the universe

this house believes the government should fund research on planet earth rather than the cosmos

big bang

According to widely accepted theory, the Universe came into existence around 13.7 billion years ago in an event astronomers call the Big Bang. The cause of the Big Bang remains largely unknown, although among the ideas proposed is the intriguing possibility that our Universe is just one of a (possibly infinite) ensemble of universes known collectively as the Multiverse.

At the moment of the Big Bang all the matter and energy in our universe came into existence. The Universe at that moment was incredibly hot and dense. Then it began to expand, cooling rapidly as it did so. It is still expanding today, and the expansion seems to be getting faster. The first stars are thought to have formed several hundred million years after Big Bang. Planet Earth (and our solar system) didn't come into being for another 9 billion years or so after that.

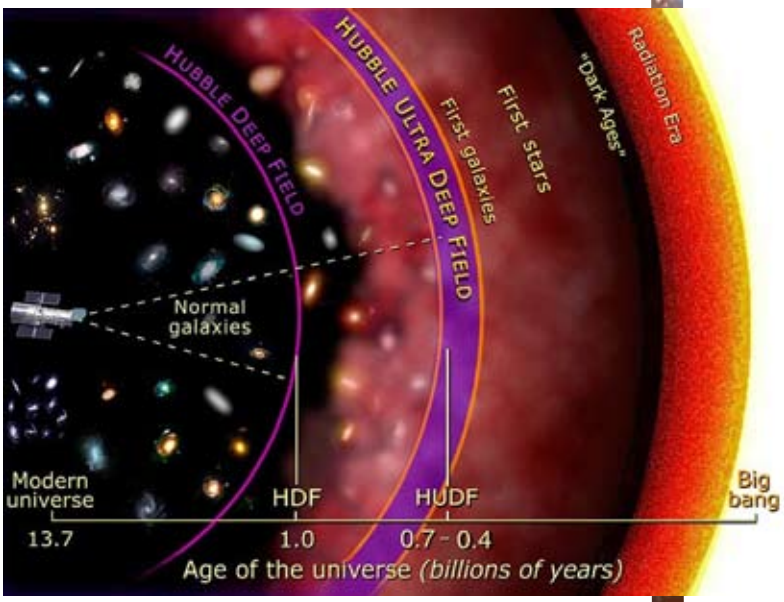
The story of our Universe is being told through both exploration of space, and complex and expensive experiments that probe the Universe on all scales - from the farthest reaches of the cosmos to the innermost secrets of sub-atomic particles.

looking back in time

Consider the Hubble space telescope, launched 21 years ago by the US space agency NASA. Hubble orbits above the earth's atmosphere so it gets a clearer, sharper view of the distant Universe than ground based telescopes. (The atmosphere distorts and blocks out some light). Hubble's recording equipment has captured some remarkable images of distant galaxies, offering us a window on the universe as it was in its early days.

In 2003 and 2004 the telescope was pointed at a seemingly empty patch of sky. Hubble's cameras took pictures over a period of about 11 days. The tiny trickle of light that was picked up had travelled billions of years to reach the telescope. When all the images were put together they revealed what the Universe looked like between 400 million and 800 million years after the Big Bang, when the light began its journey. The pictures reveal some 10,000 galaxies, racing away from us as the universe expands. This slice of time is called the 'Hubble Ultra Deep Field'. Scientists are still examining the images, and making discoveries about the stars and galaxies they reveal. Other facilities are now being planned and built to allow us to see further and farther back in time to the formation of those galaxies.

How Hubble sees back in time
(photo NASA)



Hubble ultra deep field
(photo S.Beckwith/NASA/GSA and HUDF team)

Giant nebula (photo NASA ESA and the Hubble Heritage)

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smashing protons

No one knows what caused the Big Bang but scientists want to get closer to it. Theoretical Physics suggests that a lot happened within the first billionths of a second after the Big Bang. It's hard to imagine just how small a moment in time that is, but during it came the formation of all the sub-atomic particles - like quarks and protons and neutrons - that we know today. All these particles stuck together, paving the way for the production of the simplest elements of Hydrogen and Helium, within the first 100 seconds or so after the Big Bang .

What scientists want to do now is try to look back to the moments before the protons, for example, were formed. The idea is to smash them apart to look at their constituents - hopefully recreating how things were in those infinitesimally small fractions of a second immediately after the Big Bang.

Experiments have confirmed many of the ingredients of the theory of how these particles were formed and how they interact, but what has not been established is how those particles got their mass - essentially how "heavy" they are. (Without mass, the structure of the universe would be very different.)

In 1964 British physicist Peter Higgs suggested the presence of a force called the Higgs Field, which influences some particles to give them their mass. The field is packed with particles called Higgs Bosons, which deflect other sub-atomic particles as they move through it. In recent years, the search has been on for this last piece of the jigsaw - the Higgs Boson.

The hunt has been underway, deep underground, at the Large Hadron Collider. This is the world's largest particle accelerator, built to smash protons into one another at extremely high speeds. As the protons collide - the particles that make them up are released.

In July 2012, scientists made the exciting announcement that they had found a new particle which they think is indeed the Higgs Boson. Now there is a lot of work to be done to see if the Higgs particle behaves as physics theory predicts, and whether it helps unlock other mysteries, such as the nature of dark matter and dark energy.

origins of life

Just as scientists are looking deep into Space for the origins of our Universe, they are also investigating how life began. Could there have been life elsewhere in our own solar system? Since 2004 NASA's robotic rovers (Spirit and Opportunity), have been exploring Mars, investigating giant craters which seem once to have been soaked by water.

Throughout the history of the Solar System meteorites have crossed the gulf of space between Mars and Earth- did any ancient microbes get carried that way? It's not such an outlandish idea: back in 2006 Nasa's stardust programme showed that some life's essential building blocks could have been dropped off by comets passing through our solar system. Scientists found Glycine in the dust they collected: Glycine is one of the amino acids which makes up our DNA.

Astronauts carrying out Hubble repair
(photo NASA)

The desire to understand our universe has fuelled both huge progress in science and the technology needed to study it. Big advances in computing and optics, for example, have made possible the telescopes that allow us to see into the farthest reaches of our universe; advances in network engineering and software that allow us to peer back to the Big Bang itself, are all having a huge impact on our lives in diverse fields from medical diagnostics to weather mapping.

Grappling Hubble
(photo NASA 2009)

the universe

fast facts

- Light travels at 299,792,458 metres per second or approximately 186,000 miles per second, which means it takes about 8 minutes for the sun's light to reach us.

- A light year is the distance light can travel in one year - that's about 10 million, million kilometres. Because of the vast scale of the cosmos, the light year is the unit commonly used to describe the distances between stars and galaxies.

- A Galaxy is made up of stars, gases, dust and something called 'dark matter' which accounts for the mass of most galaxies - all held together by gravity. Scientists are trying to discover the nature and origin of dark matter.

- The Hubble telescope is named after Edwin Hubble, the astronomer who discovered that the Universe is expanding.

Hanging out with Hubble (photo NASA 2009)

- The Large Hadron Collider is a European project, built by 10,000 scientists in 100 countries. By smashing particles together at close to the speed of light, scientists hope to recreate the physical conditions which existed in the first trillionth of a second after the Big Bang.

find out more

Read Brian Cox's book : *Wonders of the Universe*

http://hubblesite.org/; http://www.nasa.gov/
Discover all aspects of space travel and research; look at the amazing pictures taken by Hubble - including the Ultra Deep Field; find out how Hubble works and hear from scientists using the telescope
http://www.streaming-madness.net/watch-online/documentary/hubble-ultra-deep-field-in-3d-hd720p/
Short video narrated by NASA scientist Tony Darnell, explains how the Ultra Deep field images were made
http://www.bigtelescopes.org.uk/
Technology and science behind other space telescope projects
http://www.lhc.ac.uk/
Details of the Large Hadron Collider and what scientists have discovered since it was switched on in 2008

questions to ask

- How do we know how old the universe is?
- How were galaxies and stars formed?
- Is life unique to our planet ?
- Is space research useful in our everyday lives?

the universe in fiction

George's Secret Key to the Universe	Lucy & Stephen Hawking
Taking Off	Jenny Moss

alternative motions: this house...

... believes the cost of space research outweighs the benefits
... would look for another planet humans can live on
... would invest in the search for extra-terrestrial life
... believes that at a time of austerity we cannot afford to do 'big science'