The Double Slit Experiment Explained: Pilot Wave Theory and Foamy Ether Theory

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Abstract

This article examines wave-particle duality and the double slit experiment, offering a detailed explanation of the physical phenomena at a fundamental level. It highlights that constructing a double slit model with macro-objects, rather than atomic structures, fundamentally limits accurate representation of the underlying principles involved. Foamy Ether Theory [1] offers a more realistic model, describing how the *gravitational disturbance* of a particle or photon travels through the *entire* wall of a double slit apparatus, not just the two slits.

It is well known that gravitational waves travel through matter unimpeded. Each particle or photon is accompanied by its own gravitational disturbance (or wave) as it travels through space. Foamy Ether Theory (FET) asserts that these gravitational disturbances are equivalent to pilot waves that are described in De Broglie–Bohm theory [2].

Snapshots of simulations are presented that illustrate how these gravitational disturbances propagate through the foamy ether *and* through the walls of a double slit apparatus, thereby causing *gravitational* interference patterns to emerge. A single particle or photon *also* creates an interference pattern because it is riding on its own gravitational (pilot) wave, as it travels through *both* the slits *and* the walls.

Keywords: double slit experiment, photon, pilot wave, gravitational wave, wave-particle duality, interference pattern, diffraction pattern, David Bohm, Louis de Broglie, foamy ether theory, walking droplet

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FET Background Theory

Foamy Ether Theory (FET) characterises electromagnetic (EM) waves as distortions within the foam that are transverse to the direction of propagation. Figure 1a is a snapshot of a simulation showing that the foamy ether exhibits maximum vertical distortion (compression) at the positive and negative peaks of the EM wave. In contrast,

gravitational waves are compressions oriented parallel to the direction of propagation as depicted in Figure 1b. Further explanation can be found at: https://www.peterhahn.ca/the-photon.

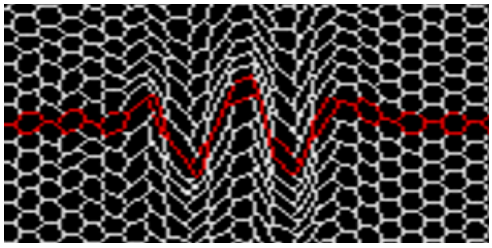

Figure 1a
EM wave through foamy ether

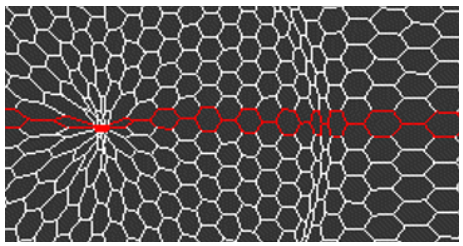

Figure 1b
Gravitational wave through foamy ether

Introduction

Gravitational waves propagate through matter virtually unimpeded. As these disturbances pass through the slits and the walls of a double slit apparatus, they generate a gravitational interference pattern. According to FET, this gravitational interference pattern ***is*** the pilot wave referenced in De Broglie-Bohm theory. FET, however, expands upon this idea by offering an ontological description, explaining the physical nature and behaviour of the pilot wave as a gravitational disturbance that propagates through a double slit (and single slit) apparatus.

The Double Slit

Figure 2a below is a sample graphic illustrating a typical (classical) configuration of the double slit experiment. A wave approaches a solid wall containing two slits. The wave then enters both slits and then recombines to produce an interference pattern on a screen (Figure 2b).

Figure 2a
Classical view of double slit

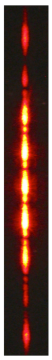

Figure 2b
Interference pattern

The root cause of the double slit conundrum is that the classical view relies on the concept solid walls. This is not an accurate representation when viewed at the atomic scale.

Jim Al-Khalili's book, *Quantum* [3], has a partially modified (atomic) view, but still retains the solid wall. As shown in Figures 3a to 3d, the ejected atomic particle is more accurately represented by a probability wave function. This is an improvement, but is still incomplete.

At the atomic scale, the concept of a solid wall is fundamentally inaccurate and does not represent physical reality. This is due to the fact that atoms are comprised primarily of empty space, with their masses concentrated in minute subatomic particles. As a result, representing the wall as a solid block, as shown in Figures 2a and 3a to 3d, fails to capture its microscopic structure. Instead, the wall should be depicted as an array of probability wave functions corresponding to the constituent subatomic particles of the atoms.

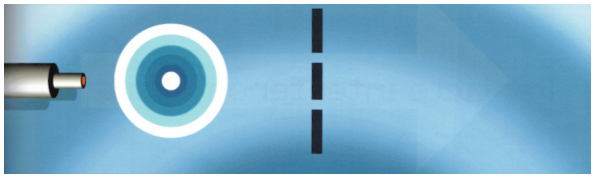

Figure 3a

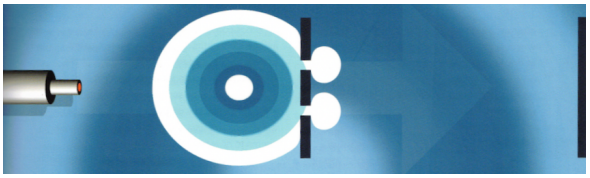

Figure 3b

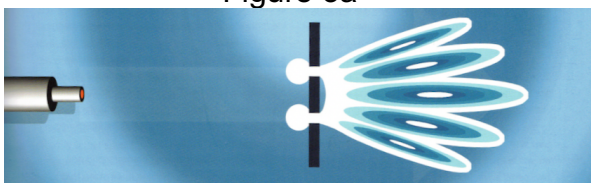

Figure 3c

Figure 3d

Travelling probability wave function
Reprinted with the author's permission: Jim Al-Khalili [4]

De Broglie–Bohm theory also utilizes a solid wall when explaining the double-slit experiment. However, the theory posits that pilot waves are responsible for altering the trajectory of the moving particle, thereby producing an interference pattern. Figure 4 below presents a diagram of potential trajectories.

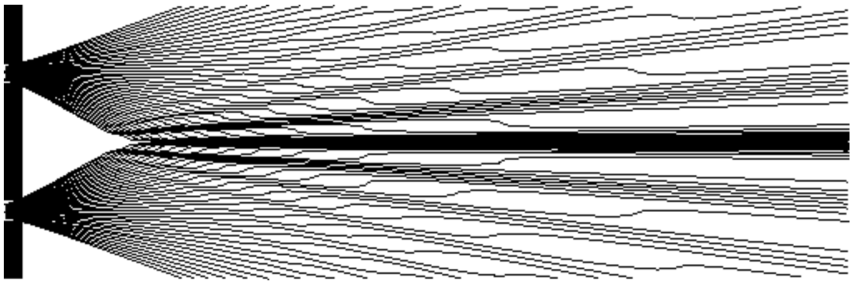

Figure 4
De Broglie–Bohm trajectories [2]

FET Explanation

Particles

Foamy ether theory provides a model that more accurately describes how the gravitational disturbance or wave associated with a particle or photon propagates, not only through the two slits, but also through the walls of a double-slit apparatus.

The primary deficiency of quantum mechanics is its exclusion of gravity, yet it is the gravitational field or disturbances around that particle that influences its path.

Gravitational waves travel through matter virtually unimpeded when viewed at a macro scale, however they are influenced by the gravitational fields of individual particles on a subatomic scale. This interaction results in gravitational lensing occurring around each atom, similar to the gravitational lensing observed near astronomical bodies such as black holes or galaxies. *Even if a particle goes through only one slit, its gravitational field/disturbance extends through both slits* ***and*** *goes through the walls of the apparatus*. The stationary gravitational fields of all the atoms comprising the wall interact with the moving particle's gravitational field, thereby altering its trajectory by creating a *gravitational* interference pattern.

FET asserts that these gravitational pilot waves are real physical waves that travel through the foamy ether. These pilot waves originate from the gravitational field (or disturbance) of the particle itself. Since gravitational waves travel at the speed of light, the gravitational pilot wave consistently precedes the particle's position, effectively guiding its movement.

Photons

By combining Planck's energy-frequency equation, $E = hf$, with Einstein's mass-energy equivalence equation, $E=mc^2$, one can derive the following: $mc^2 = hf$ or $m=hf/c^2$. This derivation suggests that a photon's mass is determined by its frequency or wavelength. Having an equivalent mass implies that a photon also has an associated gravitational field or wave which travel together. However, the electromagnetic component of the photon can only go through one slit, while the gravitational component of the photon goes through the entire wall. The gravitational interference pattern that is created while travelling through the atoms of the wall influence the trajectory of the photon when it emerges from the slit.

FET Simulations

FET simulations are generated by constructing a two-dimensional grid comprised of nodes that are interconnected by tightly stretched spring and damper pairs. They are arranged on a flat plane in a hexagonal pattern in the x and z dimensions. To simulate gravitational waves, all induced distortions are confined to the x and z directions.

Diffraction Pattern: No Slits

Figures 5a through 5d present sequential stages of a simulation illustrating the emergence of a gravitational diffraction pattern traversing a solid wall. The sequence begins in Figure 5a with the depiction of a wall composed of a vertical arrangement of knots within the foamy ether. In Figure 5b, a gravitational wave pulse is shown approaching the wall. Figure 5c shows the pulse penetrating the wall, highlighting the gravitational lensing effect occurring around each atom (knot) of the wall structure. This process results in the formation of a gravitational diffraction pattern, as denoted by the green arrows. The red arrow in Figure 5d demonstrates the continuation of the diffraction pattern beyond the wall. A full simulation of this is available at: https://www.peterhahn.ca/noslits.

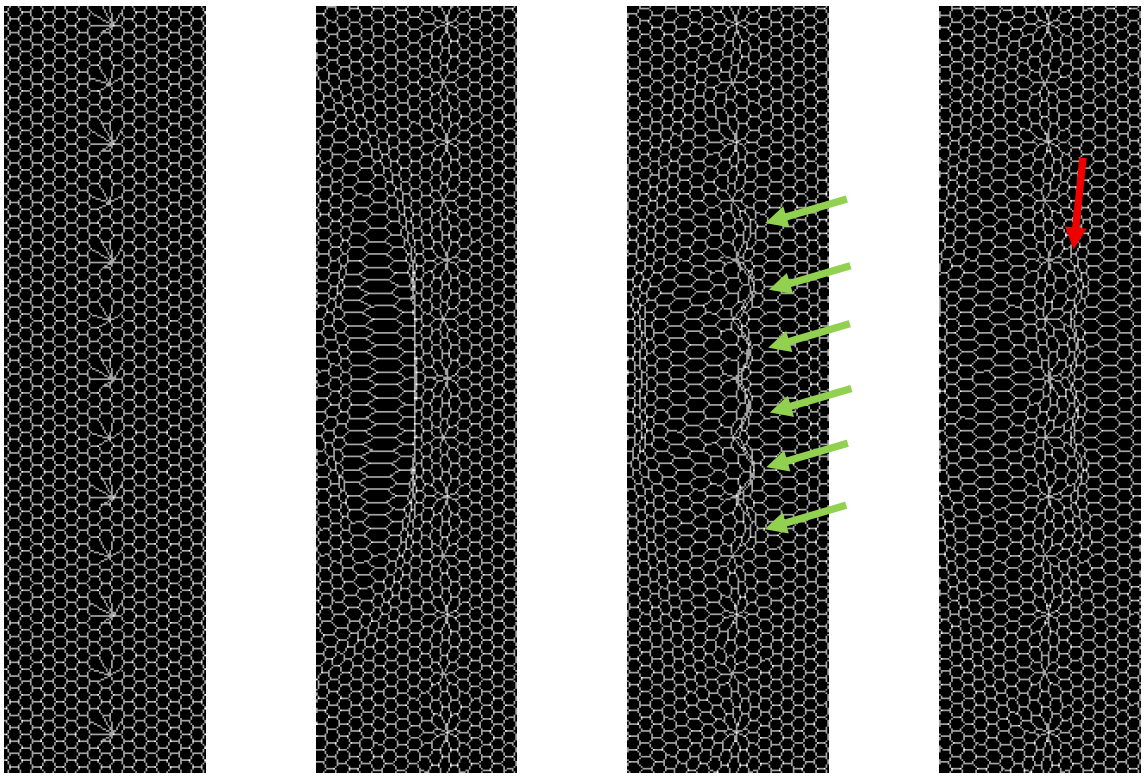

Figure 5a Figure 5b Figure 5c Figure 5d

Gravitational wave traveling through atom thick wall

A full simulation of this is available at: https://www.peterhahn.ca/noslits

Diffraction Pattern: One Slit

Figures 6a through 6d present snapshots of a simulation illustrating a gravitational wave traversing a single slit apparatus. The walls are comprised of a vertical array of atoms represented by kinks or knots within the foam. For illustrative purposes, transparent yellow rectangles are superimposed over the atomic array to convey the classical concept of a solid wall; these overlays do not influence the simulation itself. The green arrows in

Figure 6c show how the gravitational wave is distorted as it passes through the wall on either side of the single slit. The red arrow points to the portion of the gravitational wave that passes directly through the slit. Figure 6d shows how the distortions of the gravitational wave recombine and continue to propagate with wave's original symmetrical shape mostly intact. As indicated by the green arrows, some degree of wave distortion persists. This is the root cause of the diffraction pattern that occurs when individual particles or photons pass through a single slit device.

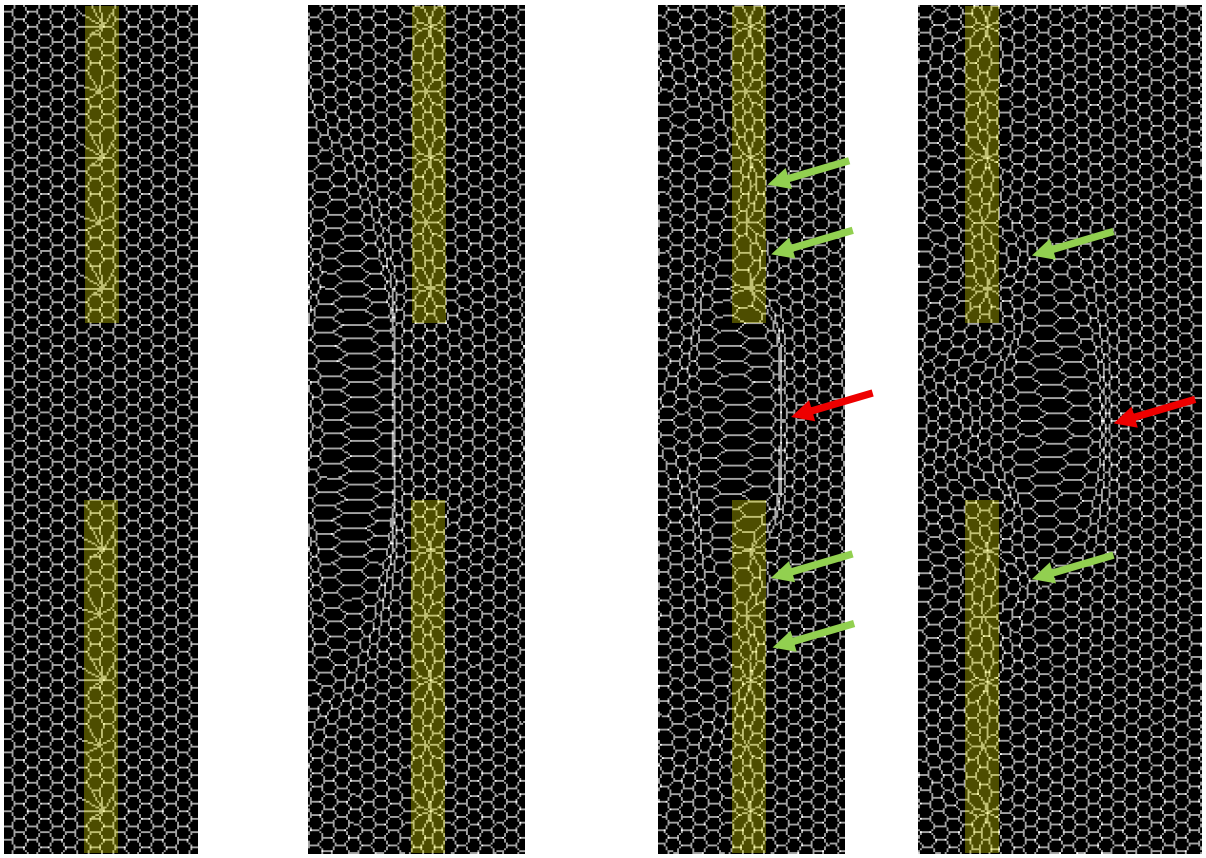

Figure 6a Figure 6b Figure 6c Figure 6d

Gravitational wave traveling through single slit and through wall
A full simulation of this is available at: peterhahn.ca/singleslit

Figure 7 is a sample photo of a diffraction pattern that is created when a laser beam is directed at a single slit device.

Figure 7
Diffraction pattern: single slit

Interference Pattern: Two Slits

Figures 8a through 8d illustrate a simulation of a gravitational disturbance propagating through a double slit apparatus. The two gaps in the array are the two slits of the device. Figure 8a depicts the initial condition with no gravitational disturbance present. In Figure 8b, the gravitational or pilot wave associated with a particle is shown approaching the lower slit. Figure 8c demonstrates that the pilot wave traverses both slits as well as the walls of the double slit apparatus. The red arrows point to the portion of the wave that travels through the bottom slit. The green arrows highlight the portion of the wave that travels through the walls. The blue arrows point to the portion of wave that travels through the top slit. Figure 8d displays the resulting interference pattern of the gravitational or pilot wave as it progresses beyond the walls. It is evident that the original symmetrical structure of the wave, as seen in Figure 8b, has been altered.

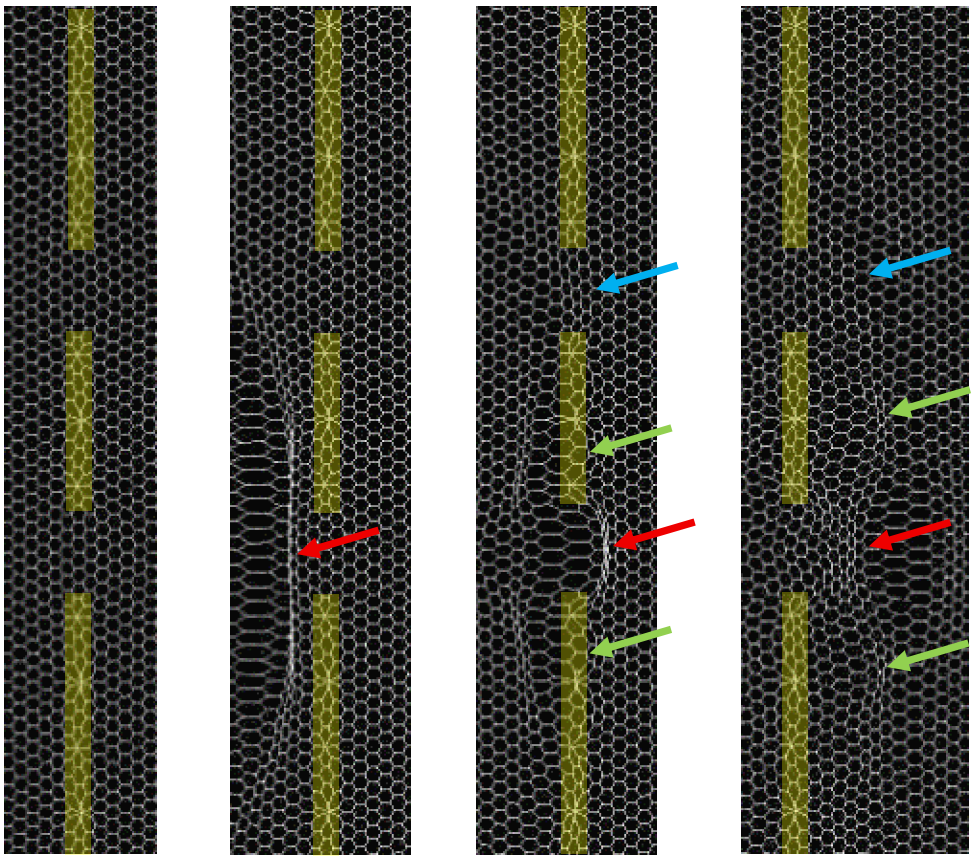

Figure 8a Figure 8b Figure 8c Figure 8d

Gravitational wave traveling through double slit and through wall
A full simulation of this is available at: peterhahn.ca/doubleslit

Figure 9 is a sample photo of a diffraction pattern that is created when a laser beam is directed at a double slit device.

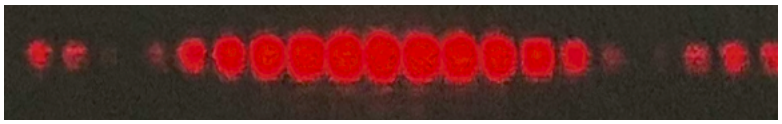

Figure 9
Interference pattern: double slit

Complete Simulation

Figures 10a to 10d present snapshots from a simulation illustrating a particle or knot traversing the bottom slit, while the gravitational pilot wave propagates through both slits and the wall of a double slit apparatus. The purple arrows point to the particle as it travels through a single slit. The red arrow points to the gravitational pilot wave. The green and blue arrows show how the pilot wave travels through the wall and through the top slit. A full simulation of this is available at: peterhahn.ca/movingknot. The simulation clearly shows how the particle/knot moves through the foamy ether, like a soliton [5], one Planck cell at a time. The yellow arrow in Figure 10d shows the history of the pilot wave, which coincidentally, is similar to what is observed in the “walking droplet experiment” [6].

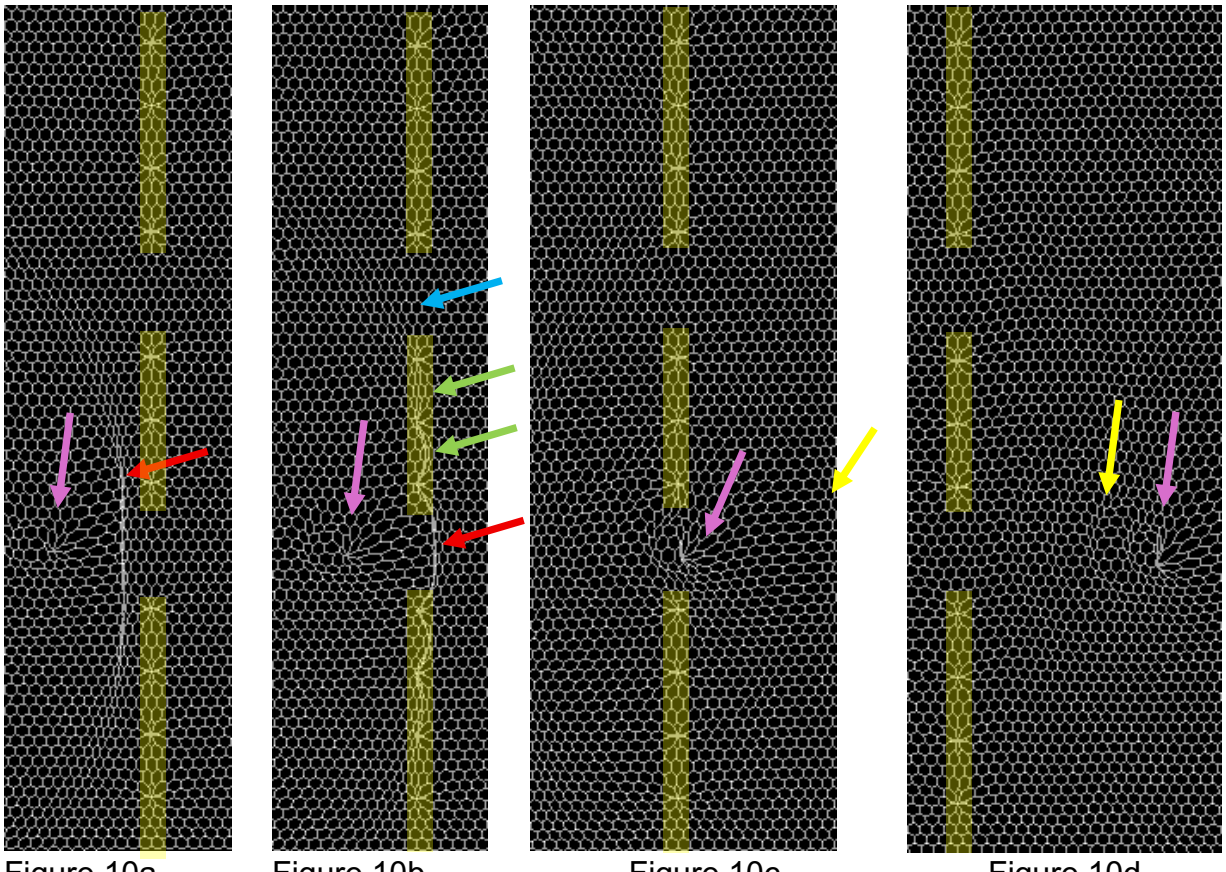

Figure 10a Figure 10b Figure 10c Figure 10d
Gravitational pilot wave travelling through both slits
and through walls, while particle travels through only one slit
A full simulation of this is available at: peterhahn.ca/movingknot

Walking Droplet Experiment

Interestingly, the walking droplet experiment shares several notable features with foamy ether theory. In this experiment, droplets of oil are made to bounce on a vibrating oil bath. At specific frequencies, these droplets can walk across the surface in a manner similar to the movement of atomic particles, as described by pilot wave theory. Each bounce generates a ripple that subsequently influences the trajectory of the droplet on its next bounce. This process is comparable to an FET knot operating as a soliton, advancing one Planck cell at a time (see simulation: peterhahn.ca/movingknot). A ripple is produced each time an ether knot jumps from one Planck cell to another. Figures 11a through 11b present snapshots taken from a YouTube video by Veritasium [7], illustrating the movement of a walking droplet passing through a double slit.

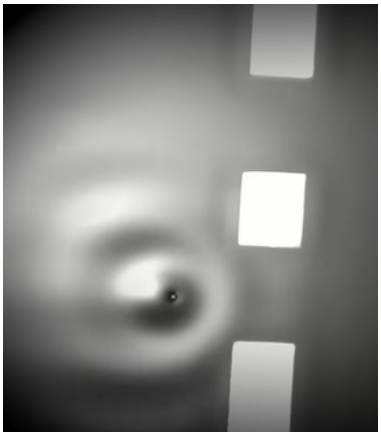

Figure 11a
Walking droplet entering bottom slit

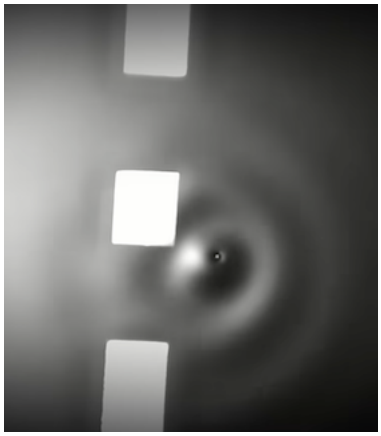

Figure 11b
Walking droplet leaving bottom slit

Is This What Quantum Mechanics Looks Like?
Source: Veritasium [7]

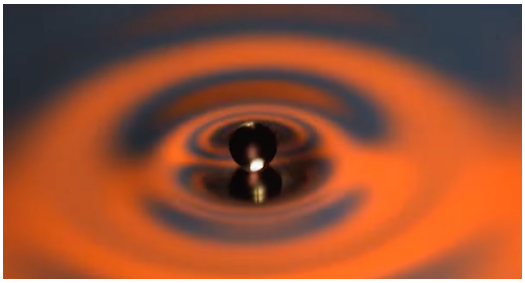

Figure 11c
Walking droplet

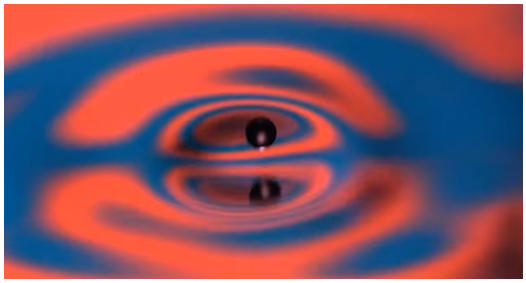

Figure 11d
Walking droplet

https://www.youtube.com/watch?v=WIyTZDHuarQ

Root Cause of Quantum Randomness

For illustrative purposes, the simulation snapshots presented in this article were constructed using an ideal foamy ether model (see Figure 12a). In reality, the ether exhibits significant noise, as depicted in Figure 12b, which is likely a residual effect of the

Big Bang. This noisy foam is the primary cause of the randomness that we observe in atomic behavior. While this random noise may be negligible at macroscopic scales, it becomes highly pronounced at the Planck scale [8].

The Copenhagen interpretation [9] of quantum mechanics employs wave functions to model this randomness, asserting that only the *probability* of a particle's position can be determined. In contrast, the De Broglie–Bohm theory maintains that each particle possesses a definite, though unknowable, location. FET posits that all particles are continually being jostled around in a noisy foamy ether, which prevents any possibility in determining a particle's precise momentum and location at any given time.

(Simulations of this noisy ether are available at:
https://www.peterhahn.ca/quantum-mechanics).

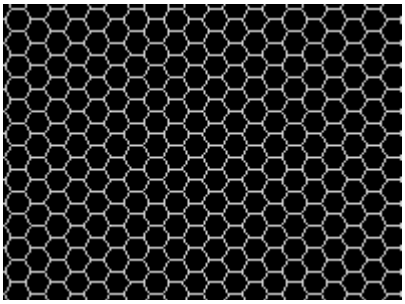

Figure 12a
Ideal foamy ether

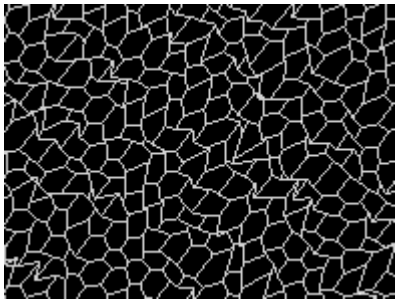

Figure 12b
Noisy foamy ether

Conclusion

Foamy ether theory offer a plausible explanation of the double slit experiment, addressing longstanding conundrums present in alternative models. FET resolves these conundrums by illuminating the fact that solid walls in single and double slit apparatuses do not align with physical reality. The walls of the apparatuses themselves are actually comprised of arrays of atoms, which are mostly composed of empty space. This allows gravitational pilot waves to penetrate the walls, thereby creating gravitational interference patterns that influence a particle or photon's trajectory.

This article further illustrates that foamy ether theory is closely associated with De Broglie-Bohm theory. FET offers an underlying mechanism for the existence of pilot waves, suggesting that these waves are, in fact, gravitational waves, resulting from the gravitational disturbances produced by individual particles or photons.

References

[1] P. C. Hahn, "Foamy (A)ether - A Framework for a Quantum Theory of Gravity," 2025. [Online]. Available: https://www.peterhahn.ca. [Accessed 2025].

[2] S. Goldstein, "Bohmian Mechanics," Stanford Encyclopedia of Philosophy, 14 June 2021. [Online]. Available: https://plato.stanford.edu/archives/fall2021/entries/qm-bohm/.

[3] J. Al-Khalili, Quantum A Guide for the Perplexed, United Kingdom: Weidenfeld & Nicolson, 2004.

[4] wikipedia, "Jim Al-Khalili," [Online]. Available: https://en.wikipedia.org/wiki/Jim_Al-Khalili. [Accessed 2025].

[5] P. C. Hahn, "Solitons in a 3D Lattice: A Model for the Underlying Structure of Reality," 17 05 2024. [Online]. Available: https://vixra.org/abs/2405.0089.

[6] A. Y.Couder, "Walking Droplets: A Form of Wave-Particle Duality at a Macroscopic Scale," 2010. [Online]. Available: https://www.europhysicsnews.org/articles/epn/pdf/2010/01/epn20101p14.pdf. [Accessed 12 2025].

[7] Veritasium, " Is This What Quantum Mechanics Looks Like?," 2016. [Online]. Available: https://www.youtube.com/watch?v=WIyTZDHuarQ.

[8] wikipedia, "Planck Units," [Online]. Available: https://en.wikipedia.org/wiki/Planck_units. [Accessed 2025].

[9] wikipedia, "Copenhagen interpretation," [Online]. Available: https://en.wikipedia.org/wiki/Copenhagen_interpretation. [Accessed 2025].