

Black hole information concealed in gravitational waves

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1. Abstract

The black hole information paradox is a contradiction between quantum mechanics and general relativity. Information in the form of matter and energy, which enters the black hole can never escape due to the extreme gravitational curvature of space-time, while at the same time the black hole slowly evaporates through the Hawking radiation due to virtual pairs generated at the surface of the event horizon. This collision of the uncertainty principle of quantum mechanics with the extreme gravitation predicted by general relativity can generate new ideas regarding the behavior of space-time. This paper suggests that information can escape from the black hole gravitational grip, in the form of gravitational waves, as they ripple the fabric of space time. A black hole is an extreme case in which the curvature of space time transforms the information concealed in matter and energy into a sequence of ripples in the fabric of space time. The black hole is also a unique case in which the extreme curvature transforms virtual particles in the vacuum to radiation (Hawking radiation) as it slowly evaporates. These ripples in space time can influence the Hawking radiation in a way that it will radiate, together with the gravitational waves, the concealed information from the black hole singularity back to outer space.

2. Introduction

The no hair theorem [1] states that all black holes have three characteristics: mass, electric charge and angular momentum. These three observable parameters are due to the singularity characteristics in the center of the black hole. This means that the black hole can communicate these three characteristics, through the fabric of space – time, from its singularity (where all the matter and energy are concentrated), to its event horizon where information can escape to the outer regions of space. This paper suggests that when information reaches the singularity region of the black hole, just before it is crushed to the singularity and gone forever, it is spaghettified into quantum bits of information in the form of a string (figure 1), generating turbulences in the fabric of space time near the singularity.

3. *Gravitational waves near the singularity at the center of the black hole*

As the information is crushed bit by bit into the singularity, these turbulences which are correlated to the information string, vibrate the fabric of space –time in singularity region and by that also influence the three black hole characteristics (mass, charge and angular momentum). These influences from the singularity region on the three parameters, that are measurable by an outside observer that has not crossed the event horizon, generate gravitational waves which are correlated to the information that reached the singularity. These gravitational waves carry the information pattern back to outer space directly or by influencing the Hawking radiation (virtual particles generated near the event horizon). This is the way information is radiated back to the outer region

of the event horizon and it is never lost even though it was crushed into the singularity of the black hole. This mechanism (figure 1) resolves the black hole information paradox [2]. In the future this mechanism can be simulated in a black hole bath [3] and black hole computer simulations.

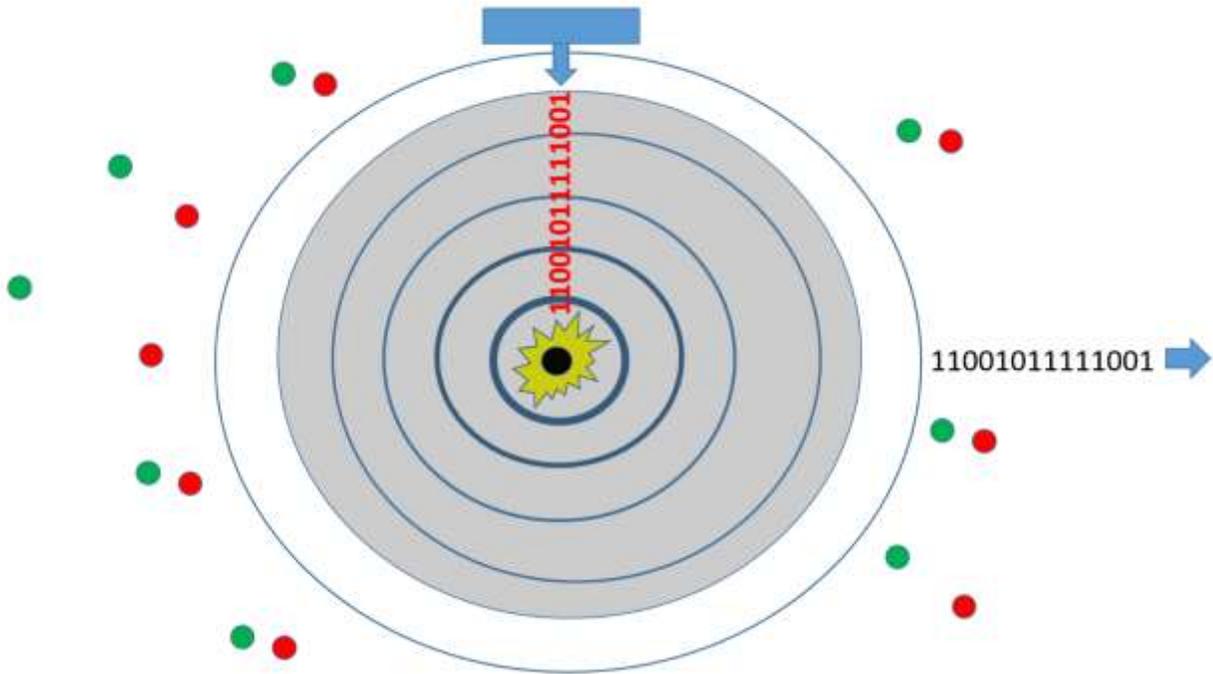


Figure 1: The black hole is illustrated as a black circle which represents the singularity zone and a gray disc surrounding it representing the internal region beyond the event horizon. As an object illustrated by a blue rectangle falls into the black hole towards the singularity it is spaghettified by the extreme curvature of space time. Near the singularity the curvature is so intense that information can pass one bit at a time, generating vibrations and turbulences in the fabric of space time in the singularity zone. The spaghettified information is illustrated by the 0 and 1 red colored string. The vibrations and turbulences in the region near the singularity (illustrated as the yellow region around the singularity zone), generate gravitational waves, represented by the blue rings. These gravitational rings (ripples in space time) carry back the information bit by bit back to outer space. The information that escapes the black hole to outer space is illustrated by the 0 and 1 black colored string. The gravitational waves which carry the black hole information can also influence the virtual particles generated near the event horizon, illustrated by the green-red colored circle pairs, that will transform to Hawking radiation. That way information is radiated from the black hole by gravitational waves and by the Hawking radiation.

4. Summary

The amount of information bits that might be concealed in the singularity of a black hole can be calculated by measuring the event horizon surface area and the Bekenstein – Hawking formula [4]. This formula can be intuitively understood by assuming that space-time is quantized into discrete units in the size of Planck's length in each dimension, and based on that assumption we can expect that for each minimal bit of information the surface of the event horizon can increase or decrease (based on positive or negative energy) in discrete units of the Planck area [5]. Due to Hawking radiation this information evaporates as virtual particles with negative energy reach the singularity and that is the black hole information paradox.

This paper has a different approach to the location of the concealed information. Let's assume for example that in the singularity region , due to extreme space time curvature ,matter and energy are being spaghettified into their most basic digital binary form of : +A,+B (positive information) or - A, - B (negative information due to Hawking radiation). The sequence in which this information string arrives to the singularity will influence the event horizon through gravitational waves. This paper suggests that in the singularity itself there is no concealed information .During the spaghettization phase, as these information bits entered as a string one bit after the other ,into the singularity region, the concealed information was radiated back into space by gravitational waves due to the vibration and turbalences which this information string generated near the singularity, in the fabric of space-time .So as the black hole evaporates due to Hawking radiation, there is no loss of information since the information was already spread back into space in the form of gravitational waves (and the influence of gravitational waves on the Hawking radiation).

The four basic formations: matter, energy, gravitational waves and virtual particles in the vacuum [6], conceal together all the information in the fabric of space time. Information can be transformed from one formation to the other. A black hole is just an extreme curvature in space time with a singularity zone in its center. The black hole information is radiated back to outer space by gravitational waves and their influence on the Hawking radiation. We can conclude that black hole is an extreme space time curvature that transforms the information concealed in matter and energy into ripples in the fabric of space time and ripples in the Hawking radiation.

References

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