

Solitons in a 3D Lattice: A Model for the Underlying Structure of Reality

Peter CM Hahn
petehahn@telus.net
May 17, 2024

Abstract

This article introduces Foamy Ether Theory (FET) [1], which is a physical model that describes the underlying structure of reality at its most fundamental, quantum level. FET is based on a 3D nonlinear lattice model [2], which replaces the current paradigm of particles existing in space with a model containing solitons that move in a tightly stretched 3D lattice. A foamy ether, with its various activities and structures, offers alternate explanations for phenomena such as gravity, electromagnetic waves, and gravitational waves. FET negates the need for metaphors or analogies, like the frequently used one describing bowling balls on a stretched sheet of rubber. FET offers an actual physical model of reality. It provides a framework for the development of a unified quantum theory of gravity which will negate the need for explanations, such as wave-particle duality, and will eliminate the need for dark matter. A series of images and snapshots, taken from simulations, demonstrate how this model works.

Table of Contents

List of Figures	1
Introduction	2
Big Bang	3
Simulating a 2D and 3D Foamy Ether Lattice Model	3
Mass and Gravity	4
Equivalence Principle	5
Galaxy Flat Rotation Curve	6
Gravitational Lensing	6
Cosmological Redshift	8
Electromagnetic Waves and Gravitational Waves	9
The Photon	9
Particles as Solitons	12
Heisenberg Uncertainty Principle	12
Conclusion	13
References	14

List of Figures

Figure 1 Big Bang with particles	3
Figure 2 Big Bang with strings	3
Figure 3 Big Bang with foam.....	3
Figure 4 3D Cube Lattice Model	4
Figure 5 2D Hexagonal Lattice Model	4
Figure 6 GR - Matter causes curvature	5
Figure 7 FET - Matter causes accelerating inflow	5
Figure 8 FET - Antimatter causes accelerating outflow	5
Figure 9 Velocity of inflow approaching v_e	5
Figure 10 Velocity of inflow = v_e	5
Figure 11 Velocity of inflow decelerating	5
Figure 12 Accelerating inflow explains flat rotation curve.....	6
Figure 13 Shapiro time delay.....	7
Figure 14 Additional time delay simulation	7
Figure 15 Additional deflection and delay caused by inflow: Green Photon.....	8
Figure 16 Stretching of space before inflow	9
Figure 17 Stretching of space after inflow	9
Figure 18 Transverse distortion creates an electromagnetic wave.	9

Figure 19 Longitudinal distortion creates a gravitational wave.	9
Figure 20 Two loop knot in a resting state.	10
Figure 21 One loop unravels, ejecting a photon.	10
Figure 22 Photon capture adds one loop to knot.	10
Figure 23 Figure eight loop in resting state.	11
Figure 24 Figure eight loop unravels, ejecting a photon.	11
Figure 25 Photon capture adds figure eight.	11
Figure 26 Particles about to collide.	12
Figure 27 Large particle splits in two	12
Figure 28 Noisy foamy ether (empty space).	13
Figure 29 Noisy foamy ether with particle.	13

Introduction

Physicists and mathematicians have made significant progress (over the last century) in the pursuit of uniting quantum theory (QM) with general relativity theory (GR). But without an actual physical model, a quantum theory of gravity will always be out of reach. Previous (a)ether models [3] have failed to explain gravity because they were based on ether particles in gaseous, liquid, or solid form. A model based on ether particles runs into circular complications because additional forces are required to explain the interaction of the ether particles with each other.

The null results of the Michelson-Morley experiment [4] caused us to reject the existence of an all-pervasive ether. However, instead of denying the existence of an ether, we should reject the paradigm of separate particles moving through space and, instead, approach our understanding of reality from a more holistic view [5]. Foamy Ether Theory (FET) [1], described in this article, presents a holistic model that replaces the concept of the vacuum of empty space with a three-dimensional lattice, weblike foamy ether, existing in a void. Conventional atomic particles are replaced with distortions (solitons) in the foamy ether.

The Millennium Simulation [6] shows that the universe has evolved into a foamy weblike structure on a cosmic scale. Foamy structures also exist in nature on both the macro scale [7] and on the microscopic scale [8]. It is, therefore, not unreasonable to hypothesize that the universe, at the Planck scale [9], is also foamy in nature.

Big Bang

A popular view of the big bang theory is illustrated in *Figure 1*, where the universe began as a microscopic dot, which then expanded into space. The bang released a huge number of particles, which eventually cooled to give us the universe that we see today. String theory proposes that the universe exploded into strings (see *Figure 2*), where particles are described as strings vibrating at specific frequencies in a ten-dimensional space.

FET proposes an alternate scenario. When our universe was created during the Big Bang, a super compressed ball of ether expanded into a tightly stretched weblike foam as shown in *Figure 3*. If you give the ether enough elasticity and stickiness, it will never actually break up, but continue to stretch like a huge expanding sponge. It is similar to a liquid under high pressure that expands into a foam when released. The distortions (kinks) shown in *Figure 3* are subatomic particles.

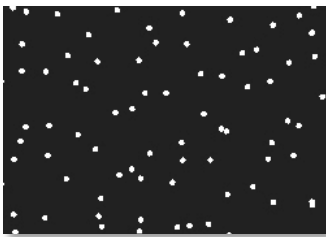


Figure 1
Big Bang with particles

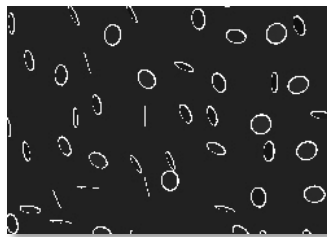


Figure 2
Big Bang with strings

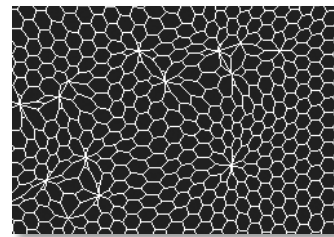


Figure 3
Big Bang with foam

This model has the benefit of keeping everything in the universe connected, including the observer, as opposed to a model in which individual particles or strings are blown into a flat empty space where the connection is lost. FET is, therefore, an inherently nonlocal quantum theory [10]. The making of foamy ether theory has been heavily influenced by the workings of David Bohm [11], described in his book *Wholeness and the Implicate Order* [5]. He describes a universe that is an unbroken whole.

Simulating a 2D and 3D Foamy Ether Lattice Model

ThreeDimSim, a 3D mechanics simulator software [12], was utilized to produce 2D and 3D lattice models that mirror the behaviour of a foamy ether. An array of spheres (or

nodes) were connected together with spring and damper pairs to form a lattice of cells as shown in *Figure 4 and Figure 5*. These spring and damper pairs were configured in a way that mimics the properties and behavior of a tightly stretched foam. The size of a bubble (or cell) signifies one Planck Length (1.616×10^{-35} meters).

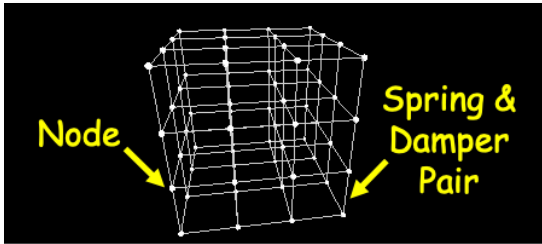


Figure 4
3D Cube Lattice Model

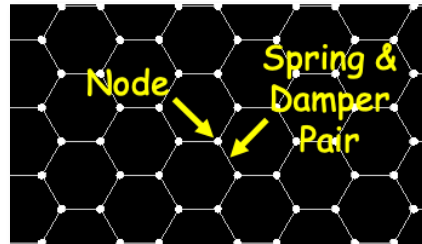


Figure 5
2D Hexagonal Lattice Model

Mass and Gravity

A common image that is used to explain GR is shown in *Figure 6*, where the curvature of spacetime is analogous to a stretched sheet of rubber where clumps of matter cause distortions to occur. Although this may be useful from a mathematical point of view, it does not give a true picture of what gravity *actually looks like* at a Planck scale. Particles (therefore gravity) can also be represented as clumps or knots in a foam (see *Figure 7*).

FET states that a knot (particle) in the foam causes an *accelerating* inward flow of ether, resulting in the phenomena we call gravity. This inflow is caused by the ether trying to return to its original condensed curled-up state. Knots with ether flowing inward are matter particles as shown in *Figure 7* and knots with ether outflow is antimatter (*Figure 8*).

Contrary to current cosmic inflationary theory [13], FET posits that antimatter dominated the universe because the ether was in an expanding outflowing mode. Since the universe has been expanding and cooling for billions of years, it is now in a condensing (inflowing) mode (see *Figure 7*). Therefore, matter now dominates. Since the stretched ether is trying to restore itself to its original state, it is natural for the kinks or knots to tend to cluster together, and the stickiness or surface tension of the foam keeps the knots intact.

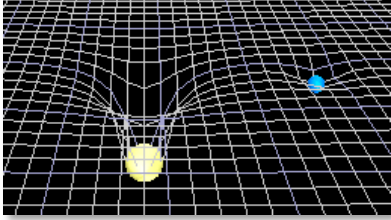


Figure 6
GR - Matter causes curvature

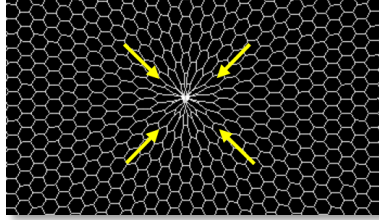


Figure 7
FET - Matter causes accelerating inflow

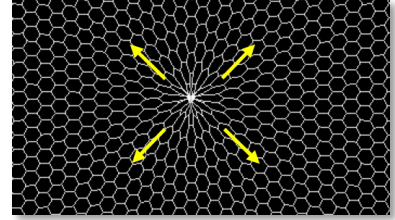


Figure 8
FET - Antimatter causes accelerating outflow

Equivalence Principle

An accelerating inflow can also be used to explain the equivalence of gravitational mass and inertial mass. If you are traveling in an accelerating spacecraft, you are accelerating through space (foamy ether). When you are standing on the surface of a planet, ether is accelerating through you. The three figures below show the Earth (blue dot) with foamy ether flowing in towards its center. The red cell in *Figure 9* is accelerating towards the surface of the Earth (indicated by the red arrow). When the red cell reaches the Earth's surface (*Figure 10*), it has achieved a downward velocity of 11.2 km/s, which is equal and opposite to the escape velocity (Eq. 1). After the red cell passes through the Earth's surface, it begins to decelerate until it reaches a velocity of zero at the Earth's center (*Figure 11*). This inflow explains *why* time dilation at the Earth's surface is equal to the time dilation experienced in a spacecraft traveling at 11.2 km/s.

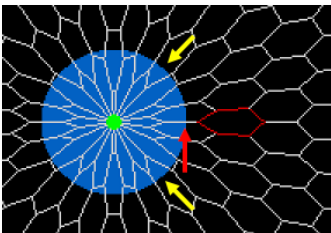


Figure 9
Velocity of inflow approaching v_e

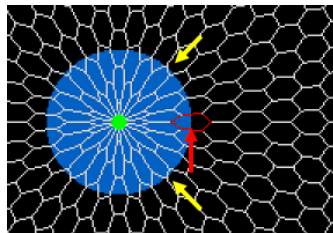


Figure 10
Velocity of inflow = v_e

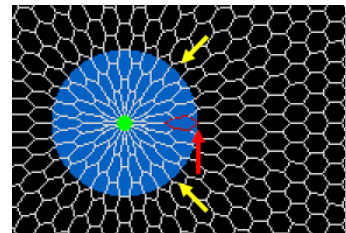


Figure 11
Velocity of inflow decelerating

$$v_e = \sqrt{\frac{2GM}{d}} \quad (\text{Eq. 1})$$

Galaxy Flat Rotation Curve

The accelerating inflow shown in *Figure 9 to Figure 12* can also be used to explain the flat rotation curve [14] that is observed in most galaxies. As shown by the yellow arrows in *Figure 12*, the outer stars of the galaxy are dragged along with the spiralling (accelerating) inflow, thereby increasing their orbital velocities at the galaxy's edge. This spiralling inflow slows down once it is inside the galaxy, causing the orbital velocity of inner stars to slow down as well.

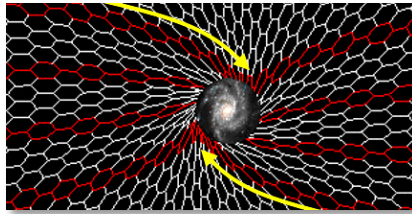


Figure 12 Accelerating inflow explains flat rotation curve.

In addition to that, light originating from the center of the galaxy takes longer to reach Earth than light coming from the galaxy's edge, because it is traveling against the inflow. We are seeing the center of the galaxy at time when the galaxy was younger, therefore rotating more slowly, a phenomena FET calls *time lensing* [15]. Each galaxy has a unique inflow pattern, dependent on the galaxy's structure, formation history, and the tidal forces of neighboring galaxies.

Gravitational Lensing

The Shapiro time delay [16] describes the delay of radar signals (or light) as they closely pass by a massive object. Referring to *Figure 13*, a signal will begin with a specific wavelength (point A). As it grazes the massive object (point B), its wavelength will shorten, *and* its speed will decrease (relative to an independent background). Once the signal passes the object, it resumes its original wavelength and speed (point C). The total travel time of the signal is greater than if the massive object were not present. This delay causes an additional deflection to take place. Newtonian dynamics calculates this deflection using Eq. 2, but GR predicts a greater deflection by using Eq. 3.

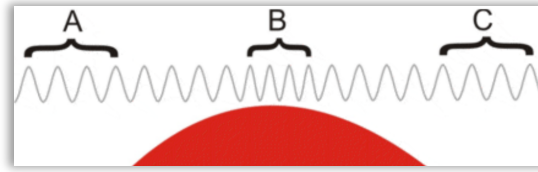


Figure 13 Shapiro time delay

Ether inflow will cause even more lensing (delay and deflection) to take place (Eq. 4). An analogous scenario can be used to explain this where two men are walking in an airport (see Figure 14). A simulation [17] shows that the top man who is walking on moving sidewalks will reach Gate 3 later than the bottom man who is not using the moving sidewalks. The delay encountered while traveling between Gates 2 and 3 is greater than the time gained while traveling between Gates 1 and 2.

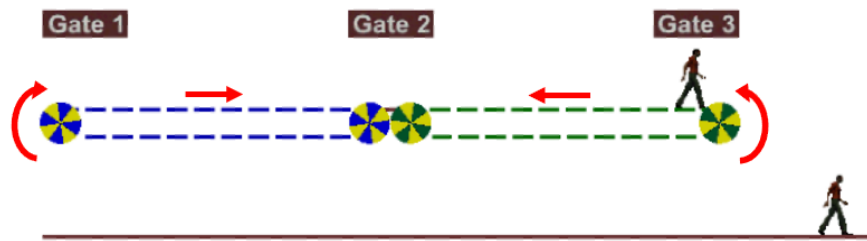


Figure 14 Additional time delay simulation

Similarly, the speed of light increases while approaching a galaxy (a massive object) because it is traveling with the flow, then decreases while leaving the galaxy because the light is travelling against the flow.

Figure 15 below shows the differences in deflections of three photons traversing a galaxy. The red photon shows a deflection based on Newton's laws (Eq. 2). The blue photon demonstrates the deflection and delay based on GR theory (Eq. 3). And the green photon shows an additional deflection and delay caused by ether inflow (Eq. 4). This Inflow offers an alternate explanation for the unexpected, extra lensing that is observed around many galaxies and galaxy clusters.

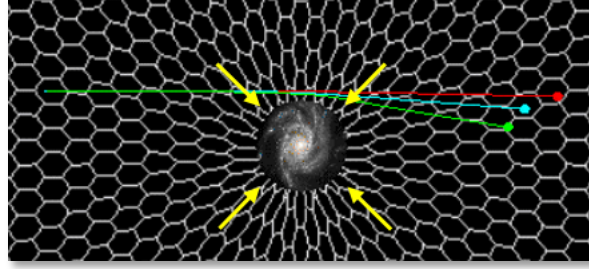


Figure 15 Additional deflection and delay caused by inflow: Green Photon

$\alpha = \frac{2GM}{c^2 d}$ <p>(Eq. 2)</p> <p><i>Newtonian Deflection: Red photon</i></p>	$\alpha = \frac{4GM}{c^2 d}$ <p>(Eq. 3)</p> <p><i>GR Deflection: Blue photon</i></p>	$\alpha = \frac{x4GM}{c^2 d}$ <p>(Eq. 4)</p> <p><i>FET Deflection: Green photon</i></p>
--	--	---

The 'x' in equation 4 is a complex number, because each galaxy or galaxy cluster has a unique gravitational lens structure, since its turbulent inflow is influenced by the galaxy's history and by the gravitational effects of neighbouring galaxies. This inflow explains why all-encompassing equations, such as those found in MOND theory [18], do not adequately explain all observable lensing patterns.

Cosmological Redshift

According to Hubble's law [19], distant galaxies exhibit redshifts that are proportional to their distances from each other. This redshift can be explained by three possible causes: 1) the galaxies are moving away from us (Doppler shift), 2) the universe is expanding, or 3) inflow is stretching space between galaxies (or even a combination of all three). The current (most popular) interpretation of this redshift concludes that the universe is expanding (caused by dark energy). However, FET offers an alternate explanation for this redshift, positing that space is being stretched by the continual inflow of foamy ether between large bodies of matter, such as galaxies and galaxy clusters. *Figure 16* and *Figure 17* are snapshots of a simulation demonstrating how inflow causes the stretching of space between galaxies while the actual distance between the two remain the same.

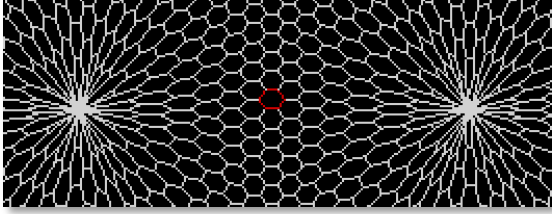


Figure 16
Stretching of space before inflow

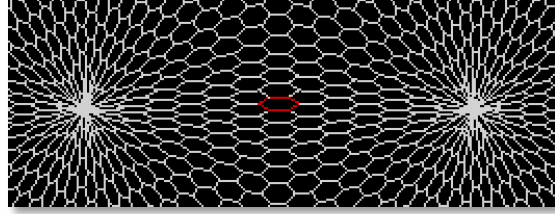


Figure 17
Stretching of space after inflow

The red cell in *Figure 16* starts out undistorted but becomes stretched after some inflow occurs (*Figure 17*). FET posits that this inflow is the major cause of the cosmological redshift.

Electromagnetic Waves and Gravitational Waves

A tightly stretched foamy ether model is capable of transporting both electromagnetic (EM) waves and gravitational waves. *Figure 18*, below, is a snapshot of a simulation of a transverse EM wave traveling through the foam. *Figure 19* is a snapshot of a longitudinal (gravitational) wave traveling through the foam. Simulations generated by *ThreeDimSim* also confirm the belief that the two types of waves travel at the same speed. This is no surprise, since the two wave types are both distortions travelling in the stretched foam.

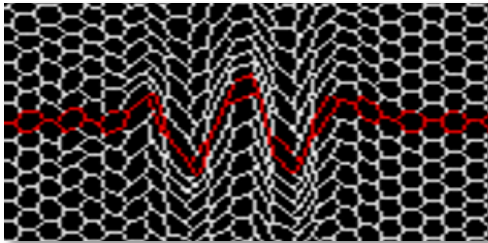


Figure 18
Transverse distortion creates an electromagnetic wave.

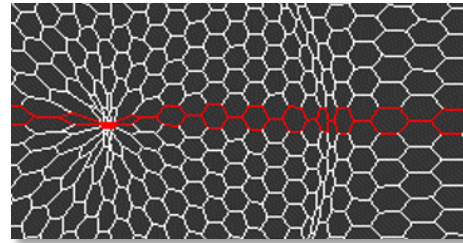


Figure 19
Longitudinal distortion creates a gravitational wave.

The Photon

A photon (EM wave) is created when a knot unravels. The three figures below show snapshots of a simulation [20] of a one-dimensional section of foamy ether. *Figure 20*

shows two knots, each comprised of two loops. The knot on the right lets go of one loop which causes a disturbance (EM wave) to travel towards the knot on the left (*Figure 21*). *Figure 22* shows the knot on the left successfully capturing the wave, thereby adding a loop to its existing two-loop knot. This is how energy is transferred from one knot (particle) to another. More wraps make the ether tighter, hence less stable, which may cause it to unwrap and eject a photon. A knot that receives a photon may capture the energy by creating an extra loop, or it may reflect the photon. This unwrapping of loops in ether also explains **why** light only comes in discrete packets of energy.

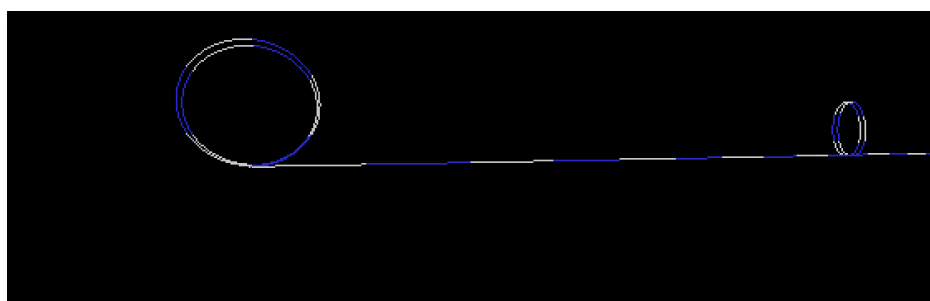


Figure 20 Two loop knot in a resting state.

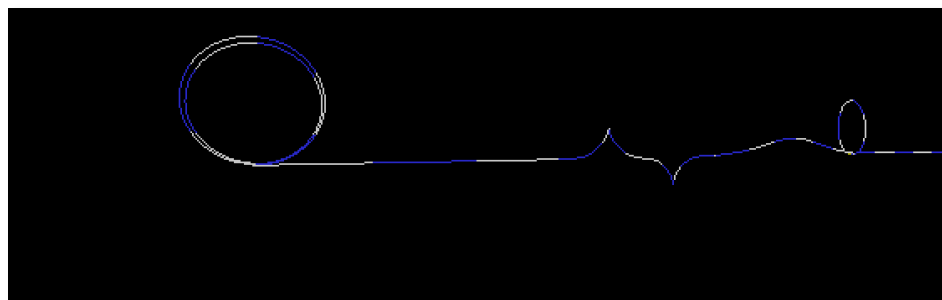


Figure 21 One loop unravels, ejecting a photon.

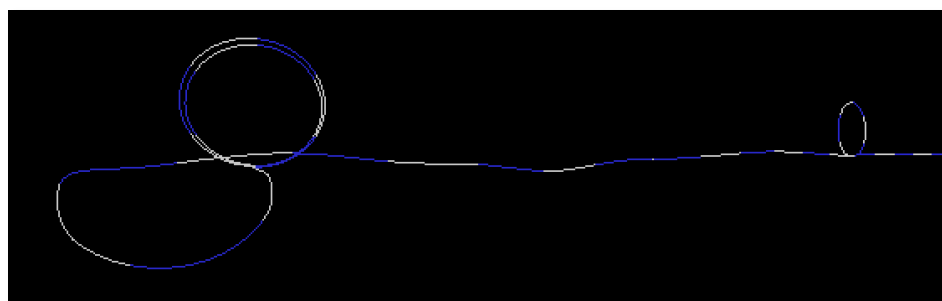


Figure 22 Photon capture adds one loop to knot.

The three figures below are snapshots of the simulation of a slightly different loop transfer. *Figure 23* shows a knot on the right containing an extra loop in the shape of a figure eight. This causes the photon to have a slightly different shape when ejected from the knot (see *Figure 24*). *Figure 25* shows that the knot on the left successfully captures the figure eight loop. The unique shapes of the waves in *Figure 21* and *Figure 24* shows that there is more to an EM wave than the amplitude and wavelength. The unique structure of the wave could be one of the hidden variables that is proposed in pilot wave theory [21].

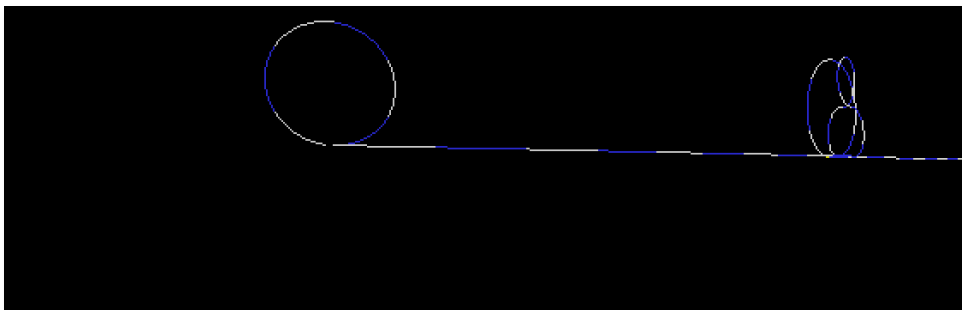


Figure 23 Figure eight loop in resting state.

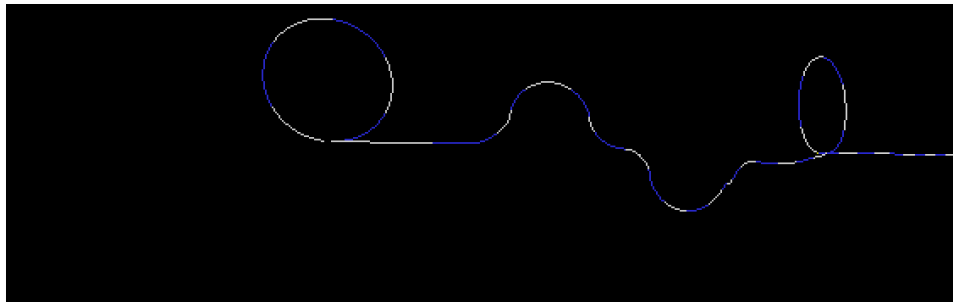


Figure 24 Figure eight loop unravels, ejecting a photon.

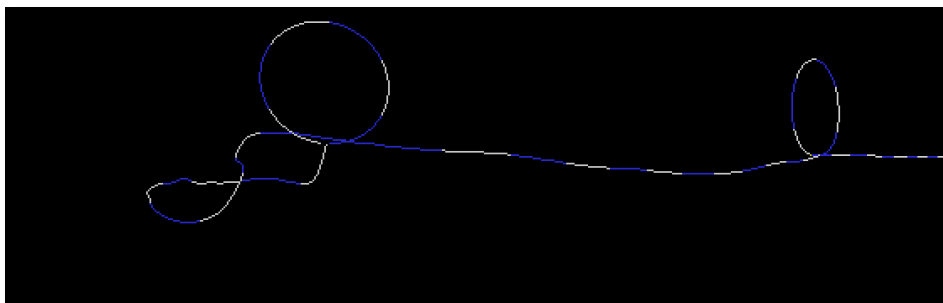


Figure 25 Photon capture adds figure eight.

Particles as Solitons

Particles are essentially solitons (or distortions) that move in the foamy ether. Unlike EM waves or gravitational waves, particles are clumps in the foam which are bound by the *sticky* properties of the ether. FET states that this stickiness is that which is currently known as the strong force.

When particle accelerators smash two particles together, a series of new particles are created. These types of interactions can also be described by foamy ether models. *Figure 26* shows a small particle (soliton) on a collision course with a larger particle. When the two collide, the stickiness is overcome, and the large particle breaks up into two smaller pieces (*Figure 27*). As shown in *Figure 26* and *Figure 27*, only the *distortion* of the foam is moving (the foam itself is stationary). This is analogous to an image moving across a TV screen; the pixels remain stationary but turn on and off in a sequence giving you the illusion of movement. Like an image on a TV screen moving one pixel at a time, solitons move one foamy cell at a time, making this the root cause of their quantum behaviour. A model that describes particles as solitons in the foam explains why particle velocities are limited to the speed of light, since distortions of the foam cannot travel faster than c .

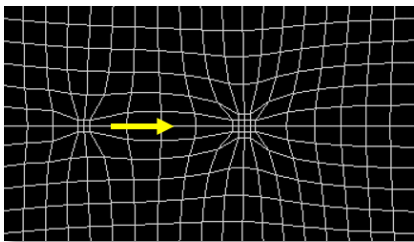


Figure 26 Particles about to collide

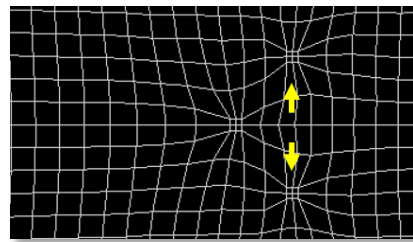


Figure 27 Large particle splits in two

Heisenberg Uncertainty Principle

Quantum mechanics originated from empirical observations that particles and space-time appear grainy in nature. The exact position and momentum of a particle can only be described by probability equations. FET is essentially a non-quantum classical theory of gravity [22] where space, thereby the location of particles, are affected by the random noisiness of foamy ether. *Figure 28* below demonstrates/postulates what this noisiness

may 'look like' at the Planck scale. The noisy foamy ether also causes particles (*Figure 29*) to randomly vibrate (at the Planck scale) which makes them appear to be fuzzy or in multiple places at once on the macro scale. This noisiness is also responsible for creating virtual particles [23]. Foam clumping together emulates a particle and a clump of foam releasing emulates antimatter. Like a vibrating string, the noisy vibrating foam contains energy. The energy in this noisy stretched foam (left over from the Big Bang) is the primary source of Dark Energy [24].

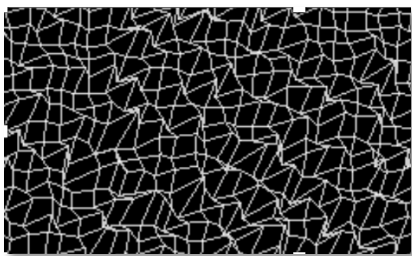


Figure 28
Noisy foamy ether (empty space)

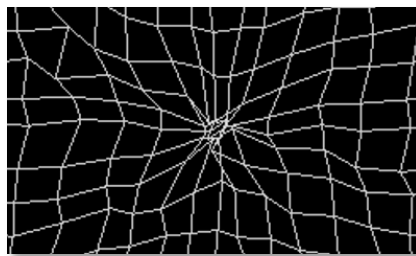


Figure 29
Noisy foamy ether with particle

Conclusion

Foamy Ether Theory is a viable theory that gives a description of the underlying structure of reality. Having a physical model of reality gives us a framework for the development of a successful quantum theory of gravity, thereby eliminating many current conundrums, such as wave-particle duality and the equivalence principle. FET also eliminates the need for gravitons and dark matter particles since gravity can be explained by accelerating ether inflow.

The physical properties of a foamy structure may also enable us to mathematically derive the values of constants of nature, such as the speed of light and the gravitational constant.

The fragmented (reductionist) approach that we have been using to describe reality has reached its limit. It is time to examine the world from a holistic view that confirms the sense that we are not mere *observers* of the universe, but an intrinsic part of the whole.

References

- [1] P. C. Hahn, "Foamy (A)ether - A Framework for a Quantum Theory of Gravity," [Online]. Available: <https://www.peterhahn.ca>. [Accessed 16 January 2024].
- [2] Y. V. a. M. B. A. a. T. L. Kartashov, "Solitons in nonlinear lattices," *Rev. Mod. Phys.*, vol. 83, no. 1, pp. 247--305, 2011.
- [3] E. T. Whittaker, *A History of the Theories of Aether and Electricity*, New York: Dover Publications Inc., 2023.
- [4] Wikipedia, "Michelson–Morley experiment," 17 December 2023. [Online]. Available: https://en.wikipedia.org/wiki/Michelson–Morley_experiment. [Accessed 2024].
- [5] D. Bohm, *Wholeness and the Implicate Order*, London: Routledge & Kegan Paul, 1980.
- [6] S. D. M. W. (. A. J. (. C. S. F. (. N. Y. (. L. G. (. J. N. (. R. T. (. D. C. (. J. H. (. J. A. P. (. S. C. (. P. T. (. H. C. Volker Springel (1), "Simulating the joint evolution of quasars, galaxies and their large-scale distribution," 6 04 2005. [Online]. Available: <https://arxiv.org/abs/astro-ph/0504097>.
- [7] dreamstime, "Soap foam background," dreamstime, 04 02 2024. [Online]. Available: <https://www.dreamstime.com/stock-images-soap-foam-background-image18982424>.
- [8] Pinterest, "Microscopic Cells," [Online]. Available: <https://www.pinterest.co.uk/pin/cell-crosssection-under-a-microscope--14284923796329160/>. [Accessed 04 02 2024].
- [9] "Planck Units," Wikipedia, [Online]. Available: https://en.wikipedia.org/wiki/Planck_units#Planck_length. [Accessed 24 02 2024].
- [10] "Quantum nonlocality," Wikipedia, [Online]. Available: https://en.wikipedia.org/wiki/Quantum_nonlocality. [Accessed 24 02 2024].
- [11] Wikipedia, "David Bohm," [Online]. Available: https://en.wikipedia.org/wiki/David_Bohm. [Accessed 16 January 2024].
- [12] Havinga, J, "Havinga Software," [Online]. Available: <https://www.havingasoftware.nl/HS/contact.htm>. [Accessed 21 January 2024].
- [13] A. H. Guth, "Inflation and eternal inflation," *Physics Reports*, Vols. 333-334, pp. 555-574, 2000.
- [14] Wikipedia, "Galaxy rotation curve," 01 2024. [Online]. Available: https://en.wikipedia.org/wiki/Galaxy_rotation_curve.
- [15] P. C. Hahn, "Time Lensing," [Online]. Available: <https://www.peterhahn.ca/time-lensing>. [Accessed 15 02 2024].
- [16] Wikipedia, "Shapiro Time Delay," 20 12 2023. [Online]. Available: https://en.wikipedia.org/wiki/Shapiro_time_delay. [Accessed 25 01 2023].
- [17] P. C. Hahn, "Gravitational Lensing," [Online]. Available: <https://www.peterhahn.ca/gravitational-lensing>. [Accessed 13 02 2024].
- [18] M. Milgrom, "MOND Theory," *Canadian Journal of Physics*, vol. 93, no. 2, 2015.

- [19] N. A. Bahcall, "Hubble's Law and the expanding universe," *PNAS*, vol. 112, no. 11, 2015.
- [20] P. C. Hahn, "The Photon," 01 2010. [Online]. Available: <https://www.peterhahn.ca/the-photon>.
- [21] Wikipedia, "Pilot wave theory," [Online]. Available: https://en.wikipedia.org/wiki/Pilot_wave_theory. [Accessed May 2024].
- [22] J. Oppenheim, "A Postquantum Theory of Classical Gravity?," *Physical Review X*, vol. 13, no. 4, 2023.
- [23] Wikipedia, "Virtual Particles," [Online]. Available: https://en.wikipedia.org/wiki/Virtual_particle. [Accessed 03 2024].
- [24] Wikipedia, "Dark energy," [Online]. Available: https://en.wikipedia.org/wiki/Dark_energy. [Accessed 01 2024].
- [25] A. Unzicker and J. Preuss, "A Machian Version of Einstein's Variable Speed of Light Theory," 13 March 2015. [Online]. Available: <https://arxiv.org/abs/1503.06763>.