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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.

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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:

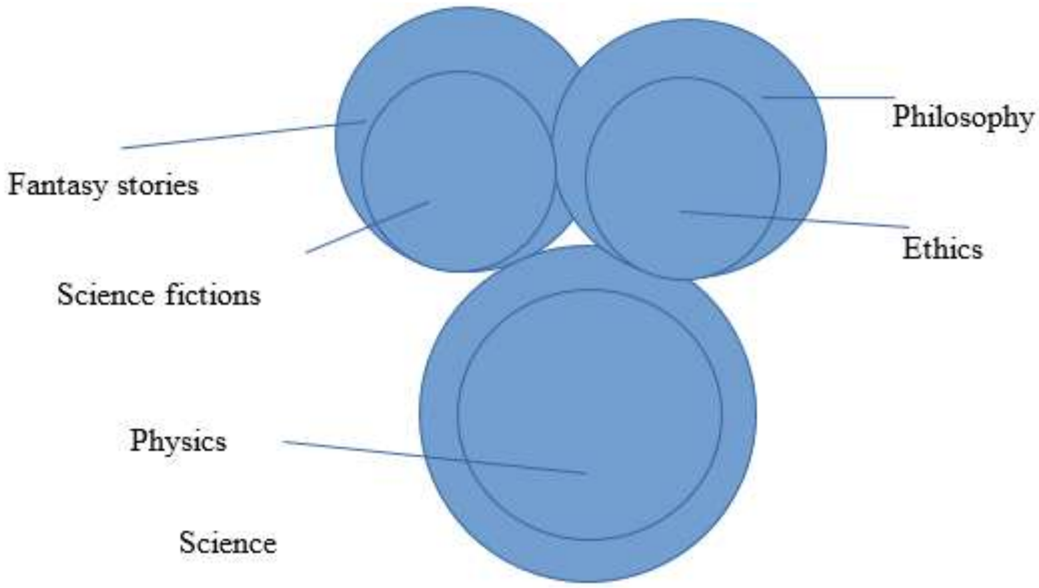

Figure 1. Neutrosophic sets depiction of science fictions, physics and philosophy/ethics.

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

[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/

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 wave-like 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 frame-dragging. 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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Author Contributaion

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.

References

[1] Hector A. Munera. Neo-cartesian unified fluid and field theory. IOP Conference series: J. Phys. Series 1251 (2019)

[2] V. Christianto, F. Smarandache, R.N. Boyd (eds.) New Foundation in the Sciences. East Java: Eunoia, Indonesia (2019).

[3] Yunita Umniyati, Victor Christianto and Florentin Smarandache. A New Hypothesis of Spin Supercurrent as Plausible Mechanism of Biological Nonlocal Interaction, Synchronicity, Quantum Communication. A book chapter at IntechOpen publication (2022). url: https://www.intechopen.com/chapters/81418; DOI: 10.5772/intechopen.102743

[4] Sergey Ershkov. НЕСТАЦИОНАРНЫЕ РЕШЕНИЯ УРАВНЕНИЙ ГИДРОДИНАМИКИ С ПОСТОЯННОЙ ФУНКЦИЕЙ БЕРНУЛЛИ. PhD Dissertation, unpublished. (2018)

[5] D. H. Wood. Deriving the Kutta-Joukowsky Equation and Some of Its Generalizations Using Momentum Balances. Open Journal of Fluid Dynamics (2011), 1, 12-16. url: doi:10.4236/ojfd.2011.11002

[6] Fu Yuhua. New Explanation of Advance of Planetary Perihelion and Solar System's Vortex Motion. ResearchGate archive, url: www.researchgate.net

[7] Tanja Rindler-Daller and Paul R. Shapiro. Angular momentum and vortex formation in Bose–Einstein-condensed cold dark matter haloes. Mon. Not. R. Astron. Soc. 422, 135–161 (2012). DOI : doi:10.1111/j.1365-2966.2012.20588.x

[8] K. Tziotziou et al. Vortex Motions in the Solar Atmosphere: Definitions, Theory, Observations, and Modelling. Space Science Reviews (2023) 219:1 https://doi.org/10.1007/s11214-022-00946-8

[9] V. Christianto, F. Smarandache, Robert N. Boyd, Electron Model Based on Helmholtz's Electron Vortex Theory & Kolmogorov's Theory of Turbulence, Prespacetime J. (2019). Also in UNM Digital Repository at url: https://digitalrepository.unm.edu/math_fsp/347/

[10] F. Smarandache, V. Christianto, Fu Yuhua, R. Khrapko, J. Hutchison. Unfolding the Labyrinth: Open Problems in Physics, Mathematics, Astrophysics, and Other Areas of Science. Phoenix: Hexis, 2006. arXiv: https://arxiv.org/abs/math/0609238, also in UNM Digital Repository at url: https://digitalrepository.unm.edu/math_fsp/74/

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*freeStreamVelocity;
(* 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;       (* Solar mass *)
m = 1;                 (* 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.

***