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Black Holes

A black hole is a large amount of matter packed into a very small area. For comparison, think of a star 10 times bigger than the sun squeezed into a sphere with an approximate diameter of New York City.

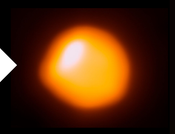
A multitude of people contributed to the discovery of black holes.
- The foundation of it all was first considered by John Michell and Pierre-Simon Laplace in the 18th century.
- In 1915, Albert Einstein's general theory of relativity showed that gravity does have an affect on the motion of light.
- In 1916, Karl Schwarzschild used Einstein's theory of relativity and found a solution to characterise black holes.
- David Finkelstein interpreted it further in 1958, and the discovery of neutron stars in 1967 sparked further in interest in black holes.

How are black holes formed?

Helix Nebula

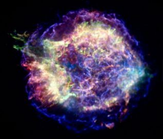
Nebula

Large Star



Betelgeuse

Red Supergiant



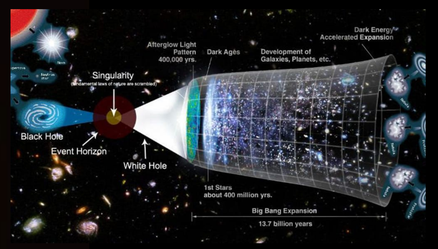
Cassiopeia A

Supernova

Why are we interested in black holes?

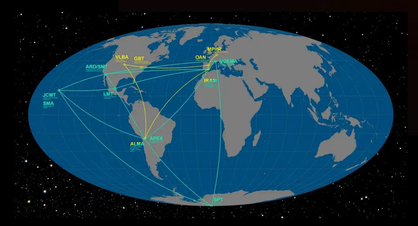
Black holes are fundamental for testing core theories that explains how the universe works on small and large scales. For example, general relativity and quantum physics.

There is also a lot of potential uses for black holes once we fully figure them out.
For example:
- We could use the information we collect to understand and expand our knowledge of how matter behaves under extreme circumstances.
- As some black holes are billions of years old, it could help scientists understand the early stages of the universe.
- It would also help us understand gravity better.



How did we capture the background photo?

In April 2019, astronomers managed to capture the first photo of a black hole.
The black hole that was captured in the photo is 6.5 million times the mass of the sun, and is located in a place 55 million light years from Earth called Galaxy M87.
The image was captured using a world-wide network of radio telescopes called the Event Horizon Telescope.
Now, how did they capture something that absorbs light itself?
- Light cannot escape a black hole, but can be bent around it, which creates a bright 'wreath' of light around it. This is called the 'Accretion Disk'.
- Matter is falling into the black hole, it then heats up and rotates at the speed of light.
- Some of the hottest matter in the universe is around black holes, creating a lot of radiation and light, which reflects upon itself. Some of this light is absorbed into the black hole, and some of it escapes and we can measure it.
- They used multiple telescopes all around the world and connected them to create an Earth-sized telescope.

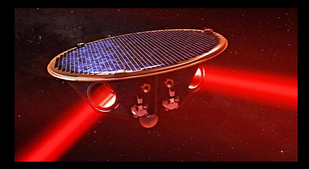


A map showing the positions of the telescopes in the EHT array.

One of the telescopes part of the EHT array, located in the South Pole, during preparations in January 2017.

What is the future of black hole research?

- Astronomers are currently looking at trying to capture a photo of the black hole at the centre of our galaxy, the Milkyway Galaxy.
- Astronomers are also continuing to develop computer simulations of black holes to help them understand how black holes better.
- The team at Event Horizon Telescope, are currently making efforts to expand their array of telescopes to be able to capture more photos of black holes with greater resolutions.
- They are also looking at trying to make their electronic and recording systems operate faster so they can increase the frequencies they record at each EHT site to capture more energy from the black holes.
- The black hole simulations could help the Laser Interferometer Space Antenna (LISA) project and confirm that it works once its expected to launch in 2037.



Video of the LISA project's path.