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BLACK HOLE

10E Group 1 and 7

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10E eGroup 1
7

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1 Introduction

A black hole is a region of space time where gravity is so strong that nothing and, including light or other electromagnetic waves, has no enough energy to escape its event horizon(The boundary of no escape). In many ways, a black hole acts like an ideal black body, as it reflects no light. . A black hole takes up zero space, but does have mass — originally, most of the mass that used to be a star. And black holes get "bigger" (technically, more massive) as they consume matter near them. The bigger they are, the larger a zone of "no return".

2 History of black hole

The one and only positive effect of world war 1 is possibly that it lead to the foundation of black hole. An older German artillery lieutenant found bulky package. That night, throwing caution to the wind, he risks using an electric light to read the long and detailed report. Little does he know that it will prove to be arguably the most important work of creative genius of the 20th century. The author of this pivotal document was a theoretical physicist named Albert Einstein(first predicted the existence of black hole with his general theory of relativity). The recipient was his colleague Karl Schwarzschild, the director of the Astrophysical Observatory in Potsdam and an accomplished theorist and mathematician. Despite his astronomical career, Schwarzschild, then in his 40s, joined the war effort. General relativity is a nonlinear system. And nonlinear systems are really hard to solve but Schwarzschild wrote back describing the first known solution to Einstein's field equations within a matter of days. Karl Schwarzschild developed the idea for black holes from relativity's equations in 1916, just a year after Einstein published his theory.

The name black hole that we use today was first used by American astronomer John Wheeler in 1967(he neatly summarized the field equation as "Space-time tells matter how to move; matter tells space-time how to curve.")before that early physicists studying these bizarre objects often called them "frozen stars." . Even though the event horizon played an integral part in Schwarz

child's solution, it took many years before black holes were accepted as anything other than a mathematical curiosity. One thing was clear: If black holes did exist, they were most likely formed by the collapse of massive stars, unable to support their own weight after running out of nuclear fuel. One thing that make discovery of black hole harder was that they give off no light. Fortuitously, the late 1960s marked the dawn of X-ray astronomy with a series of sounding rockets and satellites that could get above Earth's atmosphere help to ensure the existence of black hole. By observing X-rays from black holes, we can directly probe the properties of space-time predicted by general relativity. The first black hole ever discovered was Cygnus x-1,located with in the milk way in the constellation of Cygnus , the swan. Astronomers saw the first signs of the black hole in 1964 when a sounding rocket detected celestial sources of x-rays according to NASA. In 1971, astronomers determined that the x-rays were coming from a bright blue star orbiting a strange dark object. It was suggested that the detected x- rays were a result of stellar material being stripped away from the bright star and engulfed up by the dark object –an all consuming black hole.

3 Origin of black hole

Some black holes are born when a dying star collapses in on itself. Others through mergers. And some may have started off in an even weirder way. To talk about the origin of black hole we need first specify which type of black hole we're talking about.

3.1 Types of black hole:-

1. Stellar black hole
2. Intermediate-mass black hole
3. Super massive black hole
4. Primordial black hole

3.1.1 How do stellar-mass black holes form

The most well-understood black holes, stellar-mass black holes, form when a massive star reaches the end of its life(stars shine by burning hydrogen. The process is called nuclear fusion. The hydrogen burning produces helium " ash. As the star runs out of hydrogen it begins burning helium. The ashes of helium burning, such as carbon and oxygen, also get burned. The end result of this fusion is iron. Iron can't be used for nuclear fuel, the star no longer has the energy to support its weight) and implodes, collapsing in on itself. If the imploding star is between about eight and 20 times the mass of the Sun, however, it won't form a black hole. Instead, the collapsing material will rebound off its core, causing it to erupt as a supernova.

But if the collapsing star is greater than about 20 times the mass of the Sun, its core isn't strong enough to stop the implosion. In fact, there is no mechanism that can prevent such a star from collapsing into a black hole. gamma-ray bursts are the beacons of star death and black hole birth.

3.2 HOW DO INTERMEDIATE-MASS BLACK HOLES FORM?

As the name implies, intermediate-mass black holes fall between stellar-mass black holes and galaxy-sized black hole. Astronomers expect to see some black holes in this middle phase, on their way to becoming supermassive but not quite there yet — and, so far, they mostly don't.

Intermediate-mass black holes are thought to form when multiple stellar-mass black holes undergo a series of mergers with one another. These mergers frequently happen in crowded areas of galaxies.

3.2.1 How do SUPERMASSIVE BLACK HOLES FORM

Scientists think super massive black holes formed at the same time as the galaxy they are in. The size of the super massive black hole is related to the size and mass of the galaxy it is in. Observational evidence indicates that almost every large galaxy has a super massive black hole at its center. For example, the Milky Way has a super massive black hole in its Galactic Center, corresponding to the radio source Sagittarius A*.

There are many theories about how this type of black hole forms, one of the most compelling is that they grow so large through a runaway chain reaction of colliding stars and black holes. In this scenario, super massive black hole continually merges and gobbles up more and more material, eventually getting so massive it "sinks" toward the center of its galaxy.

3.2.2 HOW DO PRIMORDIAL BLACK HOLES FORM

Is a hypothetical type of black.
hole called As their name suggests, primordial black holes were born when the universe was still young — within a mere second of the Big Bang. This was a time long before stars, galaxies, and other black holes existed, But primordial black holes wouldn't have started out as a star anyway

3.3 Scientific significance of black hole

An empty place with a powerful gravitational force, not letting anything that passes through it can't escape, makes black holes scary to imagine I think. From the natures and characteristics of black holes, they sound like demons. But despite their horrific nature and invisibility, black holes actually play a vital part in the cosmos, benefiting their surroundings.

- Thanks to stellar explosions:- This explosion undeniably spewed millions of elements, such as hydrogen, oxygen, nitrogen, and carbon.

  Gold and platinum were also among the heavier elements expelled by the explosion. Those elements then spread as a result of collisions between black holes and neutron stars. The air that humans breathe, the fuel of rockets that now help explore space, a man's wealth of gold, all of those originally came from a dead star that burst in outer space .

- Star formation within galaxies Among all types of black holes, the super massive black hole often emits tremendous radiation rays of destruction, known as jets. While it is true that a star passing close to a black hole can be spaghettified –vertically stretched and horizontally squeezed– the super massive black hole effectively helps in the birth of new stars.

- Contribution to the performance of the galaxy The black hole at the heart of a galaxy allows it to develop in our solar system. Not only that , but it also keeps the stars and materials in the solar system in their proper positions.
  Additionally, gravitation would not exist if black holes were not there in the first place, so there is no ground on how a star can form, let alone the fact that the stars would still be in the same galaxy.

- Black holes are used in laboratories for testing fundamental theories that explain how the Universe works on the largest and the smallest scales.

- Research materials and technological advances:- The black hole study also gave rise to remarkable technology that enables them to research phenomena that the naked eye cannot see, especially the invisible black holes.

  So indeed, every creation and existence in this universe serves a purpose.

  and as the famous saying goes, don't judge a book by its cover don't judge black holes by their natural appearance.

4 Important facts about black hole

1. Our Milky Way Probably Has a Black Hole. But, thanks to the perfect creation of god we don't have to be alarmed. The major black hole that astronomists believe to be within our Milky Way is light years away from Earth.

2. You Can't Directly See a Black Hole:-obviously you can't see black hole because light can't escape through it, but you can determine that there is a black hole by observing the effect it put on it's surrounding.

3. Let say someone falls into a black hole and you are the lucky observer that witnesses this. The person who fell into the black hole's time slows down, relative to you. This is explained by Einstein's Theory of General

Relativity, which states that time is affected by how fast you are going when you're at extreme speeds close to light.

4. unless the discovery of X-Ray Astronomy discovering black hole would have been dream.

5. AS I try to mention you don't have worry about black holes because the Closest Black Hole V4647 Sagitarii. is believed to be 20,000 light year away .

6. Black holes are totally friendly unless you get too close to them, which also means that it's unlikely for a black hole to consume an entire universe.

7. Like every thing in the universe black holes also die when their energy takes the form of a slow-but-steady stream of radiation and particles that came to be known as Hawking radiation. With every bit of energy that escapes, the black hole loses mass and thereby shrinks, eventually popping out of existence altogether.

8. The famous black hole is the super massive black hole called Sagittarius A* that found at the heart of our milky way which is 26,000 light year away from earth.

   Don't forget the contribution of Steven hawking in the study of black holes he eventually squared the two ideas in 1974, showing that black holes could have entropy and emit radiation over very long timescales if their quantum effects were taken into account. This phenomenon was dubbed "Hawking radiation" and remains one of the most fundamental revelations about black holes.