A SOLUTION TO BLACK HOLE INFORMATION PARADOX

OLAYODE OLALEKAN BABATUNDE

Babatunde123olayode@gmail.com

ABSTRACT

This is a framework to unify black hole, dark matter and dark energy as faster-than-light moving perfect fluid. Two postulates to unravel the underlying physics behind the event horizon of black hole; by the virtue of these postulates we will be able to comprehend the nature and the evaporation of black hole. I establish a relationship between second order in ricci scalar curvature and dark energy current, and show that the current is conserved.

1. INTRODUCTION

Since the work of Stephen Hawking black hole information paradox has been one of the most sought-after problem in theoretical physics. The hope is that a solution will reconcile the conflict between general relativity and quantum mechanics. This paper attempts at unification of black hole, dark matter and dark energy as faster-than-light moving perfect fluid. The approach to be followed in this paper is a deterministic hidden-variable description of quantum gravity and I believe that 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:

- *It is the nature of the Ground State of a Quantum field of a black hole to be Steady*.

- *Speed of Light Is Quantized*.

2.0 BLACK HOLE AND EPR PARADOX

Suppose a spin zero particle at the event horizon of black hole as shown in figure1 decays into electron-positron pairs as shown in figure2. what will be the fate of the ingoing and the outgoing particles?

Particle with spin zero decays into leptons $s \rightarrow e^- e^+$
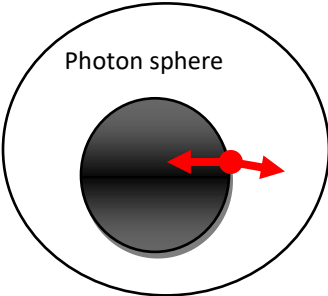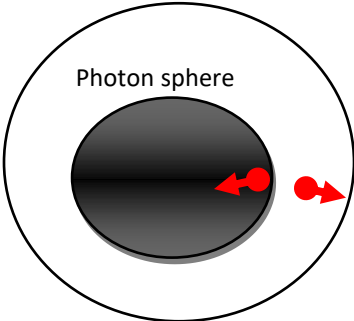
Figure1

Figure2

Binomial approximation of scalar stress energy curvature $T^n = 1 + nx$ where $n = \frac{v}{c}$, v is the velocity and c is speed of light. at $x = -1$, $T^n = 1 - n$, when $v = 1c$, $T^1 = 0$; at $v = 2c$, $T^2 \neq 0$. Now if $n = \chi$ is euler characteristic at $n = 2$ as in (1) which describe second order in scalar stress energy curvature for sphere $T^2 = -1$ and for torus $T^2 = 3$.

$$T^2 = 1 - \chi \tag{1}$$

- *The Laws of Physics are Invariant*

From Galilean transformation of Newtonian mechanics to Einsteinian relativity motion has been relative and the laws of physics are invariant but if we consider classical theory of electromagnetism relative motion is quiet not necessary and the laws of physics hold true. If we place either of the electron-positron pairs at a point in the interior of black hole and the other at a point in the photon sphere, I claim that the laws of physics are the same. The classical theory of electromagnetism does not change.

$\langle \Lambda^2 \rangle$ represents vacuum expectation value of cosmological constant of black hole. Special orthogonal group $SO(2)$ formulation implies that $\det(A)^2 = \pm 1$, $SO(2) \cong S^1$ and 1-dimensional torus is isomorphic to S^1.

$$AA^T |n\rangle = \det(A)^2 |n\rangle \tag{2}$$

The vacuum expectation value of black hole cosmological constant can be calculated as follows, where n is number of ground state.

$$\langle \Lambda^2 \rangle = \frac{2}{3} \langle n| \det(A)^2 = \pm 1 |n\rangle \tag{3}$$

$$\langle \Lambda^2 \rangle = \pm \frac{2}{3} n^2 \tag{4}$$

$$R_{\mu\nu} + \frac{1}{2} g_{\mu\nu} = 1 \tag{5}$$

$$\overline{\Psi} \gamma^\mu \Psi = J^\mu \tag{6}$$

$$\mathcal{L} = -\frac{1}{4} F_{\mu\nu} F^{\mu\nu} + \frac{\Lambda^2}{2n\pi} J^\mu A_\mu \tag{7}$$

$$J_\mu J^\mu \cos^2\theta = 1 - A_\mu A^\mu \sin^2\theta \tag{8}$$

$$\Lambda^2 J_\mu J^\mu \cos^2\theta + \Lambda^2 A_\mu A^\mu \sin^2\theta = 2n\pi \tag{9}$$

$$E^2 = 162 n\pi \times 10^{32} J \tag{10}$$

$$R_{\mu\nu} R^{\mu\nu} = \frac{\Lambda^2}{2\pi n} J^\mu J_\mu \tag{11}$$

AMPS firewall model claimed that the entanglement between ingoing and outgoing Hawking radiation is broken once the ingoing particle crosses the event horizon which creates firewall on the event horizon of a black hole ref [4]. EPR=ER model provided a solution by claiming the entangled particles are connected by wormhole ref [2] but in this article we will look at it from different perspective, according to the first postulate "it is the nature of the ground state of a quantum field of a black hole to be steady". by implication as the ingoing particle crosses the event horizon it distorts the steadiness of the ground state of the black hole which triggers the emission of energy which flows from the interior of black hole to the photon sphere back and forth in such a way that the current of the energy is conserved. Equation (1) showed how the speed is related to the dimension of second order in stress-energy scalar curvature tensor. The energy arises not from the disentanglement of electron-positron pairs but from the distortion of ground state of black hole. this energy is what I describe as dark energy.

$$J^\mu J_\mu = 1 \tag{12}$$

$$E^2 - P^2 = 1 \tag{13}$$

$$aa^\dagger - a^\dagger a = 1 \tag{14}$$

$$\langle E|aa^\dagger|E\rangle + \langle P|a^\dagger a|P\rangle = bb^\dagger \tag{15}$$

Dark energy current of the outgoing and incoming energy is conserved as shown in (11); in (12) and (13) creation and annihilation operator act on the energy-momentum state of black hole to create dark energy as the result of particle invading black hole.

$$R_{\mu\nu}R^{\mu\nu} = \frac{\Lambda^2}{2n\pi} \tag{16}$$

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} = 0 \tag{17}$$

$$R_{\mu\nu}R^{\mu\nu} = \frac{1}{4}R^2 g_{\mu\nu}g^{\mu\nu} = 1 - \frac{1}{4}g_{\mu\nu}g^{\mu\nu} \tag{18}$$

$$R^2 = 3 \tag{19}$$

if we substitute Einstein's equation in (17) into second order in ricci curvature tensor we will be able to calculate the second order in ricci scalar curvature as shown in (18) and (19). The values for second order in ricci scalar in (19) and second order in stress-energy scalar curvature in (1) are similar and it is obvious that they are interchangeable.
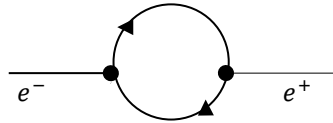
one State Diagram of Black Hole interacting with spin zero particle before decay

spin zero particle
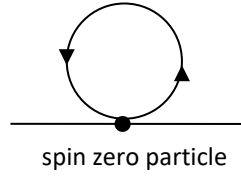
$$\langle n|AA^T|n \rangle = \langle \Lambda^2 \rangle = \pm \frac{2}{3} \approx 0.6666 \tag{20}$$

$$\frac{\Lambda^2}{2\pi} = 0.1060 \tag{21}$$

Two States Diagram of black hole interacting with electron-positron pairs after decay

e^- \hspace{3cm} e^+

$$\langle n|AA^T|n \rangle = \langle \Lambda^2 \rangle = \pm \frac{8}{3} \approx 2.6666 \tag{22}$$

$$\frac{\Lambda^2}{4\pi} = 0.2121 \tag{23}$$

Vacuum expectation value of cosmological constant of black hole is described as SO(2) orthogonal matrices acting on a single ground state for spin zero particle and two states for electro-positron pairs.

SUMMARY AND CONCLUSION

- I unified black hole, dark matter and dark energy as faster than-light moving perfect fluid.

- Two postulates to unravel the underlying physics behind the event horizon of black hole; by the virtue of these postulates we will be able to comprehend the nature and the evaporation of black hole.

- I established a relationship between second order in ricci scalar curvature and dark energy current and I showed that the current is conserved.

- The paradox is solved within the scope of this paper.

ACKNOWLEDGEMENT

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. . . to God Be the Glory.

END.