Quantized space time and Einstein's special theory of relativity

Corresponding author: Eran Sinbar, Ela 13, Shorashim, Misgav, 2016400, Israel,

Telephone: +972-4-9028428, Mobile phone: +972-523-713024,

 Email: eyoran2016@gmail.com

Abstract

Based on Prof. Bekenstein and Prof. Hawking, the black hole maximal entropy[1], the maximum amount of information 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). This is a surprising result since it limits the amount of information bits in a volume of space to the amount of Planck area units that can fit into its surrounding surface area. Taking this information limit to the event horizon of a sphere in the size of Planck length in each of its three dimensions, will open up a new approach to our space - time structure.

Introduction

The Hawking Bekenstein equation of black hole entropy, limits the amount of the entropy in the volume of space within the event horizon to be proportional to the area of the event horizon divided by Planck's area (the square of Planck's length). Since any volume of space will contain less information than a black hole, the information in a sphere is limited by its surrounding surface divided by Planck area units. This means that a three-dimensional sphere of space with the radius size of Planck length can contain only one bit of information since its surface area is in the size of one Planck area.

Equation 1: $\quad S \approx \frac{A}{l_p{}^2}$

S – The amount of information bits in a sphere of space, A – the area of its surrounding surface, $l_p{}^2$ – Planck area (information unit area).

Equation 2: $\quad S_P \approx \frac{A_P}{l_P{}^2} \approx \frac{l_P{}^2}{l_P{}^2} = 1$

S_P – The amount of information bits in a sphere of space with a radius of Planck length. A_P – the area of its surrounding surface which is equivalent to one Planck area. $l_p{}^2$ – Planck area (the Hawking Bekenstein information unit area).

This means that a volume of space in the radius of Planck length can contain only one bit of information. There are endless combinations of entropy (information) setups in an arbitrary Planck sized volume of space, and **this is a contradiction to equation 2**.

Conclusion

Based on the Hawking Bekenstein formula, a volume of space in the radius of Planck length can contain only one bit of information. This restriction can be achieved only by quantizing space-time into non-arbitrary, spherical, local, unit cells of space, with a Planck sized radius, where each unit cell can either occupy every Planck time a Planck information qbit (1 or -1) or no information at all (0). **These are the fundamental basic building blocks of space - time**. The Hawking Bekenstein black hole information formula leads us to a four-dimensional quantized space time model in the size of Planck length and Planck time.

Contradiction with Einstein special theory of relativity

Based on Einstein special theory of relativity, if Alice measures in her frame of reference a quantized space time in the size of Planck length space unit and a Planck time unit as the basic fundamental building blocks of space-time, Bob who is moving relative to Alice in a different frame of reference compared to Alice, will measure different length and time for these same fundamental building blocks of space - time due to relativistic length contraction and time dilation between different frames of reference. This conclusion contradicts the relativistic approach that all frames of reference should measure equivalently the same length and time of the fundamental space-time building blocks, especially due to the fact that Planck length and Planck time are derived from the three fundamental physical properties of space-time: Newton's gravitational constant (G), speed of light (c) and Planck's constant (h), which should be the same for all frames of reference.

The grid dimensions

There is a symmetrical structure that enables both Alice and Bob to have a quantized local (limited to the speed of light) space time, with the same building block dimensions of Planck length and Planck time. In order to build this symmetrical structure, we need to introduce the extra four-dimensional non-local grid dimensions. These extra grid-like dimensions divide like a grid the quantized building blocks of space-time enabling to stagger both Alice quantized frame of reference space time and Bob's quantized frame of reference space time (figure 1). In their own frame of reference quantized space-time, they will both agree that the dimensions of their quantized space-time building blocks are in the size of Planck length and Planck time. Each one of them (Alice or Bob) will experience only his own quantized space time point of view and the symmetry will be kept and there will be no contradiction.
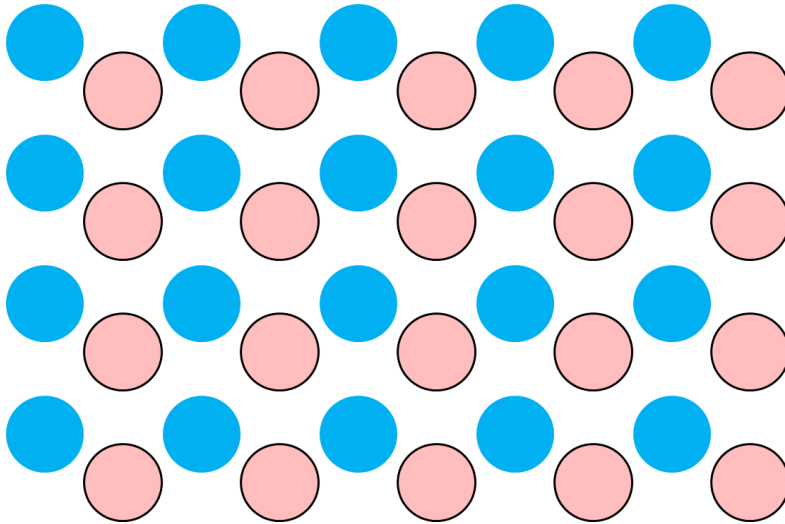
Figure 1: Two frames of reference staggered one next to each other. The two dimensional red circles illustrate Alice's local four-dimensional quantized (or quantum) space-time world and the two dimensional blue circles illustrate Bob's local four-dimensional quantized space-time world. Alice and Bob are in a different frame of reference, but in their quantized space-time world, they both agree that the universal fundamental non-arbitrary basic building blocks of space and time (illustrated as red and blue circles), are at the size of Planck's length and Planck time for all reference frames. Alice will measure only the quantized world built from her red circles and Bob will measure only the quantized world built from his blue circles. Alice and Bob will not agree on the length of the same object and they will count, in their own quantized world, a different number of Planck length space units to describe the length of the same object. Alice and Bob will not agree on the same period of time and they will count, in their quantized world, a different number of Planck time units to describe the same period of time. This is due to length contraction and time dilation between different frames of reference [3]. In the figure are illustrated only two quantized worlds (frames of reference) in a small region of space at a specific pulse of time, in two dimensions (instead of the real four space-time dimensions). For each world there is an infinite number of quantized space-time units. There is an infinite number of quantized worlds (frames of reference) staggered next to each other changing through the Planck length pulses of time generated since the big bang. The four-dimensional space time between the quantized space-time units is the grid dimension (illustrated as the white two-dimensional grid like space between the red and blue circles). The concept of infinite staggered matrixes of four- dimensional space-time quantized worlds, floating in the grid dimension can describe also the Hugh Everett many worlds interpretation to quantum mechanics [4]. The extra non-local grid dimensions can explain also the quantum non-local entanglement "spooky action at a distance" [5].

REFERENCES:

[1] https://journals.aps.org/prd/abstract/10.1103/PhysRevD.7.2333

[2] https://www.space.com/loop-quantum-gravity-space-time-quantized

[3] https://scienceready.com.au/pages/time-dilation-and-length-contraction

[4] https://en.wikipedia.org/wiki/Many-worlds_interpretation

[5] https://www.quantamagazine.org/how-bells-theorem-proved-spooky-action-at-a-distance-is-real-20210720/