ABSTRACT

This is a unification of black hole, dark matter and dark energy as a massless faster-than-light moving perfect fluid with positive and negative pressure. I calculated the interaction constant and interaction strength of black hole interacting with electron- positron pairs.

CHAPTER ONE

1. INTRODUCTION

This paper attempts at unification of black hole, dark matter and dark energy as a massless faster-than-light moving perfect fluid with positive and negative pressure. The approach to be followed in this paper is a deterministic description of quantum gravity in two dimensions and determinism gives rise to non-locality. I will try to reconcile the conflict between general relativity and quantum mechanics as much as I can. The whole ideas in this paper will heavily depend on the following two postulates that I put forward:

(1) The Vacuum/Ground State of Quantum System Is a Steady State: steadiness of ground state implies that some of the most cherished properties of quantum mechanics and quantum field theory will break down such as
(i) Planck’s description of energy that $E = hf$

(ii) Heisenberg’s uncertainty principle e.g. $\Delta E \Delta t \geq \frac{\hbar}{2\pi}$

(iii) the creation and annihilation of virtual particles.

(iv) the probabilistic nature of quantum mechanics.

And so on will not hold. I will explore the consequences of this in chapter three of this paper and how it is related to black hole information paradox

(2) Speed of Light Is Quantized: the velocity is the multiply of speed of light $v = nc$ or $\frac{v}{c} = n$

CHAPTER TWO

2.1 BLACK HOLE, DARK ENRGY AND DARK MATTER

Since the work of Stephen Hawking, black hole information paradox has been one of the most sought after problem in theoretical physics. The hope was that a solution would reconcile the conflict between general relativity and quantum mechanics. Leonard Susskind, Larus Thorlacius and John Uglum (1993) introduced three postulates asserting the validity of conventional quantum theory, semi-classical general relativity and the statistical basis for thermodynamic as the foundation for the study of black hole evolution. Samir D. Mathur (2015) replaced the singularity at the heart of black hole by positing that the entire region within black hole’s event horizon is actually a ball of strings called fuss ball. Ahmed Almheiri, Donald Marolf, Joseph Polchinski and James Sully (2013) argued the three postulates of black hole complementary cannot be all true and suggested a resolution that is known as firewalls. Juan Maldacena and Leonard Susskind (2013) showed that two distant black hole are connected via wormhole or einstein rosen bridge. The solution can be interpreted as maximally entangled state of two black hole that form a complex EPR pair.

Could black hole be related to dark energy and dark matter? K.S Crocker, K. A Nishimura and D. Farrah (2019) considered some observational consequences of replacing all black hole (BHs) with a class of non-singular solution that mimics BHs but with dark energy interiors; (GEODE). J.S. Farnes (2018) constructed a toy model which suggested that dark matter and dark energy can be unified into a single negative mass fluid. The model is a modified $\Lambda CDM$ cosmology and indicates that continuously created negative masses can resemble the cosmological constant and can flatter the rotation curve of the galaxies. The model leads to a cyclic universe with a time-variable hubble parameter, potentially providing compatibility with the current tension that is emerging in cosmological measurements
CHAPTER THREE

3.1 BLACK HOLE AND EPR PARADOX

Suppose a particle of spin zero at the boundary of black hole as shown in figure 1 decays into electron-positron pairs as shown in figure 2. what will be the fate of the incoming and the out-going particles.

Theorem: A 2-dimensional black hole on infinite dimensional surface has no boundary

Check the appendix for the proof the theorem

\[ \sigma(T) = \int_{\Delta t=0} T^2 \]  
\[ \frac{\partial}{\partial x^2} T = T^2 \]

Binomial approximation shows that  \( T^n = 1 + nx \) where \( n = v/c \)  \( v \) is the velocity and \( c \) is the speed of light. at \( x = -1 \), \( T^n = 1 - n \), so at \( v = 1c \), \( T^1 = 0 \); at \( v = 2c \), \( T^2 \neq 0 \). Now if \( n = \chi \) is euler characteristic at \( n = 2 \) the equation (3) for a sphere \( T^2 = -1 \) and for a torus \( T^2 = 3 \)

\[ T^2 = 1 - \chi \]  

According to no boundary theorem equation (1) the out-going electron or positron particle will neither leave the surface of black hole as in figure 3.

Particle with spin zero decays into leptons \( s \rightarrow e^- e^+ \)
3.2 INTERACTION OF BLACKHOLE

Let $S$ represents a module of ricci soliton $R = T^n g$ such that $\varphi : S \rightarrow S'$, I claim that $\ker \varphi = 0$

Equation (4) is a coset of a module of ricci soliton on sphere with negative scalar stress energy scalar tensor $T^2 = -1$

$$R_{\mu \nu} + \frac{1}{2} g_{\mu \nu} = 1 \quad (4)$$

Equation (5) is also a coset of module of ricci soliton on a torus with positive scalar stress energy tensor

$$T_{\mu \nu} - \frac{1}{2} g^{\mu \nu} = 1 \quad (5)$$

The solution to equations (4) (5) is by invoking on the kernel of a module homomorphism $\ker \psi = 0$. heat equation can be used to describe a steady ground state of the postulated quantum state.

$$\Delta \varphi = m^2 \psi = 0 \quad (6)$$

Let $\langle \Lambda^2 \rangle$ represents vacuum expectation value of the interaction constant of black hole with electron-electron or electron-positron pairs

$$\frac{\partial \varphi}{\partial x^2} = \Lambda^2 \varphi \quad (7)$$

Special orthogonal group $SO(2)$ formulation such that $\det(A)^2 = \pm 1$, $SO(2) \cong S^1$ and 1-dimensional torus is isomorphic to $S^1$

$$AA^T \frac{\partial}{\partial x^2} \varphi = \det(A)^2 \varphi \quad (8)$$

The vacuum expectation value of black hole’s interaction constant can be calculated as follows, where a scalar function $\varphi = n$ is number of ground state

$$\langle \Lambda^2 \rangle = \begin{cases} \frac{2}{3} \langle n | \det(A)^2 = \pm 1 | n \rangle \\ \pm \frac{2}{3} n^2 \end{cases} \quad (9)$$

$$\langle \Lambda^2 \rangle = \begin{cases} \frac{2}{3} n^2 \end{cases} \quad (10)$$
we should be able to construct equation of motion of a steady quantum state where there is no such thing as quantum fluctuation that is gauge invariant.

\[ L = \bar{\psi} \gamma^\mu D_\mu \psi - \psi \gamma^\mu m \psi - \frac{\phi^2}{8 \mu_o} F_{\mu \nu} F^{\mu \nu} \]  

(11)

\[ D_\mu = \partial_\mu + i \Lambda^2 e A_\mu \varphi \]  

(12)

\[ j^\mu = e \bar{\psi} \gamma^\mu \psi \]  

(13)

Black hole interaction current between the particles

\[ \Lambda^2 j^\mu A_\mu \varphi = \Lambda^2 e \bar{\psi} \gamma^\mu A_\mu \varphi \psi \]  

(14)

\[ \partial_\mu \frac{\partial L}{\partial (\partial_\mu \varphi)} - \frac{\partial L}{\partial \varphi} = 0 \]  

(15)

\[ \frac{\varphi}{4 \mu_o} F_{\mu \nu} F^{\mu \nu} + \Lambda^2 j^\mu A_\mu = \frac{\partial L}{\partial \varphi} = 0 \]  

(16)

\( k \) represents the strength of electromagnetic interaction, \( \mu_o \equiv 1 \) is magnetic constant, \( j^\mu \) is current density, \( \varphi \) is scalar function and \( \Lambda^2 \) is vacuum expectation value of black hole interaction constant.

\[ F_{\mu \nu} F^{\mu \nu} = -\frac{4 \mu_o \Lambda^2}{\varphi} j^\mu A_\mu \]  

(17)

\[ F_{\mu \nu} F^{\mu \nu} = -kJ^\mu A_\mu \]  

(18)

\[ k = \frac{4 \Lambda^2}{\varphi} \]  

(19)

One Ground State Feynman Diagram of Black Hole Interaction current between electron-positron pairs

\[ e^- \quad \bullet \quad e^+ \]

\[ \langle \Lambda^2 \rangle = \frac{2}{3} = 0.6666 \]  

(20)

\[ k = \frac{\Lambda^2}{n}, \quad n = \varphi \text{ is number of ground state} \]  

(21)

\[ k = \frac{4 \Lambda^2}{n} = 2.6666 \quad \text{for} \quad n = 1 \]  

(22)
The calculation of interaction constant and interaction strength showed that they increase as the number of states increase. Equation (17) and (18) showed that inner product of electromagnetic force is directly proportional to the interaction current. There is no how electron-positron pairs will escape such gravitational force of black hole.
SUMMARY AND CONCLUSION

I unified black hole, dark matter and dark energy as a massless faster than-light perfect fluid with positive and negative pressure.

I show that there exists interaction current between electron-positron pairs

I showed that Inner product of electromagnetic force is directly proportional to interaction current

I calculated the vacuum expectation value of the interaction constant and interaction strength and showed that they increase with increase in number of ground state.

Electron-positron pairs will never escape black hole’s gravitational force

The paradox is solved within the scope of this paper.

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The mighty hands that wrote beautiful equations that only a feeble mind could understand hallowed be thy name

I was taught by a friend greater than I was and the only one greater than I was I am that I am. for I was convinced that I was taught by...

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Theorem: A 2-dimensional disk on infinite dimensional surface has no boundary

Proof: let \( c_n(E) \) represents a chain complex on a fiber bundle \( E \) such that \( \forall \ p, v \in E \)

\[
\partial_n = \frac{\partial}{\partial x^n} \colon c_n(p, v) \to c_{n-1}(p, v)
\]

\( \ker \partial_n \colon c_n(p, v) \to p_n, \ \forall \ p_n \in \text{base} \ B \) on manifold \( M \)

\[ \exists \ T : p_n \to G \ (\text{group}) \]

Such that \( H(c_n(p, v), T) \) forms a cohomology group on \( E \) with cochain complex

\[
1 \leftarrow T \partial_{n-1} c_{n-1} \leftarrow \cdots \leftarrow T \partial_3 c_3 \leftarrow T \partial_2 c_2 \leftarrow T \partial_1 c_1 \leftarrow 1
\]

Let’s define a differential forms as a group on the manifold equipped with partition of unity

\[ T : p_n \to \Omega^n \]

\[ d : \Omega^n \to \Omega^{n+1} \]

the support of \( T = \sigma(T) \epsilon \Omega^n \)

\( \sigma(T) \) and \( e \epsilon \Omega^n, \sigma(T)e = \sigma(T) \)

\( \sigma(T)^{-1} \epsilon \Omega^n \sigma(T)\sigma(T)^{-1} = e = 1 \)

\[ 0 \leq n \leq \infty \]

\[ 1 \to \Omega^1 \delta_1 \to \Omega^2 \delta_2 \to \Omega^3 \delta_3 \to \cdots \to \Omega^n \to 1 \]

\[
d_0T^0 = \frac{\partial}{\partial x^n} dx^0 ; \quad d_1T^1 = \frac{\partial \sigma(T)}{\partial x^1} dx^0 \wedge dx^1 ; \quad d_2T^2 = \frac{\partial \sigma(T)}{\partial x^2} dx^0 \wedge dx^1 \wedge dx^2 ; \quad d_3T^3 = \frac{\partial \sigma(T)}{\partial x^3} dx^0 \wedge dx^1 \wedge dx^2 \wedge dx^3 ; \cdots \quad d_nT^n
\]

\( \Omega^1 \cong C^1(M) \cong R \quad \Omega^2 \cong C^2(M) \cong R^2 \cong D^2 = 2\text{-dimensional disk} \)

\[ \int_{\Omega} d_nT^n \sigma(T)^{-1} = \int_{\partial \Omega} T^n \sigma(T)^{-1} = 1 \]

\[ \sigma(T) = \int_{\partial \Omega} T^n \]

I claim that \( \sigma(T) = \ker \frac{\partial}{\partial x^n} T \)

\[ \sigma(T) = \int_{\partial \Omega} T^2 \text{ at } n = 2 \quad \text{Q.E.D} \]
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Crooker, Kevin; Nishimura, Kurtis; Farrah, Duncan (2019) The GEODE mass function and its astrophysical implications”. arxiv: 1904.037

\ldots To God Be The Glory.

END.