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White Holes:

Potential Solutions to Dark Matter?

Abstract

This paper aims to determine the legitimacy of Shahram Jalalzadeh’s newly-proposed theory proposing dark matter as composed of quantum black hole-white hole entangled states. By comparing and contrasting multiple different theories detailing the formation of white holes, this paper will analyze the consistency of physical properties, both general and quantum, of black and white holes throughout these different theories. Specifically, the quantum nature of the black hole singularity as presented through these theories will be analyzed and compared to Jalalzadeh’s. Finally, this paper will analyze the probability that each theory may be experimentally confirmed in order to more accurately determine the probability that Jalalzadeh’s theory may be experimentally confirmed, provided that there are indeed connections between Jalalzadeh’s theory and these other theories.

Introduction/Background

Einstein’s theory of relativity is arguably the most revolutionary idea in modern science, as traditional Newtonian physics is shown to fail in several conditions [1]. Specifically, the theory of general relativity reveals the existence of extremely dense singularities – black holes – that display properties breaking the known laws of physics, such as seemingly having an infinite spacetime curvature at its singularity (analogous to the black hole having infinite gravity at its center) [2-3]. While the nature of black holes had generally been accounted for with general relativity, the infinite nature of the singularity had not, giving rise to quantum gravity. Quantum gravitation is extremely new in the world of physics, relatively speaking, but seems to hold answers to numerous unanswered problems, including the information loss paradox resulting from Hawking radiation as well as the aforementioned infinite nature of the singularity [4-6]. Specifically, this results from mathematical computations concerning the nature of quantum black holes (black holes at the point of evaporation) that result in theoretical white hole solutions – essentially “time-reversed” black holes. These white holes mirror their black hole counterparts except rather than absorbing matter around them, white holes theoretically release the matter their counterpart had accumulated throughout its lifetime [7]. The physical discovery of a white hole could both confirm the currently unprovable quantum theories that potentially govern the nature of a white hole and raise numerous questions concerning cosmology, the study of the universe in its entirety, such as creating the genuine potential for a multiverse. Furthering the importance of discovering a white hole even more, a paper published in June 2022 by Shahram Jalalzadeh proposes that dark matter is composed of quantum black hole-white hole entangled states, examining the degeneracy of the black hole at the quantum scale [8].

While completely theoretical, the accuracy of this theory could lead to even more specialized research on the nature of dark matter, which has remained a mystery to physicists. At its core, dark matter is gravitationally attractive (exactly like matter) but is completely undetectable to us, violating many previous assumptions concerning the composition of the universe. However, this is basically everything currently known about dark matter, giving great importance to theories discussing the nature of dark matter. Confirming the accuracy of Jalalzadeh’s theory would be an instrumental step in revealing both the nature of white holes as well as the nature of dark matter. As such, this research paper seeks to determine the legitimacy of Jalalzadeh’s specialized quantum theory through analyzing other relevant theories specialized in different scopes of the universe – such as the various models of white holes in broader spacetime – and examining the possibility of smoothly transitioning between them at their boundaries.

Methods

In order to confirm the accuracy of Jalalzadeh’s theory, the methodology of this paper will most likely be split into two distinct sections: first, confirming the convergence of various theories revolving around the quantum deformation of a black hole at the evaporation point and resulting formation of a white hole with Jalalzadeh’s and second, confirming the convergence of theories concerning the properties of white holes in broader spacetimes with Jalalzadeh’s. In other terms, the methodology will be split between analyzing Jalalzadeh’s results concerning the properties of black holes and of white holes, comparing them to the results of other previous theories. Because the laws of physics must be universal, theories determining the nature of the universe at different scopes must converge at the boundary points. For example, the theory of general relativity is shown to reduce to Newtonian gravity in extremely small gravitational fields. As such, the more general formulation of black holes and white holes in spacetime should converge with Jalalzadeh’s more specialized theory concerning the quantum properties of black hole-white hole entangled states at the quantum boundary. Specifically, I will examine the results of various theories concerning the physical properties of black and white holes in a broad scale, the same physical properties at the horizons and singularities of black and white holes, and the probability that these properties can be experimentally determined. Examining the probability for experimental determination for the results of each theory is as critical as examining the actual connections between the theories due to the fact that experimental observation is the defining characteristic concerning the legitimacy of a specific theory. Thus, confirming connections between Jalalzadeh’s theory and other theories as well as determining the probability that each connecting theory may be experimentally confirmed could accurately show the likelihood that Jalalzadeh’s theory is indeed correct.

In order to do this, I will examine Jalalzadeh’s results for the properties of quantum deformed Schwarzschild black holes – the most basic black hole solutions – with the properties of quantum deformed black holes produced by other theories. Given the same conditions, all the physical properties, such as the mass, interior volume, rate of change, conservation of energy, etc., should be maintained. Following this, I will examine the same properties in respect to white holes, comparing the results of various theories with Jalalzadeh’s. For Jalalzadeh’s theory to be correct, general properties of both the black hole and the corresponding white hole must be conserved between these various theories. Then, I will delve into comparisons between the results concerning quantum interactions in black and white holes, as the more general physical properties become imbued with quantum considerations. Specifically, the quantum interactions present at the singularity of a black hole should connect to both theories detailing the formation of white holes as well as Jalalzadeh’s theory on the nature of quantum states present in the singularity of a black hole/white hole pair and their relationship to dark matter.

Specifically, I wish to compare Jalalzadeh’s results with two other theories [9-10] detailing the formation of a white hole from the evaporation of a black hole, using other more specialized theories as supporting knowledge to [11-14]. All theories consider Schwarzschild black hole solutions in quantum scenarios, so the theories should indubitably connect in some way. The quantum tunneling process of a black hole into a white hole in particular should be extremely relevant to the formulation of quantum black hole-white hole entangled states in a quantum deformed Schwarzschild black hole. As well, the quantum corrected spacetime of a white hole should give insight into its properties at that scale, which should also agree with the properties determined by Jalalzadeh. The geometry of the black hole-white hole pair at its transition should also agree with other quantum considerations. Finally, the physical properties of both the black hole and white hole should be relevant to the physical nature of dark matter, as if dark matter actually is the quantum entangled states, there should be some resolution concerning dark matter and the physical matter present in black and white holes.

Returning to the introduction on the methodology of this paper, if analysis shows that the more general physical qualities of black and white holes are indeed preserved throughout different quantum theories, I will then delve into the possible reduction of broader theories on black and white holes into quantum theories towards evaporation. Only if results from this section of research support my thesis might continued research on the continuity of theories concerning the quantum properties of black holes be useful, as a different theory on the quantum properties of black holes must be explored. If these general properties are shown to be conserved, however, examination of the quantum properties previously detailed will be the defining factor in analyzing the legitimacy of Jalalzadeh’s theory.

The resolution of broader theories with Jalalzadeh’s would be magnificent though fairly unlikely, given the quantity of relevant theories that exist. More likely, one or more of the theories will fail to synthesize with others in certain circumstances; in this case, determining precisely which theory fails could be virtually impossible. Though, this failure would indubitably call for revision of existing theories or creation of new ones.

Conclusion

Overall, considering the failure of general relativity at the evaporation stage of a black hole’s life, quantum theories of gravity must be employed. Research into possible quantum gravitational theories then gave rise to the theoretical existence of “time-reversed” black holes – white holes. One of these theories, Shahram Jalalzadeh’s proposal of quantum black hole-white hole entangled states at the quantum level being candidates for dark matter, could provide extremely useful avenues for further research on the nature of dark matter. As such, I will have determined whether Jalalzadeh’s theory can be unified with other potential black hole-white hole theories, both quantum and cosmological, giving a decent insight into the legitimacy of Jalalzadeh’s results.

Expected Results/Budget

Due to the theoretical nature of this research project, the budget will require funding for the time spent researching and analyzing rather than funding for experimentation. So, I would require enough funding to sustain my health and necessities throughout the duration of the project. In terms of expected results, there are none for this project. Due to the nature of modern physics and my current familiarity with it, I cannot determine whether Jalalzadeh’s theory will accurately connect to others prior to the actual results of the research project.

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