THE QUESTION MARK OF RELATIVITY AND QUANTUM PHYSICS

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1. Introduction

The reason for conducting this research is trying to grasp the complexity of the universe. Since the beginning of mankind we wanted to understand the way things work, including the universe. To state the fact that Einstein's equations of relativity does not complete the theory of everything, the search for an ultimate answer is yet to be found. To understand the power of a black hole and its influence on nearby planets we created a simulation that may bring us closer to this ultimate answer. For this research we asked ourselves: *What happens in and around a black hole?*

2. Research Methods

To better understand the outcome of our research, we had to understand the behaviour of a black hole. To achieve this, we divided our research into two parts. The first part consists of a theoretical framework in which we described all the possible phenomena that occur inside a black hole. For the second part of our research, we used all the necessary mathematical and physical equations to create a simulation of a binary planet system orbiting a black hole. By slightly altering the pre-calculated (stable) start values, the simulation then showed the outcome of what would actually happen in our universe. This gave us insight in how planets behave around a black hole and made us able to answer the question *What happens around a black hole?* All the things we were not able to gather from our simulation, we could answer by using our theoretical framework.

There are four different types of metrics. Each one shows a different character that directly leads to another outcome, i.e. they all behave in a different way. For our simulation we used the Schwarzschild metric, which has no angular momentum and no charge, so only mass. A black hole with a Schwarzschild metric can mathematically be described as:

$$c^2 d\tau^2 = \left(1 - \frac{r_s}{r}\right) c^2 dt^2 - \frac{dr^2}{1 - \frac{r_s}{r}} - r^2 (\, d\theta^2 + \sin^2\theta \; d\varphi^2) \qquad (1)$$

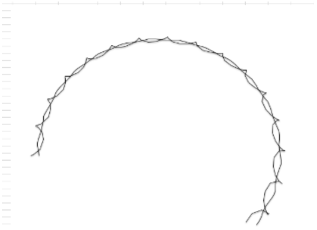
where $d\tau^2$ is positive, τ the proper time (time measured for the black hole), c the speed of light, t the time coordinate (time measured from a distance), r the radial coordinate, θ the colatitude, φ the longitude and r_s the Schwarzschild radius which can be described separately as:

$$r_s = \frac{2GM}{c^2} \qquad (2)$$

where M is its mass and G is the gravitational constant [1].

3. Results

To correctly formulate an answer to our thesis and build up validity for our outcomes, we compared the data of our simulation to other simulations. We could see how the black hole had influenced the binary planet. In some of the results we could even see that the planets had set in a new stable way around the black hole.



pre-calculated stable model

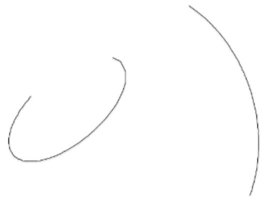


Figure 2 – The outcome of a stable model with altered start values

4. Conclusion

All the different outcomes that the simulation showed us made complete sense, for it made us understand the behaviour of the black hole. Furthermore, it made us able to answer one part of our main question: *What happens around a black hole?* It made us see how this particular black hole behaves just like any other form of mass. The only difference, in this case, is its radius, therefore making it not reflect any photons, thus making the black hole *black*.

In the case of the other types of black holes, they simply reflect the outcome we predicted with the already existing formulas. We can describe their behaviour by looking at the outskirts of our universe and compare it to our knowledge we already have on them.

To answer the question: *What happens inside a black hole?* we used the data we gathered for our theoretical framework. It's very clear that the special- and general relativity debunk the theory of quantum physics and vice versa. Combining these theories creates a numerous amount of paradoxes, such as the information paradox; where the universal law of conservation of information gets broken. When matter gets radiated away (due to Hawking radiation), there is no way to tell what its original charge, direction and momentum was. This makes it near impossible to know what happens inside a black hole. In other words, at best we can only formulate a hypothesis considering *What happens inside black hole?*

5. References

[1] Schwarzschild, K. (1916). “Über das Gravitationsfeld eines Massenpunktes nach der Einsteinschen Theorie“. 189-196. Bibcode: 1916AbhKP1916..189S.