The Origins of Supermassive Black Holes

Eran Sinbar*

March 2, 2024

Abstract

Based on Bekenstein-Hawking formula, the black hole maximal entropy [1], the maximum amount of information bits that a black hole can conceal, beyond its event horizon, is proportional to the area of its event horizon surface divided by quantized area units, in the scale of Planck area (the square of Planck length). Since any sphere is limited to the amount of information bits it can contain within its volume of space, up to the limit of the information within a black hole with an event horizon at the radius of this sphere, the Bekenstein-Hawking formula is the upper limit for information contained within any sphere (or volume) of space. This is a surprising result since it limits the amount of information bits that are concealed in a volume of space to the amount of Planck area units that can fit onto its surrounding surface area. This can lead to the idea that the fabric of spacetime is a fabric of entangled information units at the size of Planck length (for each information unit). Due to entanglement, the information in a volume of space is entangled to the information on its surrounding sphere and is limited by the surrounding sphere area divided by Planck area, just as Bekenstein-Hawking calculated for the black hole entropy. The best candidate to carry the entangled information quantum bits in empty space, will be the virtual particles quantum fluctuations in the vacuum, that pop in and out of existence due to The Heisenberg uncertainty principle [2]. Some of these virtual particles that pop in and out of

*Correspondence: Eran Sinbar, Ela 13, Shorashim, Misgav, 2016400, Israel
Telephone: +972-523-713024
Email: eyoran2016@gmail.com

existence in empty space are non-correlated random noise fluctuations that cancel each other, and some are correlated information fluctuations. The correlated information fluctuations on the surface of the sphere represent information regarding the energy and mass within the volume of this sphere. As the information carrying, correlated virtual particle pairs pop in and out of existence, **they define the pulse of time**.

Introduction

This paper suggests that the fabric of space is entangled information in the form of virtual particles in the vacuum, the information quantum bits are in the size of Planck length, and the rhytume in which they pop in and out of existance is the rhytume of time. This is the fabric of space-time. **Entangled information popping in and out of existance is spacetime.** Based on Bekenstein-Hawking formula, the information of mass A in empty space (with no other gravitational effect), is spread on any surface of a sphere surrounding mass A within a distance of R_A , and the number of information bits is limitted by $\frac{4\pi R_A{}^2}{Planck\ area}$. As R_A decreases, the free space on the surface of the sphere decreases, the probability for correlated information virtual paticles to pop in and out of existance while maintaining the information of mass A decreases, and the pulse of time slows down, meaning time runs slower (gravitational time dilation or curvature of time).
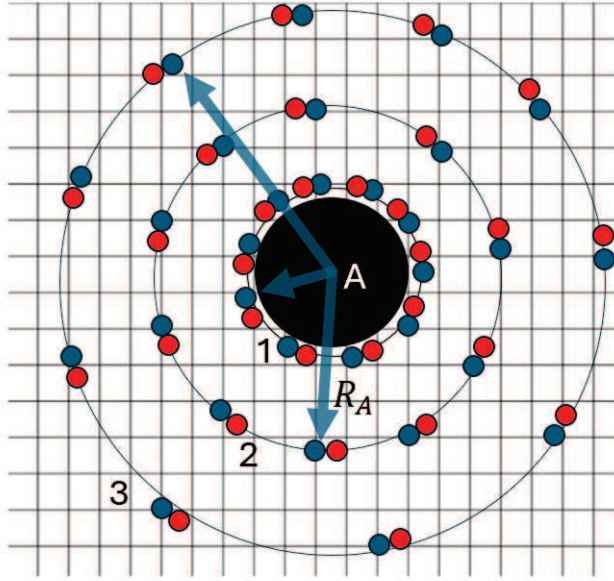
Figure 1 : the grid illustrates the entangled fabric of space time. Each rectangle in the grid is in the size of Planck length (the size of an information quantum bit). The black circle illustrates mass A, the blue and red circles illustrate the **correlated** quantum information bits in the form of virtual particle pairs (matter and anti matter pairs) that pop in and out of existance, while keeping the information of mass A. The free space between them is where random noise in the form of non-correlated virtual particle pairs, pop in and out of existance without any contribution to the entangled information. Same information of mass A will be represented by the correlated information carrying virtual particle pairs of surface 1,2 and 3, only the distance of free space between two neighboring correlated information pairs will change. As R_A ,illustrated by the blue arrows, decreases, the distance of free space between two neighboring correlated information pairs will decrease and the probability of the correlated information carrying virtual particle pairs to pop in and out of existance while maintaining the information of mass A will decrease.

Gravity

A pulse of time on the surface of the sphere is valid, only when the information is kept after the rearrangement of the information carrying correlated virtual particle pairs. Lets imagine virtual particles that pop randomly in and out of existance on the surface of

the sphere surrounding mass A, and only when they represent the correlated information of mass A it will be a valid pulse of time on this specific surface. As the sphere becomes smaller (closer to mass A) the number of combinations to reach the information of mass A decreases and it will take more randomal virtual pair fluctuations to reach the right combination of information carrying correlatrd virtual particle pairs, representing the information of mass A for each valid pulse of time. This leads to the gravitational time dilation (the pulse of time slows down as the distance from mass A decreases) [3]. Assuming correlated information carrying virtual particle pairs can mix up between them (due to their information carrying correlation property), as R_A decreases two correlated neighboring pairs of virtual particles can mix up and partly annihilate each other while generating two new real particles (matter from one pair and anti matter from the second pair) that will not annihilate each other, and flow into space (figure 2). This process of generating energy out of empty space will cause space to lose energy and curve. The curvature of space time is gravity as defined by Einstein's field equation [4].
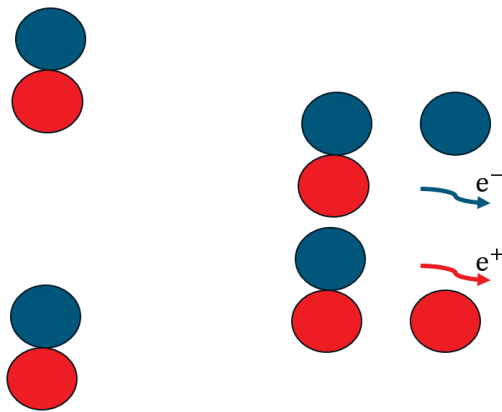

Figure 2 :Illustration of information in the form of correlated information carrying virtual particle pairs. The blue circles illustrate information in the form of virtual matter and the red circles illustrate information in the form of virtual anti-matter. On the left the pairs are far away from each other, and the probabily of mixup between pairs is low. On the right, as R_A decreases

the distance between the information carrying correlated pairs decreases and the probability for mixup between pairs increases. As the virtual matter from one pair annihilates the virtual anti-matter from its neighboring second pair, the matter particle from the first pair (illustrated as e^-) and the anti-matter particle from the second pair (illustrated as e^+) radiate into space. As space radiates matter particles and anti matter particles, it losses energy and curves (similar to a baloon losing its air). This curvature of space time is the gravitational field as defined by Einstein's field equations.

Conclusion

As the radius R_A from mass A decreases, the density of correlated information carrying virtual particles (matter and anti-matter) that pop in and out of existence increases and the free space for generating these pairs decreases slowing down time. This is the curvature of time (time dilation). As the density of pairs increases the probability for mix up between correlated information pairs increases. The mix-up generates real matter particles and real anti-matter particles which are radiated to space. This energy which is generated from space itself curves space just like the illustration in figure 3. This curvature in space and time is the gravitational field as defined by Einsteins field equations.
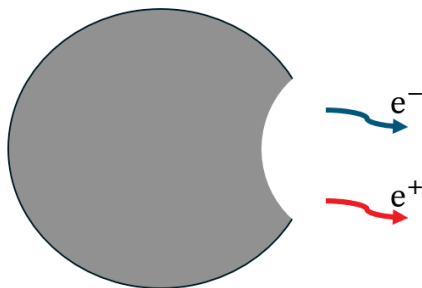
Figure 3 : When space generates a **real** pair of matter partical (illustrated as e^-) and anti-matter partical (illustrated as e^+) it losses energy and curves like a baloon that looses

molecules of air. This is illustrated by the gray blaoon shaped space curving as it loosses energy due to the generation of real matter and real anti-matter pair of paricles from space itself.

Predictions

This paper suggests that as energy and matter increase in a volume of space, the number of information carrying correlated virtual particle pairs that pop in and out of existence on its surrounding surface increases and the number of real matter and anti-matter particles that are generated by space itself increases due to mix-up between these correlated pairs. This can explain the origin of super massive black holes, billions of times larger than the mass of our sun [6]. These giant black holes generate real matter and anti-matter particles near the horizon, due to the strong gravitational field (as explained in this paper), and some of these real matter and anti-matter particles are swallowed by the black hole, due to its strong gravitational field enabling him to feed and keep growing from space itself. If this correlation between curvature of space and the generation of matter and anti-matter real particles from space itself will be considered, **the calculations for the origin of the super massive black holes can be revealed.** The remaining matter and anti-matter particles, generated from empty space itself, that were not swallowed by the black hole, can generate a disc around the horizon of the black hole or it might radiate into space forming new stars and galaxies.

REFERENCES:

[1] https://en.wikipedia.org/wiki/Black_hole_thermodynamics

[2] https://en.wikipedia.org/wiki/Quantum_fluctuation

[3] https://en.wikipedia.org/wiki/Gravitational_time_dilation

[4] https://en.wikipedia.org/wiki/Einstein_field_equations

[5] https://en.wikipedia.org/wiki/Supermassive_black_hole