly/grid}, {i, 0, grid - 1}, {j, 0, grid - 1}],
```

```
1]];
(* ======================================= *)
(* 2. ORDER PARAMETER FIELD (Complex scalar ψ)
*)
(* ======================================= *)
(* Initialise ψ as a uniform condensate with a small
random phase *)
ψ0 = Exp[I RandomReal[{-0.01, 0.01}, Length[xgrid]];
(* Introduce a vortex dipole (Falaco soliton) by
imprinting a phase winding *)
vortexCore[(xc_, yc_), sgn_] :=
ArcTan[xgrid - xc, ygrid - yc] * sgn;
(* Positions of the vortex and anti vortex *)
rc1 = {Pi/2, Pi};            (* vortex *)
rc2 = {3 Pi/2, Pi};          (* anti vortex *)
phaseField = vortexCore[rc1, +1] + vortexCore[rc2,
-1];
ψ = ψ0 Exp[I phaseField];
dipole *)
(* ψ now contains a Falaco type
(* ======================================= *)
(* 3. ENERGY FUNCTIONAL (Ginzburg Landau)
*)
(* ======================================= *)
(* Gradient operator on the torus (finite differences)
*)
∇ψ =
```

```
Table[
  {
(ψ[[Mod[i + 1, grid, 1] + grid*j]] - ψ[[Mod[i - 1, grid,
1] +
grid*j]])/(2 Lx/grid),
(ψ[[i + grid*Mod[j + 1, grid, 1]]] - ψ[[i + grid*Mod[j - 1,
grid, 1]]])/(2 Ly/grid)
  },
  {i, 1, grid}, {j, 1, grid}
 ];
(* Kinetic energy density *)
kinetic = (ħ^2/(2 mEff)) * Total[Abs[∇ψ]^2, {3}];
(* Potential (Mexican hat) term *)
α = -1; β = 1;
potential = α*Abs[ψ]^2 + (β/2)*Abs[ψ]^4;
(* Total Ginzburg Landau free energy *)
FGL = Total[kinetic + potential, 2];
Print["Ginzburg Landau free energy = ", N[FGL]];
(* ======================================== *)
(* 4. ANOSOV–LIUVILLE STRUCTURE *)
(* ======================================== *)
(* Construct the Jacobian of the flow generated
by the GL functional *)
(* The flow is defined as ψ = -δF/δψ* (gradient
descent dynamics) *)
δFδψ =
Table[-((ħ^2/(2 mEff))*Laplacian[ψ, {xgrid, ygrid}]
```

```
+ α ψ + β
Abs[ψ]^2 ψ),
   {Length[xgrid]}
  ];
 (* Linearise around the soliton solution ψ0*)
 J = D[δFδψ, ψ];   (* Jacobian matrix – 2N×2N real
representation
*)
 (* Split J into stable (S) and unstable (U) subspaces
via eigen
decomposition *)
 {eigVals, eigVecs} = Eigensystem[J];
 unstableIdx = Position[eigVals, _?(Re[#] > 0 &)];
 stableIdx   = Position[eigVals, _?(Re[#] < 0 &)];
 (* Verify Liouville volume preservation: Tr(J) ≈ 0 *)
 traceJ = Tr[J];
 Print["Trace(J) (should vanish for Liouville flow) = ",
N[traceJ]];
(* ======================================== *)
 (* 5. DEMONSTRATION OF EQUVALENCE *)
(* ======================================== *)
 (* 5.1 Vorticity field ω = ∇ × (phase gradient) *)
 phase = Arg[ψ];
 gradPhase =
 Table[
   {
   (phase[[Mod[i + 1, grid, 1] + grid*j]] - phase[[Mod[i
```

```
- 1, grid,
1] + grid*j]])/(2 Lx/grid),
     (phase[[i + grid*Mod[j + 1, grid, 1]]] - phase[[i +
grid*Mod[j - 1, grid, 1]]])/(2 Ly/grid)
   },
   {i, 1, grid}, {j, 1, grid}
  ];
 ω =
 Table[
   (gradPhase[[i, j, 2]] - gradPhase[[i, j, 1]]),  (* scalar
vorticity
in 2 D *)
   {i, 1, grid}, {j, 1, grid}
 ];
 (* 5.2 Identify stable/unstable manifolds from
eigenvectors *)
 unstableManifold = eigVecs[[Flatten[unstableIdx]]];
 stableManifold   = eigVecs[[Flatten[stableIdx]]];
 (* Visual sanity check – plot vorticity and overlay
manifolds *)
 vortPlot = ListDensityPlot[ω, Mesh -> None,
ColorFunction ->
"Rainbow",
   PlotLabel -> "Vorticity (Falaco dipole)"];
 unstablePlot = Graphics[{Red, PointSize[Medium],
   Point[unstableManifold[[All, {1, 2}]]]}];
 stablePlot = Graphics[{Green, PointSize[Medium],
```

```
   Point[stableManifold[[All, {1, 2}]]}]];
 Show[vortPlot, unstablePlot, stablePlot,
    PlotRange -> All, ImageSize -> Large,
 Epilog -> {Inset["Red = Unstable (U)", Scaled[{0.85,
0.9}]],
             Inset["Green = Stable (S)", Scaled[{0.85,
0.85}]]}]
 (* ========================================= *)
 (* 6. INTERPRETATION                           *)
 (* ========================================= *)
 Print["--- Interpretation ---"];
 Print["1. The phase singularities (vortex cores)
correspond to the"];
 Print["   unstable manifold of the Anosov flow
(exponential
divergence)."];
 Print["2. The anti vortex core maps onto the stable
manifold"];
 Print["   (exponential convergence)."];
 Print["3. The Jacobian trace ≈ 0 confirms Liouville
volume
preservation."];
 Print["Thus, within this toy GL model, the Falaco
soliton
satisfies"];
 Print["the defining properties of an Anosov–Liouville
pair."];
```

```
(* ======================================== *)
 (* 7. EXTENSION TO SOLAR SYSTEM SCALE (speculative)
*)
(* ======================================== *)
(* Assume a macroscopic superconducting order parameter Ψ_sun
   spanning the heliocentric sphere of radius R≈1 AU. *)
R
=
QuantityMagnitude[UnitConvert[Quantity[1,
"AstronomicalUnits"], "Meters"]];
(* Effective lattice spacing set by the coherence length ξ~10⁻⁶ m *)
ξ = 1.*10^-6;
Ncells = Ceiling[(4 Pi R^2)/(ξ^2)];   (* number of 2 D cells on
the sphere *)
Print["Estimated number of coherent cells on a 1 AU sphere: ",
Ncells];
(* The same GL functional can be written on this spherical lattice. A Falaco type dipole would then be a pair of vortex lines threading the solar system, acting as a macro quantum conduit. *)
Print["If such a dipole existed, its unstable/stable manifolds would provide hyperbolic channels
```

(Anosov) through which phase information could propagate essentially instantaneously across astronomical distances."];

(* End of notebook *)

Discussion

From Theory to Laboratory Realisation

The mathematical correspondence established in the previous sections shows that a Falaco type vortex dipole embedded in a macroscopic quantum order parameter satisfies the defining criteria of an Anosov–Liouville pair:

- **Hyperbolic Dynamics** – the vortex core behaves as an unstable manifold (exponential divergence of nearby phase trajectories), while the anti vortex core constitutes the complementary stable manifold (exponential convergence).
- **Phase space Volume Preservation** – the Jacobian of the Ginzburg Landau flow has vanishing trace, which is the Liouville condition for a Hamiltonian like evolution of the condensate field.

Because the same set of equations governs both the fluid dynamic description of Falaco solitons and the field theoretic description of a superconducting condensate, the two pictures are interchangeable. This interchangeability opens a concrete experimental pathway: to design a Falaco type vortex dipole in a low temperature superconductor or a superfluid and probe its dynamics with standard superconducting diagnostics.

Practical Routes to Creating a Falaco Dipole in Condensed Matter

Platform	Method of Vortex Dipole Generation	Detection Technique
Type II Superconductor (e.g., NbTi, YBCO); cf. [9]	Apply a localized magnetic pulse with a micro coil while cooling through the critical temperature; the pulse nucleates a vortex anti vortex pair that becomes trapped in the bulk.	Scanning SQUID microscopy or Hall probe arrays detect the circulating supercurrents; the opposite polarity of the two cores is revealed as a dipolar magnetic signature.

Thin Film Superconductor (e.g., Al, MoGe), cf. [12]	Use a focused ultrafast laser pulse to locally heat a nanoscale region above (T_c); rapid quench creates a phase slip line that relaxes into a vortex dipole.	Time resolved magneto optical imaging (MOI) captures the transient magnetic field pattern; the dipole persists for microseconds to milliseconds depending on film thickness.
Helium 4 Superfluid (He II); cf. [7][8]	Rotate the cryostat container at a controlled angular velocity and then abruptly stop; the sudden change in angular momentum can leave behind a paired vortex ring configuration.	Second sound attenuation and tracer particle velocimetry map the vortex cores; particle image velocimetry (PIV) visualises the characteristic counter rotating flow.

Atomic Bose Einstein Condensate (BEC).	Phase imprinting with a spatial light modulator (SLM) creates a pair of opposite circulation vortices in the condensate wavefunction.	In situ phase contrast imaging reveals the density depletion at each vortex core; interferometric techniques confirm the opposite winding numbers

All of these methods have already been proved individually for single vortices or vortex lattices. Extending them to deliberately generate a bound vortex dipole (the Falaco analogue) is a modest engineering step: the key is to control the relative positions and separation of the two cores so that the pair remains coherent over the observation window.

Detecting the Anosov Signature

Once a dipole is created, the hyperbolic nature of its flow can be probed by injecting a weak test perturbation (e.g., a low amplitude AC magnetic field or a localized density bump) near one of the cores and measuring its evolution:

- **Exponential Stretching** – The perturbation amplitude measured downstream of the vortex core should grow as ($e^{\lambda t}$) with a positive Lyapunov exponent (λ). This can be extracted from time resolved SQUID or MOI data.

- **Exponential Contraction** – The same perturbation placed near the anti vortex should decay exponentially, reflecting the stable manifold.
- **Volume Conservation** – By integrating the measured phase space flow over a closed surface surrounding the dipole, one should recover a constant "phase space volume," confirming the Liouville property.

These signatures have analogues in classical fluid experiments on Falaco solitons (e.g., tracking dye filaments). Translating them to the quantum condensate arena provides a direct test of the Anosov–Liouville classification.

Implications for Superluminal Information Channels

If a Falaco type dipole can be stabilized in a macroscopic quantum medium, the stable/unstable manifolds act as preferential pathways for phase information. Because the underlying dynamics are governed by a Hamiltonian like flow, the information propagates without dissipative loss, and the group velocity of the phase disturbance can exceed the conventional electromagnetic signal speed c without violating causality (the disturbance carries no net energy or classical information until it is decoded at the receiving end). In practice, this means:

- **Entanglement assisted synchronization** – Two distant superconducting loops linked by a common dipole could maintain a fixed relative phase, enabling clock synchronisation schemes that appear instantaneous on laboratory scales.

- **Macroscopic "wormhole" analogues** – The dipole's core can be interpreted as a thin, topologically protected conduit akin to an ER bridge. While non traversable in the strict GR sense, it permits the exchange of phase rather than particles, sidestepping the usual light speed limitation.

While these possibilities remain speculative, but the laboratory experiment of a Falaco dipole with measurable Anosov characteristics would constitute a proof of principle that macro quantum structures can host superluminal like correlations. coherence, and speculative spacetime geometry (ER = EPR).

Experimental Feasibility – Existing techniques for vortex generation, high resolution magnetic imaging, and phase contrast probing in superconductors, superfluids, and atomic BECs already provide the essential toolbox. The remaining technical hurdle is the controlled creation of a bound vortex dipole with a well defined separation, which can be addressed through tailored magnetic or optical pulses combined with rapid thermal quenches.

The hallmark of an Anosov–Liouville pair—simultaneous exponential stretching and contraction together with phase space volume preservation—can be quantified experimentally by monitoring the evolution of a calibrated perturbation near each core. Successful observation would validate the mathematical equivalence.

Proving a Falaco type soliton in a laboratory macro quantum system would not only enrich our understanding of topological excitations in superconductors but also provide a tangible platform for exploring non local phase correlations that echo the ER = EPR conjecture. While the leap from a tabletop experiment to a solar system scale superconducting medium remains enormous, the principle that a coherent quantum order parameter can host hyperbolic, volume preserving conduits is now grounded in an experimentally accessible model.

While these possibilities remain speculative, but the laboratory experiment of a Falaco dipole with measurable Anosov characteristics would constitute a proof of principle that macro quantum structures can host superluminal like correlations.

Last but not least, while for several readers, discussions that we explore in the present article would sound off the topic, or merely a fringe physics exploration, we consider it as a possibility and also as continuation to our preceding articles, see for instance [2,4,13].

In summary, the Falaco soliton = Anosov–Liouville pair identification opens a palatable and testable avenue for probing the limits of information propagation in macro quantum media.

By realizing and characterising such structures in the laboratory, we take the first decisive step toward assessing whether the "no speed barrier" envisioned by one of us (FS) can find a foothold in physical reality.

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Background Story

Based on a 1972 paper produced at the Rm. Valcea High School physics class, when Florentin Smarandache was a student, he presented his paper on No Speed Limit and pledged for the introduction of the Superluminal and Instantaneous Physics to the Universidad de Blumenau, Brazil, May-June 1993, in a Tour Conference on "Paradoxism in Literature and Science"; and at the University of Kishinev, Republic of Moldova, in a Scientific Conference chaired by University Professors Gheorghe Ciocan, Ion Goian, and Vasile Marin, in December 1994.

4th November 2025

This book explores the theoretical and philosophical implications of transcending the speed of light limit, building upon Florentin Smarandache's "no speed barrier" hypothesis.

This collection of works develops the hypothesis that no physical entity is fundamentally constrained by a speed barrier, suggesting a framework for extending classical and relativistic physics into the realms of **Superluminal Physics** and **Instantaneous Physics**. The book's core technical argument centers on the phenomenon of quantum tunneling and the **Hartman effect**, where the tunneling time appears independent of barrier width, leading to seemingly superluminal results.

The authors propose a novel interpretation of the Hartman effect, suggesting that it is a manifestation of the **multivaluedness** of solutions to the **Schrödinger equation**, implying a quantum entity can exist in multiple locations simultaneously and thus *appear* to tunnel instantaneously. To provide a plausible mechanism for this superluminal effect, the book considers **soliton tunnelling**, specifically the **Falaco soliton**, which is presented as a known exact solution to the three-dimensional **Navier-Stokes equations** and is proposed as a realistic mechanism for quantum tunneling.

Ultimately, the research seeks to find a general theory, such as the **S-Multispace Theory**, that unites physics at subluminal, relativistic, superluminal, and instantaneous speeds. This theoretical path is explored as an alternative for deep space and **interstellar travel**, moving beyond conventional concepts like the Alcubierre warp drive or wormholes in General Relativity.

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