International Journal of Scientific Engineering and Research (IJSER)
ISSN (Online): 2347-3878
Impact Factor (2022): 7.741

What is on the Other Side of a Blackhole?

Himansh Chitkara

Abstract: ***A black hole is a region of spacetime where a fixed mass is compressed into an infinitely small volume. This results in gravity being extremely strong around the region that no information is able to escape. Although many black holes have been discovered till date, no one is completely sure about what lies on the other side of black holes. This paper provides information on the Wormhole, White hole, and Parallel Universe in order to speculate what could possibly lie on the other side of the black hole. The paper will not only explain these theories, but will also provide an evaluation of the supporting evidence for each theory in order to present their merits and reliability to readers.***

Keywords: Blackhole, Wormhole, Parallel Universe, White hole

1. Introduction

Some know them for their unforgiving gravitational strength. Some know them for defying every law of Physics known to man. Some know them by an endless list of names Sagittarius A*, TON-618, M87*, Cygnus X-1…But we all know them for one thing in common – a captivating mystery. First predicted by Einstein in 1916 and named by Wheeler in 1967, "Black Holes" are areas in space where the gravitational force is so strong that even light falling past the event-horizon can't escape (Fig 1) (Tillman, et al, 2022). Formed due to a fixed mass being compressed into an infinitely small volume known as the "singularity", black holes bend and pull the fabric of spacetime into an infinite curve making them impossible to escape from, thereby creating a dark region in space which can only be detected through its effect on nearby bodies (Gravity, Black Holes and Gravitational Waves, n. d.). As a result, there is no conclusive evidence which can prove what is on the other side of a blackhole; however, through the analysis of research and several theories proposed, this essay aims to explore the possibilities of wormholes, white holes and parallel universes on the other side of black holes.

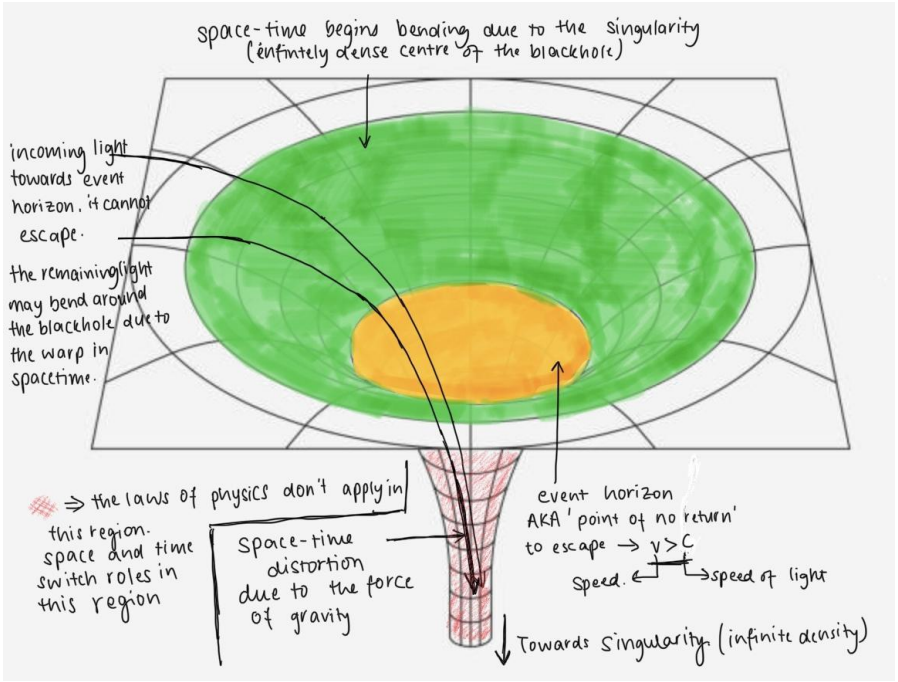

Figure 1: Black Hole Wireframe Geometric Shape Stock Illustration, 2021

Wormholes

A Wormhole (AKA the Einstein-Rosen Bridge) is a theoretical concept and a solution to Einstein's field equations of general relativity. Simply put, wormholes are tunnels connecting two different regions of spacetime (Fig 2) (Darling, n. d.). Although scientists are still unaware about the implications of the infinite curvature of spacetime in a black hole, they seem to be able to provide the immense forces of gravity required to curve spacetime into a tunnel, thereby making wormholes a plausible theory, but not one that is practical. Due to the infinite force of gravity in a black hole, a wormhole would collapse the moment it forms by sinking into the black hole. Furthermore, to stabilize a wormhole, a substance known as "exotic matter" i. e., matter with a negative mass, energy and density, is required. Although this substance exists mathematically, it hasn't been detected in the observable universe (Tillman et al, 2022). However, counter arguments have come forward in light of new research suggesting that if there is a quantum connection (Fig 3) between two black holes, "exotic matter" may not be required to stabilize the tunnel. If such wormholes indeed do exist in black holes, then quantum

information entering the black hole will be able to travel through the wormhole into another part of the universe, thereby solving the paradox of loss of information in a black hole (Wolchover, 2017). However, as none of this research has empirical evidence, no definitive claims can be made.

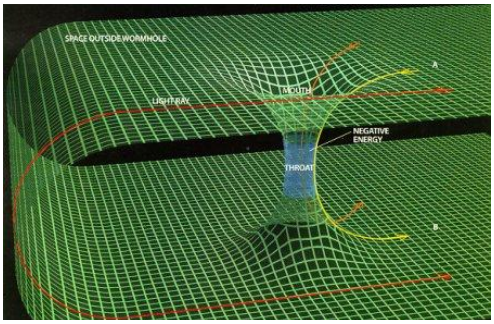

Figure 2: (Darling, n. d.)

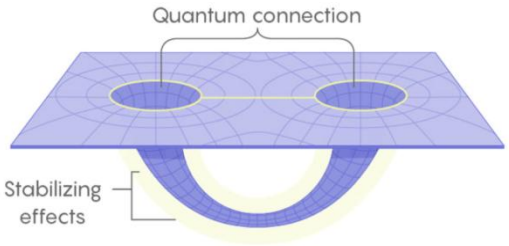

Figure 3: (Wolchover, 2017)

White holes

As the name suggests, white holes are fundamentally opposite to black holes. While it is impossible to escape from a black hole, it would be impossible to enter a white hole (Xiao, n. d.). Both white holes and black holes look similar in nature when observed from space, however, the brief expulsion of matter is what differentiates the two. Viewing a white hole would almost be like a "time reversal" of viewing a black hole (Wood, 2022). However, white holes at best can be called an impossible possibility, mainly because of two reasons. Firstly, for the existence of a white hole on the other side of a black hole, a wormhole would be required to exist inside the black hole joining two regions of spacetime (Fig 4). As seen above, it is highly unlikely for such a theory to be true. Secondly, white holes fail to obey the second law of thermodynamics –entropy (a measure of how many different states particles in a system can be in) in the universe can either remain the same or it can increase; however, the existence of white holes would lead entropy to decrease as they would reverse the destruction caused by a black hole, a phenomenon which isn't possible (Kennell, 2015). On the other hand, claiming that no empirical evidence has been found suggesting the presence of a white hole would be wrong. In 2006, a gamma ray burst, called GRB 060614, was observed for 102 seconds. As the source of the rays wasn't close to any other astronomical body which could possibly emit gamma rays, scientists have hypothesized the radiation came from a white hole (Retter et al, n. d., pg 3). However, in the 16 years since the occurrence of this radiation burst, no such similar events have occurred, deeming the existence of white holes a mystery yet to be solved.

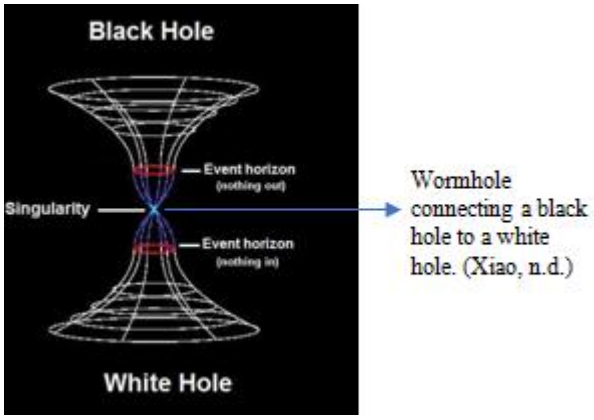

Figure 4

Parallel Universe

The possibility of other universes existing has always seemed to have fascinated scientists. In fact, quite recently, Nikodem Poplawski has come up with the theory of other universes existing in black holes through the use of a concept called space time torsion, one that is of great significance in black holes (Chieml, 2020). As black holes spin at extremely high speeds, they twist the matter falling and compress it into infinite density. However, if this mass was to suddenly unspring itself because of the amount of heat generated, it would lead to a large explosion launching the mass into another universe thereby making them portals (Poplawski, 2012). Although, Poplawski's concept is mathematically sound, obeys all laws of physics known to man, successfully explains the Big Bang and is in line with research about black holes exploding, empirical evidence is awaited to confirm this theory.

2. Conclusion

Based on the arguments presented, it can be said that all three possibilities mentioned above – Wormholes, White Holes, and Parallel Universes – have been analyzed and evaluated successfully in this essay. Nevertheless, these are just three of the several possibilities of what could be on the other side of a black hole. Indeed, black holes are a captivating mystery for human kind. We might not completely understand what black holes are, we might not agree on what lies on the other side of a black hole, we might not even make progress in this field of Astrophysics for the next few years, but in the words of Neil Armstrong "Mystery creates wonder and wonder is the basis of man's desire to understand" (Brainy Quote, n. d.) As long as black holes remain a mystery, we will remain curious.

References

[1] Black Hole Wireframe Geometric Shape Stock Illustration-Download Image Now-Black Hole-Space, D., 2021. *Black hole wireframe geometric shape stock illustration*. [online] iStock. Available at: https://www.istockphoto.com/vector/black-hole-wireframe-geometric-shape-gm1343491756-422214387

[2] Brainy Quote. n. d. *Neil Armstrong Quotes*. [online] Available at:

https://www.brainyquote.com/quotes/neil_armstrong_135030

[3] Chmiel, R., 2020. *Acclaimed Physicist Publishes Groundbreaking Research*. [online] Newhaven. edu. Available at: https://www.newhaven. edu/news/blog/2020/nikodem-poplawski-research. php

[4] Darling, D., n. d. *wormhole*. [online] Daviddarling. info. Available at: <https://www.daviddarling. info/encyclopedia/W/wormhole. html> [Accessed 10 September 2022].

[5] Kennell, J., 2015. *You've Heard of Black Holes, but What About White Holes?*. [online] The Science Explorer. Available at: http://thescienceexplorer.com/universe/you-ve-heard-black-holes-what-about-white-holes

[6] Physics. fau. edu. n. d. *Gravity, Black Holes and Gravitational Waves*. [online] Available at: https://www.physics. fau. edu/~wolf/PublicScience/Grav_GWs_BHs/Grav_GWs_BHs. html#: ~: text=If%20enough%20mass%20is%20concentrated, light%2C%20can%20escape%20this%20region

[7] Poplawski, N., 2012. *Every Black Hole Contains a New Universe*. [online] Inside Science. Available at: https://www.insidescience. org/news/every-black-hole-contains-new-universe

[8] Retter, A. and Heller, S., n. d. *The Revival of White Holes as Small Bangs*. [online] pp.1-3. Available at: https://arxiv. org/vc/arxiv/papers/1105/1105.2776v1. pdf

[9] Tillman, N. and Harvey, A., 2022. *What is a Wormhole?*. [online] Space. com. Available at: https://www.space.com/20881-wormholes. html

[10] Tillman, N., Biggs, B. and Dobrijevic, D., 2022. *Black holes: Everything you need to know*. [online] Space. com. Available at: https://www.space.com/15421-black-holes-facts-formation-discovery-sdcmp. html

[11] Wolchover, N., 2017. *Newfound Wormhole Allows Information to Escape Black Holes | Quanta Magazine*. [online] Quanta Magazine. Available at: https://www.quantamagazine. org/newfound-wormhole-allows-information-to-escape-black-holes-20171023/

[12] Wood, C., 2022. *White holes: What we know about black holes' neglected twins*. [online] Space. com. Available at: https://www.space.com/white-holes. html

[13] Xiao, K., n. d. *The Difference Between Black & White Holes:* . [online] Futurism. Available at: https://futurism.com/what-is-the-difference-between-a-black-hole-and-a-white-hole