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Research Article

Research for the Possibility of Creating Extraterrestrial Civilizations on Black Hole Terrestrial Exoplanets

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ABSTRACT

It may be possible to produce life on planets orbiting around black holes, but it has little chance of evolving extraterrestrial civilizations. The production of life on planets orbiting around black holes is dependent on the amount of energy that results from the temperature difference between the black hole accretion disk radiation and the cold space around the planet the Cosmic Microwave Background (CMB) radiation. However, the likelihood of the evolution of life and the creation of extraterrestrial civilizations on these planets must also be examined. A study conducted in 2016 showed that life could be produced on black hole exoplanets, but so far the chances of life evolution and the creation of extraterrestrial civilizations have not been investigated. For this reason, this issue was investigated in this study. This research has shown that even assuming the possibility of producing life on black hole exoplanets, there are several factors that hinder the creation of extraterrestrial civilizations on the surface of these planets. As a result, black hole exoplanets are not good targets to discover intelligent life.

Keywords: Black hole; Habitable zone; Photosynthesis and chemosynthesis; Extraterrestrial civilizations.

INTRODUCTION

In recent years there have been discussions about the possibility of life on black hole exoplanets [1]. Even science-fiction films like Interstellar have been made on this. Energy generated by the difference between the temperature caused by black hole accretion disk radiation and the cold space around the planet (cosmic microwave background radiation or CMB) can provide the conditions needed to generate life on these planets [1,2]. But the conditions necessary for the evolution of life on terrestrial planets and the creation of civilization on the surface of these planets are not simply the conditions for producing life on their surface.

The production and evolution of life on black hole exoplanets faces many problems. Changes in the amount of energy the planet receives from the black hole over time, approaching the black hole's habitable zone, the danger of the planet approaching the black hole event horizon and the planet's tidal locking, and the probability of black hole accretion disk radiation activities including X, UV, and gamma rays, are some of the dangers facing production and evolution of life on the black hole exoplanets. But the absence of light emission from the black hole event horizon and the presence of a dark sun in the sky of black hole exoplanets, have the highest impact on the process of production and evolution of life on these planets.

There have been many debates about the conditions for the production and evolution of life on terrestrial planets orbiting around the stars [3-8].

However, there has been debate recently about the possibility of life existence on exoplanets orbiting around black holes. But about the possibility the evolution of life on these planets and the creation of extraterrestrial civilizations have not been discussed. As a result, this study examines this question.

In this study, by examining the properties of black holes and the life produced on the surface of the planets orbiting around them, it was found that extraterrestrial civilizations could not be created on these planets, even assuming the being possible of producing life on these planets.

MATERIALS AND METHODS

The possibility of life emergence on black hole terrestrial exoplanets

On the black hole exoplanets, the temperature difference between

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the black hole's accretion disk radiation and the cold space around the planet (CMB) provides the energy and heat needed to generate life on these planets. But the amount of energy the planet receives from a non-rotational black hole is less than enough for living standards. Due to the accelerated expansion of the universe, the temperature of the cold space will gradually decrease. As a result, planets orbiting around black holes will receive less energy from the black hole over time. In the planets orbiting the fast rotating Kerr black holes, the amount of energy the planet receives from the black hole is more than a planet with a non-rotational black hole [1].

If we replace the sun with a black hole with the solar mass in our solar system, the planets' distance from the sun and their orbits will not change [9], but the situation of the habitable zone in the solar system will change [10], and will get closer to the black hole [2,11]. The heat radiation emitted from accretion disk of this black hole, which is equivalent to the solar mass, is about 100 nano Kelvin which is much lower than the CMB radiation temperature (2.7 Kelvin). These temperature differences provide good heat for producing life on black hole exoplanets.

Approaching the habitable zone to the black hole could expose the planets within this zone to tidal locking [2], or the danger of approaching the planet to the black hole event horizon.

The X, UV, and gamma rays can also be emitted from the black hole accretion disk. These dangerous rays can destroy hypothetical life on the surface of the planets that surrounding them.

Also, if the black hole is supermassive, it will gradually increase its mass by absorbing the CMB radiation [12]. So there is a danger of black hole growth and devouring nearby planets over millions and billions of years. This factor could jeopardize the life evolution and creation of intelligent and civilized species on black hole exoplanets.

The black holes that host the planetary system have to be isolated from their surrounding environment for a long time (for millions and billions of years) to give the opportunity of life evolution on the planets around them, and not devour any matter. Because they would then become an active black hole, and the resulting radiations would put the planet and its hypothetical life at risk of complete destruction. Of course, black holes are unlikely to remain completely inactive for millions and billions of years.

Properties of life on black hole terrestrial exoplanets

As the escape velocity is more than the velocity of light for an escape from the gravity field of a black hole, light is trapped in the black hole event horizon and cannot escape the black hole. As a result, although low-mass black holes can emit heat radiation from their accretion disk, no light can be emitted from the event horizon and there is a dark sun in the sky of black hole exoplanets.

As a result, the early microscopic life on these planets cannot be based on photosynthesis but can be in the form of chemosynthesis. In photosynthesis by absorption of water and carbon dioxide by photosynthetic organisms, formaldehyde and oxygen are produced [13] but in chemosynthesis by absorption of water, carbon dioxide, hydrogen sulfide, and oxygen by micro-organisms, sulfuric acid and sugars are produced [14]. Also, photosynthesis is done by visible light, but the light rays emitted by the black hole accretion disk is mainly X, UV, and gamma rays.

Due to this, early and advanced photosynthetic plants cannot be found on the surface of these planets.

Autotrophic organisms on black hole terrestrial exoplanets are confined to chemosynthetic micro-organisms, and heterotrophic multicellular animals on the surface of these planets must be carnivorous.

Visual power is the result of the reflection of light emitted from objects towards the eyes. So the creatures on these planets have poor or no vision due to the lack of light. Instead, it must have evolved into a sense of hearing in these hypothetical animals similar to the creatures of a cave on Earth including bats.

There is no much volume of oxygen in the atmosphere of these planets because of the lack of photosynthetic organisms. As a result, hypothetical creatures on the planet's surface must use other compounds in the atmosphere of the planet such as nitrogen, methane, ammonia, water vapor, carbon dioxide or sulfide gases to breathe.

RESULTS AND DISCUSSION

Extraterrestrial civilizations on black hole terrestrial exoplanets

Since there are no plants and photosynthetic unicellular micro-organisms on the surface of these planets, there is no possibility of producing primary energy resources such as coal (from plants) and petroleum (from photosynthetic unicellular micro-organisms). These primary energy resources are needed for the creation of zero type civilizations on the Kardashev scale [15].

There is no daylight on these planets, and it is almost always night, unless a meteor, black hole accretion disk radiation activity, or a supernova explosion for short time illuminates the dark sky. But because these hypothetical intelligent creatures are most likely blind, they can never see of the starry sky above them and think to the exploration of the universe in the out of their planet environment so visual instruments such as telescopes are of no use for them. Consequently, there is no possibility of the creation of higher civilizations than the one type civilization (able to leave its planet for obtaining more energy).

Due to the time dilation phenomenon near the black hole, time is passed slowly for hypothetical intelligent creatures on black hole exoplanets, and thus the evolution of life on these planets takes a longer time than stellar planets [11].

According to the above, may be hypothetical intelligent carnivorous creatures on these planets (because trying to find food in a dark environment over the entire lifetime of a specific species on these planets, in addition to the muscular-skeletal evolution, causes its brain to evolve [16,17] but they are unlikely to become a civilization at the level of zero type civilizations and higher (Table 1) summarizes the life-threatening factors and properties of life on black hole terrestrial.

Table 1: Life-threatening factors and life characteristics of black hole exoplanets.

Life properties on black hole exoplanets	Threats to the evolution of life on black hole exoplanets
Absence of photosynthetic organisms and the formation of life based on chemosynthesis due to lack of light.	Decreasing the planet's energy from the black hole over time.
The carnivorous potential of heterotrophic and multicellular organisms due to lack of plants.	The proximity of the habitable zone to the black hole.
Weakness or lack of vision in hypothetical living organisms due to lack of light.	The danger of the planet being near the event horizon or its tidal locking.
Zero civilizations are unlikely to be created due to the lack of primary energy resources such as fossil fuels.	Risk of black hole accretion disk activity and emission of X, UV, and gamma rays.
Impossibility of creating civilizations higher than the one type civilization due to weakness or lack of sight in hypothetical intelligent creatures.	The danger of black hole growth over time and devouring the planet.

CONCLUSION

On the black hole terrestrial exoplanets, even assuming of life production possibility, there are numerous factors that hinder the evolution of life and the creation of extraterrestrial civilizations on these planets. As the habitable zone of black holes is approaching, it threatens the danger of planet's vicinity to the event horizon and the planet's tidal locking. X, UV, and gamma rays from the black hole accretion disk can destroy the life on the surface of the black hole exoplanets. Because light traps in the black hole's event horizon and not emits light from the black hole, photosynthetic organisms cannot form on the surface of these planets. Instead, there is a possibility of chemosynthetic micro-organism's existence on the surface of these planets. There are no plants on these planets due to the lack of light, and the multicellular organisms must be carnivorous. Due to the lack of oxygen (due to the absence of photosynthetic organisms) in the atmosphere, these hypothetical creatures must breathe other compounds in the atmosphere. In black hole terrestrial exoplanets due to the absence of photosynthetic organisms, there are no fossil fuels, including petroleum and coal, which are a primary energy resource for zero type civilizations (on a Kardashev scale). As a result, hypothetical intelligent creatures on the surface of these planets face with the problem of scarcity of energy resources to create an early civilization (zero type). Lack of light in the sky of black hole exoplanets causes that the living organisms on the surface of these planets to always stay in the darkness and have poor or no vision. This causes that hypothetical intelligent creatures on the surface of these planets cannot to see their sky, and contemplate to the exploration of out of their planet environment. Consequently, there is no possibility of creating civilizations higher than the one type civilizations on these planets.

In this regard, it may suppose that there are intelligent creatures on the surface of black hole exoplanets, but these hypothetical intelligent creatures cannot able to the creation of a civilization. This research shows that black hole terrestrial exoplanets are not good targets to search for intelligent life, and this search should be done for stellar terrestrial planets.

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