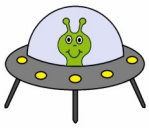
Space and Aliens

The Big Bang Theory and Black Holes

W/C: 18th May 2020



As you know, in Year 6, we love learning about different scientific theories and most importantly, working as scientists. Unfortunately, our Featherstone rocket is social distancing so we can't launch you all up into space but what we can do, is build scientific models to test the theories we learn. We would love to hear about your predications, see your findings and read your conclusions on our Year 6 Twitter Page!

Subject: Science

Activity 1) Build a Big Bang Model

Learn about the leading explanation for how the universe was created by watching the two videos below and reading the short explanation paragraph.

Test how accurate the theory is by building your own model of it with just a few pieces of equipment. Answer the questions to form your conclusion - do you believe in the Big Bang theory?

- *A video explanation of the Big Bang* https://www.youtube.com/watch?time_continue=104&v=gs-yWMuBNr4&feature=emb_logo
- *Professor Brian Cox explains how light is a form of evidence for the Big Bang Theory* https://www.bbc.co.uk/programmes/p00fz5z4

Challenge

Create your own Kahoot on the topic of the Big Bang. Send it to your family, friends and teachers to play! Feeling creative? Make this stretchy universe out of slime.

https://spaceplace.nasa.gov/universe-slime/en/

Subject: R.E.

Activity 2) Can a Christian believe in God and the Big Bang Theory?

All religions have an explanation for how life was created on Earth. A creationist is someone who believes that God is responsible for life. How God created life is especially debated within Christianity.

For some Christians, science can be combined with religion but for others it can't. Read the different opinions with creationism and then choose one to draw a comic strip on how life was created.

Challenge

Imagine that you are a Catholic who believes that God created the Big Bang and evolution. Write a first person narrative from the point of view of God, describing what he can see and how he feels as the Big Bang occurs.

Subject: Science

Activity 3) Model the formation of a black hole.

Learn about one of England's most famous physicists: Stephen Hawkins and his theory on black holes. Read the slides on the sheets below, before watching this short clip https://www.bbc.co.uk/teach/class-clips-video/physics-ks3--gcse-what-are-black-holes/z4pyrj6 . Now you understand the theory, you are going to create a model to demonstrate how black holes are formed (just don't fall in). Collect data to see whether your model really does help to prove or refute the theory.

Challenge

Is one model not enough? Then model the action of a black hole by following these instructions https://www.scienceinschool.org/2013/issue27/blackholes

Subject: Art

Activity 4) Sketch your own interpretation of a black hole.

Remember the sketching skills we learned to help us draw our very own Fantastic Beast? Well now, we are going to apply and develop these skills further by sketching your own interpretation of a black hole. Watch the video links below to see now but if you would like more inspiration, then take a look at the images on page 9 too.

Mild: https://www.youtube.com/watch?v=Z_7EfgbRKWE

Hot: https://www.youtube.com/watch?v=o11AsCdVlMA

Flaming Hot: https://www.youtube.com/watch?v=Tm2XuJR0WhM

Challenge

Acrylic painting https://www.youtube.com/watch?v=Y96f0rS1qeM

Acrylic fluid art painting https://www.youtube.com/watch?v=EwyucgqKDuE

Spray paint a black hole https://www.youtube.com/watch?v=dASH_VG7lGM

Activity 1

Most astronomers believe that the Universe began with a 'Big Bang' 13.8 billion years ago. In the beginning, the Universe was unimaginably hot and dense; concentrated into a volume smaller than a pinhead. Suddenly, it expanded rapidly as a hot explosion. It kept growing at a fantastic rate and is still expanding today.

In just a tiny fraction (far less than one millionth) of a second the Universe was bigger than a grapefruit and is still expanding today. After the Big Bang, the Universe continued to expand and cool. In the first seconds particles formed. Then, in the first few minutes neutrons and protons combined to form the first atomic nuclei, such as deuterium, helium and lithium. Once the Universe had expanded and cooled further, after about 380 000 years, atoms formed. The Universe was then filled with clouds of mostly hydrogen and helium gas, and light could travel freely for the first time.

Build a Big Bang Model

In this activity we will compare an expanding balloon to the Big Bang and attempt to explain the beginning of the Universe. Watch https://www.youtube.com/watch?v=GEJp2s7oGzw to give you an initial idea.

Equipment
Balloon, Marker, Peg, Measuring, Tape

Procedure

1. Partially inflate the balloon.
2. Fold and clip it shut with the peg so the air does not escape.
3. Draw six evenly spaced dots on the balloon with the marker.
4. Label the dots A through F
5. Using the ruler, measure the distance, in mm, from Dot A to each of the other dots
6. Record your measurements in Table1 under initial measurements.
7. Remove the clothespin and inflate the balloon some more
8. Observe what happens to the dots
9. Pin the balloon closed and measure the distance from Dot A to each of the other dots.
10. Record your data in Table 1 under Trial #1
11. Repeat Steps 7 – 10 two more times

Balloon Point	Initial Measurement	Trial 1	Trial 2	Trial 3
A				
B				
C				
D				
E				
F				

Questions
In your model, what distance changed the most?
In your model, what distance changed the least?
If each dot represents a group of stars, describe the motion of these groups relative to one another
Based on your model, is the Universe expanding, contracting, or staying the same?
Based on your model, how does the distance between the objects effect how quickly the objects are moving away?
What parts of the Big Bang theory does your model allow you to verify?
How is your model similar to reality and how is your model different?
What are some of the advantages and disadvantage of using your model to study the Big Bang Theory?
Does your model prove the Big Bang Theory? Explain.
What alternative theories could explain what you modeled?

Activity 2

Virtually all religions include an explanation for life on Earth in their scriptures. In the UK, and even more so in the USA, the creationism debate largely involves Christians. Generally, the main points of creationism are these:

- everything in the universe has God as its ultimate cause
- the nature of life on Earth is the direct result of God's creative actions

Creationism comes in many different forms, which we will explore further...

Young Earth Creationism

- Earth was created by God as described in the Bible
- The Book of Genesis is literally true:

Day 1: God created Heaven and Earth, night and dark

Day 2: God created water and the sky above it

Day 3: God created land, sea and plants

Day 4: God created the sun, moon and stars

Day 5: God created birds and sea creatures

Day 6: God created all the animals that live on the land and human beings

Day 7: God rested

- The Earth and all forms of life were created by God in 6 days, around 10,000 years ago
- If science opposes this, then science is wrong

Gap Creationists

- There were two creations - one before Adam, and a second one, which included Adam and Eve, after a lengthy time gap
- This theory combines both the scientific age of the Earth with the story in Genesis
- Most scientists say that the geological evidence shows that this theory is false

Od Earth Creationists

- Believe the Genesis story of creation to be true
- However, the 'days' described in Genesis are not necessarily 24-hours
- Therefore, the Earth is as old as scientists say (around 4 billion years)

Catholics

- Do not see the Biblical creation story as literally true
- Can therefore, accept the Big Bang and evolution
- However, they think that God started the Big Bang and evolution

Activity 2

Choose one form of creationism from the previous page and create a cartoon strip to tell its story *e.g. I could draw how a Catholic **might** explain creation, by drawing God creating the Big Bang and then the universe expanding because of it.*

Activity 3

Stephen Hawking's Life

Stephen Hawking was born in Oxford on 8th January 1942. He grew up with his parents, his brother and sisters.

At school, Hawking enjoyed science and maths and he was nicknamed 'Einstein' by his friends. He wanted to study maths at the University of Oxford, but Oxford didn't offer a maths degree at that time. Instead, Hawking chose to study physics and chemistry.

Hawking found the work at university very easy. He joined the college boat club and was known as a daredevil because of the risks he took when rowing the boats.

After graduating from Oxford, Hawking studied for his PhD at the University of Cambridge.

Hawking's Life

It was at Cambridge that Hawking first developed problems with his health. He became very clumsy, regularly falling or dropping things. His speech became slurred and hard to understand.

Doctors diagnosed Hawking with Amyotrophic Lateral Sclerosis, or ALS. Hawking was given just two years to live and he became very depressed. However, his disease progressed more slowly than doctors had imagined and he returned to his studies.

He met and fell in love with Jane Wilde, and Hawking felt that he had something to live for.

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ALS: A motor neurone disease that causes muscle weakness, paralysis and respiratory failure. It is a degenerative disease, which means it gets worse over time. There is no cure.

Hawking's Life

Stephen Hawking lived a full life despite his disabilities.

He used a wheelchair to move around and a computer with a voice synthesizer to talk.

His condition did continue to deteriorate, though, and this renowned scientist sadly died on 14th March 2018, aged 76.

Hawking's Life

Stephen Hawking is remembered as one of the greatest scientists that ever lived.

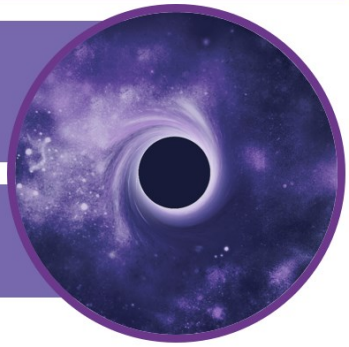
His theories, such as those concerning black holes, have changed the way we understand the universe.

His many books have helped millions to understand difficult scientific concepts and he has inspired people around the world with his passion for science and his ability to overcome difficulties.

Black Hole Theories

Hawking developed theories about how black holes are formed, how they behave and where they can be found in the universe. This is one of his theories:

A black hole is a place where gravity has got so strong that it pulls matter down into it and doesn't let any of this matter escape, not even light.



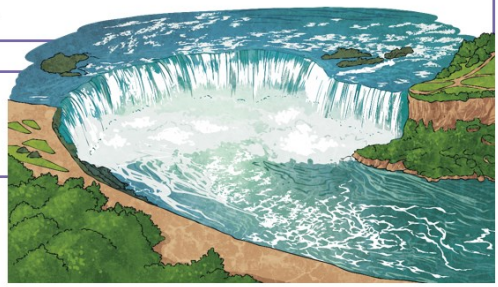
Anything too close to a black hole will be sucked down into it and trapped forever.

Black Hole Theories

Imagine it is like a river with a waterfall.

If you are swimming in the river away from the waterfall, you may be able to swim away fast enough so that you don't go over the edge, but as you get nearer to the edge, you cannot swim fast enough to escape the current of the water.

You will be pulled over the edge of the waterfall.

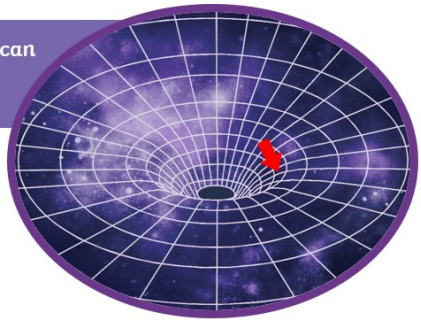


Black Hole Theories

This is how matter is pulled into a black hole.

The edge of a black hole is called the event horizon.

Past the event horizon, nothing can travel fast enough to escape the black hole.



Black Hole Model

Watch: https://www.youtube.com/watch?v=pcOxhdu5gh8

In this activity, you will model and measure the collapse of a large star to understand the important role of density in black holes.

Equipment

A blown-up balloon, a few sheets of aluminium foil, a digital scale, a flexible tape measure, and a pair of scissors or another sharp implement.

1) Completely wrap the balloon in the aluminium foil, making sure you can't see any of the balloon peeking out. It may take a few sheets of foil to do this, depending on the size of the balloon, so use whatever you need. This foil-wrapped balloon represents a large star. Measure the circumference of the balloon with the tape measure and weigh the balloon on the scale. Record your baseline measurements.

2) Gently squeeze the balloon, here you are the giant "hands" of gravity and the balloon should resist being squeezed because of the air pressure within the balloon. This is similar to what happens during the normal life a star, when gravity is balanced by fusion energy created at the core of the star.

3) Now you're ready to simulate the end of the star's life as it runs out of fuel and that balance is broken. Pop the balloon carefully, trying not to crush the aluminium foil as you pop it.

4) Be the hands of gravity again and gently squeeze the aluminium ball. This time, it doesn't push back. Make it about an inch smaller, keeping it as round as possible. Again, measure its circumference and weight, and record your new measurements.

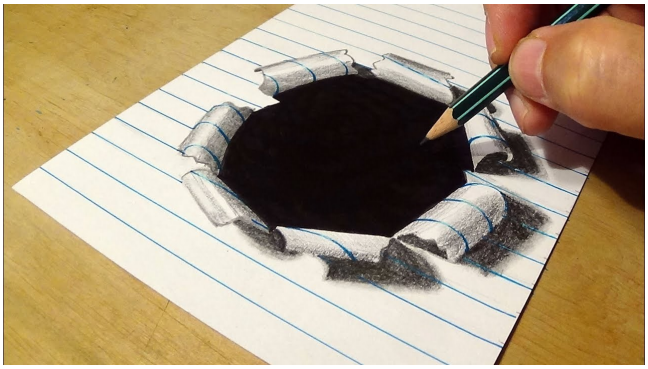
5) You'll repeat those steps a few more times, crushing down the foil ball about an inch more between measurements.

6) For you final measurement, crush the ball as much as you possibly can, while keeping it round. Take one final measurement of its circumference and weight.

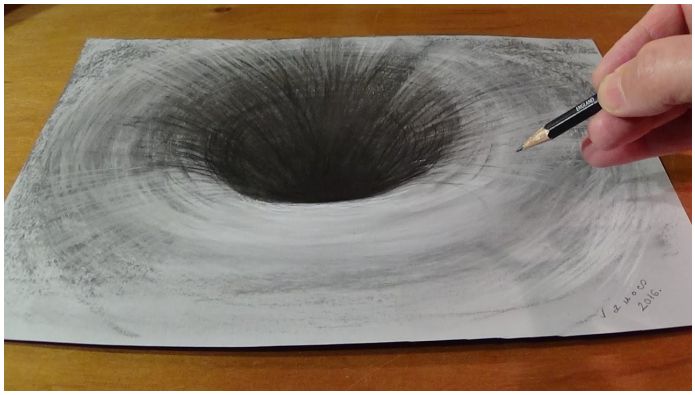
Results Table	
Circumference	**Weight**

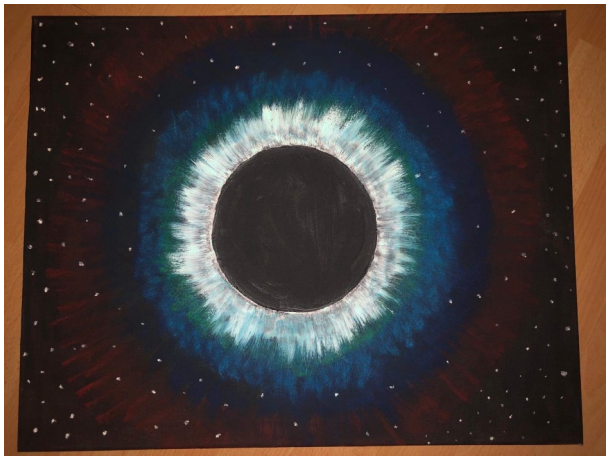
You should have see that even though the size of the ball changed, its mass did not. This means that it just got more and more dense, like when a star collapses into a black hole.

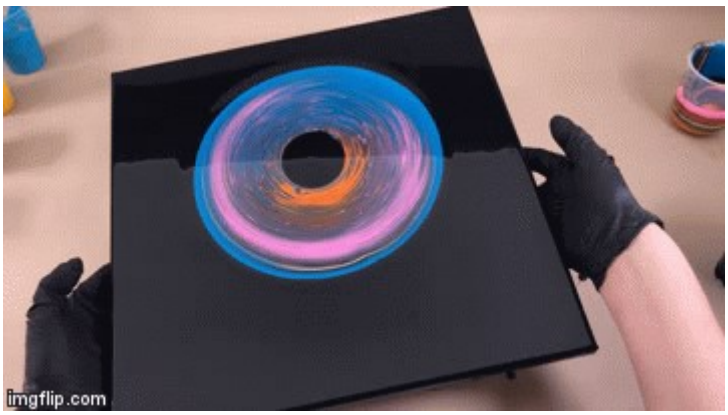
Activity 4

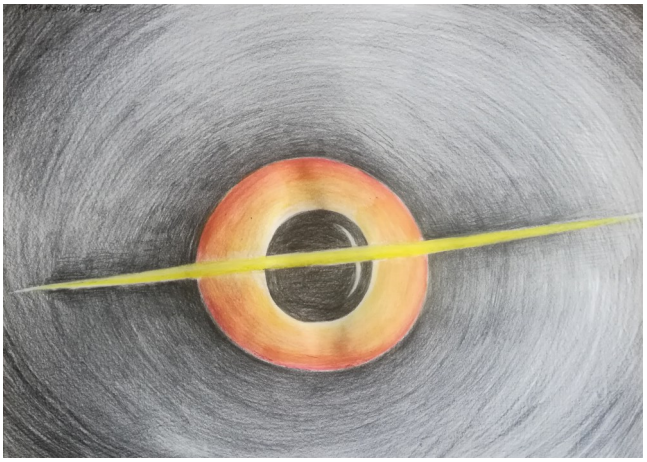


Funky Fact: This was the first ever image taken of a black hole. The picture, taken over five days of observations in April 2017 using eight telescopes around the world by a collaboration known as the Event Horizon Telescope, depicts luminous gas swirling around a supermassive black hole at the centre of M87, a galaxy 54 million light-years away.









Want to know more?

There are so many areas of space for you to explore and enjoy: life on other planets, black matter, stars and meteors, the birth of the moon, the work and life of astronauts, the size of the universe, the end of the universe… The list goes on!

Take a look at the links and ideas below to find out more:

- Watch a lecture on the Big Bang Theory by Professor Brain Cox https://www.bbc.co.uk/programmes/p00njbp3
- Watch 'The Planets' series by Professor Brian Cox https://www.bbc.co.uk/iplayer/episodes/p07922lr/the-planets
- Watch astronomer, Pete Edwards, help explain how big the universe actually is https://www.tes.com/teaching-resource/teachers-tv-our-universe-and-the-big-bang-6085040
- The European Space Agency https://www.esa.int/kids/en/learn
- NASA for Kids https://www.nasa.gov/kidsclub/index.html
- Science lessons at home https://www.jodrellbank.net/learn/sciencelearningathome/
- Play this NASA game on Black Holes https://spaceplace.nasa.gov/black-hole-rescue/en/
- Play some Kahoots on space https://kahoot.com/blog/2018/10/03/world-space-week-kahoots/
- Have a listen to these space themed pop songs:

The theme tune to the TV program 'The Big Bang Theory'

Rocket Man – Elton John

The sun never shone that day – A-HA

Blackhole – Beck

Beagle 2 – Blur

Alien – Bush

Moonlight drive – The Doors

Electric Barbarella – Duran Duran

Ticket to the moon – ELO

Skydive – Freefall featuring Jan Johnston

Stellar – Incubus

Saturn V – Inspiral Carpets

Stairway to Heaven – Led Zepplin

Apollo 11 – OMD

Walking on the Milky Way – OMD

Walking on the moon – The Police

To the moon and back – Savage Garden

Universe – Savage Garden

Luna – Smashing Pumpkins

Rocket – Smashing pumpkins

Free fallin – Tom Petty and the Heartbreakers

Moondance – Van Morrison

Rocket – Def Leppard

Fly me to the moon – Frank Sinatra