Extraterrestrial Life: A Journey Through Space.

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***Abstract*- Space travel is life-enhancing; Thus, it is worth doing. Astronomy and studying extraterrestrial life are very important in order to know how everything around us works. Furthermore, exploring the extraordinary objects will help us find habitable planets to live on after the sun dies, saving humanity. Moreover, we might be able to find aliens and other creatures in the universe and communicate with them. Our research paper focuses on the most important technique to study and observe space, the telescope. It also focuses on the most common things in our universe, such as dark matter, dark energy, black holes, and white holes, to understand the nature of the universe and expand our knowledge about the ability to find extraterrestrial life. Our universe mainly consists of 68% dark energy, 27% dark matter, and 5% baryonic matter. Dark energy is responsible for the accelerated expansion of the universe. Dark matter is mainly helping the stars and galaxies stay in their orbits instead of floating randomly in space. Black and white holes are also from the interesting structures to study. Considering all the possible results that could be achieved, scientists are making a lot of effort searching for extraterrestrial intelligence.**

***Index Terms*—** Extraterrestrial life, Telescopes, Dark Energy, Dark matter, Black Holes, White Holes. (Keywords)

I. Introduction

Humans are curious creatures who always seek to reveal the unknown. Since the beginning of life, the ancient human was asking a lot of questions about everything around him. Asking questions and searching for logical and scientific answers is the main core of all these discoveries we see nowadays. Our grandparents always wondered about the stars and the nature of the objects we can find outside the Earth, but the main question was how to see these extraterrestrial things close enough to start studying them. Therefore, in 1608, the first telescope was invented by Galileo Galilei. A telescope is optical equipment that collects and focuses light rays and magnifies the resulting picture to make distant objects look closer. Over the years, the techniques and telescopes were developed continuously to reach the best ways to help to discover extraordinary things that are very far away and study the vastly expanded universe to understand the different phenomena with very high accuracy. We focus in our paper mainly on how humans were able to discover space and the extraordinary things that are in it, such as dark matter, dark energy, black holes, and white holes.

II. Analyses

Telescopes-

Humans have been observing the sky for a long time in order to explore the unknown things in outer space and discover the world in which we live. Until 1608, there were no tools to help the ancient scientists to look deeper into outer space; therefore, all observations before that year were with the naked eye. In 1608, the first telescope was invented by Galileo Galilei. Since then, many types of telescopes were invented, such as Refractor Telescopes, Reflector Telescopes, Dobsonian Telescopes, and Maksutov-Cassegrain Telescopes.

Refracting telescopes are the oldest and the most common telescopes. It provided humans with the first close-up views of the galaxy. It is composed of two main parts, which are an objective lens and an eyepiece. The objective lens gathers light from distant astronomical objects and forms an image of that object in the focal plane, as shown in "fig1". The formed image is a tiny dot in the objective lens's focus, a point where the light converges after passing through the lens. After gathering the light, the eyepiece is used to magnify the formed image for the observer. Although this process forms the images successfully, they won't be clear. This problem is because a lens bends different colors of light through different angles, which results in a different focal point for each type of light, as shown in "fig2-a".

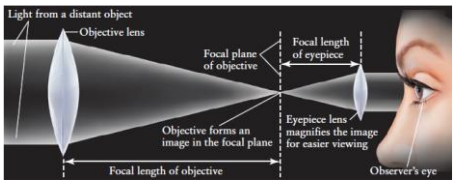

Figure 1
Refracting telescope's mechanism

The stars showed by a telescope using this type of lens appear to be surrounded by fuzzy, rainbow-colored halos. A solution was found: to use an objective glass that isn't composed of one piece of glass. If a thin lens gets added behind the

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objective lens, as shown in "fig2-b", different light colors will be brought to the same focal point.

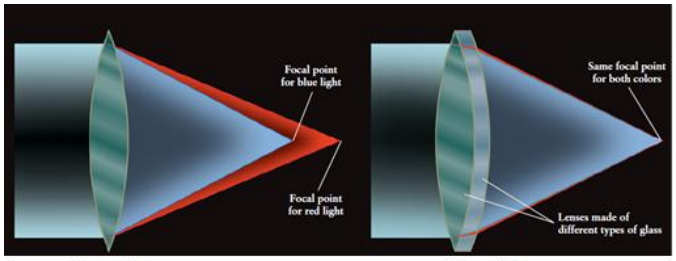

Figure 2-a
Different focal points

Figure 2-b
Same focal point

Extraordinary Objects in Space

Using telescopes made scientists able to discover a lot of extraordinary things floating in space. Some of these objects will be explained below.

Scientists, over the years, made great efforts to know what our universe is made of. They tried all the time to reach the recipe of the universe. Through many theories and experiments, scientists could discover the universe's ingredients, which are electrons, quarks, and other 14 particles. Can you imagine that these particles are just 5% of our entire universe? Our universe also contains dark matter and dark energy, which play big and important roles in making the universe the way we see now.

Dark Matter

Dark matter is composed of particles that do not absorb, reflect, or emit light, so they cannot be detected by observing electromagnetic radiation. It is material that cannot be seen directly, and that is why we call it "dark." Dark matter makes about 27% of the whole universe. Scientists have been able to infer the existence of dark matter only from the gravitational effect it seems to have on visible matter.

If we cannot see dark matter, how do we know it exists? Scientists were able to calculate the mass of large objects by studying their motion. Astronomers examined spiral galaxies in the 1970s and expected to see the stars in the center moving faster than the ones on the outer edges. The surprise was that they found the stars in both locations were moving with the same velocity. As a result, they understood that there is an invisible matter which organizes the movement of stars and galaxies, saving them from swimming away in space; an example is shown in "fig 3".

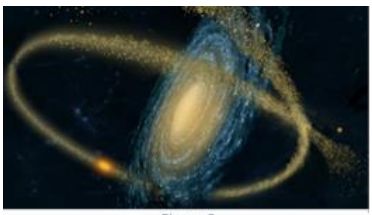

Figure 3
Mapping dark matter in the Milky Way

Studies of the gas within elliptical galaxies indicated a need for more mass than the mass found in visible objects. Einstein showed that massive objects bend and distort light, allowing them to be used as lenses. Astronomers could create a dark matter map in the universe by studying how light is distorted by galaxy clusters, as shown in "fig 4."

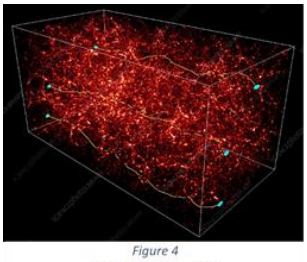

Figure 4
Dark matter map

Dark Energy

Even though dark matter makes up most of the matter in the universe, it only presents a quarter of the universe. The energy of the universe is dominated by dark energy. After the Big Bang, the universe began expanding outward. Scientists thought it would run out of energy and slow down as gravity pulled the objects inside it together, causing the universe to collapse. On the contrary, studies of distant supernovae, using the Hubble Space Telescope (HST), revealed that the universe today is expanding faster than it was in the past, indicating that the expansion is accelerating, as shown in "fig 5". That would not be possible unless the universe had enough energy, dark energy, to overcome gravity.

Roughly 68% of the universe is dark energy. That is a big percent, but it seems logical because we need such huge energy to overcome gravity and make the universe expand. We can say that dark energy is a new kind of dynamical energy fluid or field, which fills all of the space but opposite the matter and normal energy.

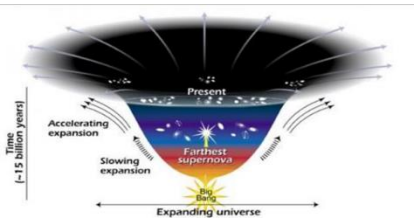

Figure 5
Expansion of the universe by dark energy

Black Holes

Black holes are places in the universe where matter and energy are compacted so densely together that their escape velocity is greater than the speed of light. Because they are so compact, they have very strong gravity. Gravity is a force that tries to pull two objects toward each other. Anything which has mass also has a gravitational pull.

Your weight is the amount of force that gravity exerts on you. The more substance your body contains, the more you weigh. In the same way, the more matter an object has, the stronger its gravity.

A black hole has a very strong gravity that even the light itself can't escape from it. The gravity is so strong because its matter has been squeezed into a tiny space. Black holes can be created when a star is dying. You cannot see the black hole even if a bright star is shining right next to it, and that is why we call it "black." They are invisible because no light can get out. Special telescopes can help find black holes. They can see how stars that are very close to black holes act differently than other stars. Instead of reflecting the light as other objects do, the black hole swallows the starlight forever. Any matter that gets too close to a black hole gets swallowed up as well. The shape of black

Figure 6
An imaginary shape of a black hole

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holes is imagined to be as shown in "fig 6."

Scientists think that the smallest black holes were formed at the early beginning of the universe. Stellar black holes are made when the center of a very big star collapses, causing a supernova, an exploding star that blasts part of the star into space.

Black holes are incredible and very dangerous at the same time. No one would like to be near any black hole for sure. Fortunately, there is no black hole that will eat our Earth because no black hole is close enough to the solar system to do that.

White Holes

A white hole looks exactly like a black hole - It has mass, it might spin, and has a ring of dust and gas that could gather around the event horizon. A white hole is a black hole's "time reversal." While a black hole's event horizon is a sphere of no return, a white hole's event horizon is a boundary of no admission. Objects inside a white hole can leave and interact with the outside world, but the interior is cut off from the universe's past since nothing can get in.

While general relativity describes white holes in theory, we don't know how they might actually form. Even if large white holes did form, they probably wouldn't live too long. Any outgoing matter would collide with the matter in orbit, and the system would collapse eventually into a black hole.

How does a black hole die? We don't know. How is a white hole born? Maybe a white hole is the death of a black hole. We don't know for sure yet. We believe that we might reach an answer to this mystery.

After this quick exploration and all of these mysterious, impressive, and even dangerous things that our universe consists of, can we find any other lives outside the Earth in this vast and expanded universe?

III. Extraterrestrial life

There have been many rumours about aliens visiting our planet and abducting humans to perform their experiments on them. Although None of these rumours has been verified, there are some reasons to think that life might exist beyond Earth. One of these reasons is that scientists found living organisms in some of the most unearthly environments on Earth. For some reason, it is believed that if living organisms are to be found on other planets, their biochemistry will be similar to the biochemistry of all living things on Earth, which is based on the unique properties of the carbon atom. The first reason is that carbon has the most versatile chemistry of any element; its atoms can form chemical bonds to create uniquely complex and long molecules and compounds. These compounds are called organic molecules, which can be linked together to form lattices, fibers, and chains. The second reason is that carbon is one of the most abundant elements in the universe.

If this belief is right and extraterrestrial life is based on organic molecules, these molecules must exist on a planet so that life might arise from it. There are many chemicals based on carbon, such as methyl cyanoacetylene (CH3C3N), acetaldehyde (CH3CHO), formaldehyde (H2CO), and ethyl alcohol (CH3CH2OH). These chemicals are found in giant interstellar clouds in our galaxy as well as other galaxies. Our solar system's planets are formed out of interstellar material. Some of the organic molecules from that material must have ended up on the surfaces of the planets. Evidence for this comes from meteorites, called carbonaceous chondrites, that contain many carbon-based molecules. Meteoroids existed in the early solar system with much greater numbers than they exist now. Thus, the likelihood of their collisions with plants was much bigger than it is now. From the beginning of our solar system, these collisions had seeded the planets with organic compounds. Once meteorites bring simple organic chemicals to the surface of a planet, chemical reactions can produce a wider range of the complex organic compounds needed for life.

Searching for Extraterrestrial life

Water is an essential element for life as known. Thus, while searching for extraterrestrial life, it is reasonable that we should search for water on other planets. For water to remain liquid, the planet must have a thick atmosphere to provide enough pressure that prevents the water from evaporating. The Martian atmosphere now is so thin that water cannot exist as a liquid on its surface. However, images of Mars show sediment deposits, dried-up streambeds, and flash flood channels. These features ensure that the atmosphere on Mars was thicker and that water once existed over the surface of the planet. In December 2003, the European Space Agency's Mars Express spacecraft, which went into orbit around Mars, used infrared cameras to examine the ice cap at the south pole of Mars. The surface layer of this ice cap was a layer of frozen carbon dioxide. The cameras showed that beneath this layer, there was a layer with the characteristic spectrum of water ice, as shown in "fig 7." In January 2004, Spirit and Opportunity — NASA's two robotic rovers — landed on opposite sides of Mars to search for more evidence that water once existed on Mars. The side where Spirit landed appeared that it has been dry for billions of years. The side where Opportunity landed, however, appeared to have been underwater for a long while. It was confirmed that some of the dark material, at the surface of Opportunity's landing site, contains grey hematite, an iron-rich mineral. This mineral is commonly found at the bottom of mineral hot springs or lakes.

Many meteoroids that came from Mars were found on Earth. One of these meteoroids is 4.5 billion years old. That means it was on Mars during the period when liquid water existed on the planet's surface. This meteoroid was called ALH 84001 and was found in Antarctica in 1984. It had rounded grains of minerals called carbonates which form only where water exists. ALH 84001 was studied for two years by David McKay and Everett Gibson of the NASA Johnson Space Center. In 1996, they reported three results. First, the carbonates contain a type of organic molecules that result from the decay of microorganisms. Second, there were large numbers of elongated, tubelike structures resembling fossilized microorganisms in and around the carbonate grains. Third, the carbonate grains contain very pure crystals of iron sulfide and magnetite. These two compounds are rarely found together — especially in the presence of carbonates — but can be produced by certain types of bacteria.

Many techniques are being used for the purpose of interacting with an alien civilization or finding Earthlike planets. One of these techniques is an orbiting telescope called Kepler, which was launched in 2009. When a planet passes in front of the star in an event called a transit, it blocks some of the star's light. If this transit happened in front of our line of sight, it causes a temporary dimming of the light we see from

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the star. Specialized detectors will be used in Kepler in order to detect the slight dimming caused by the transit of a small Earth-sized planet. Once it detects stars that dim slightly as expected, astronomers will have to make sure that the dimming is because of a transiting planet and not some other cause.

IV. Results

The potential outcomes from such searches are great. Receiving a message from an alien civilization and sharing scientific information with another species would change the course of our civilization. Within only a few years, our industry and technology could advance the equivalent of centuries into the future. Such changes would touch every person on Earth. Considering all of these great possible results, scientists are making a lot of effort searching for extraterrestrial intelligence.

V. Conclusion

Eventually, we can conclude that astronomy and astrophysics is a very huge and mysterious science. Still, such searches and information can lead us to know more about the nature of the universe and the extraordinary objects that exist in it and play a big role in its balance. It will also increase the possibility of finding habitable planets and being able to contact aliens and get deeper into their cultures, which will improve our civilization and make us in a very advanced level of understanding space.

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