

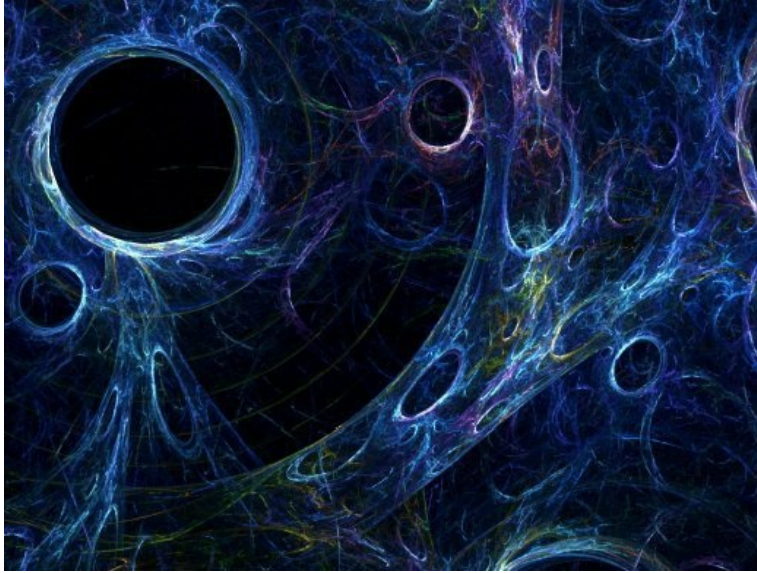
DARK ENERGY

**The Biggest Mystery In
The Universe**

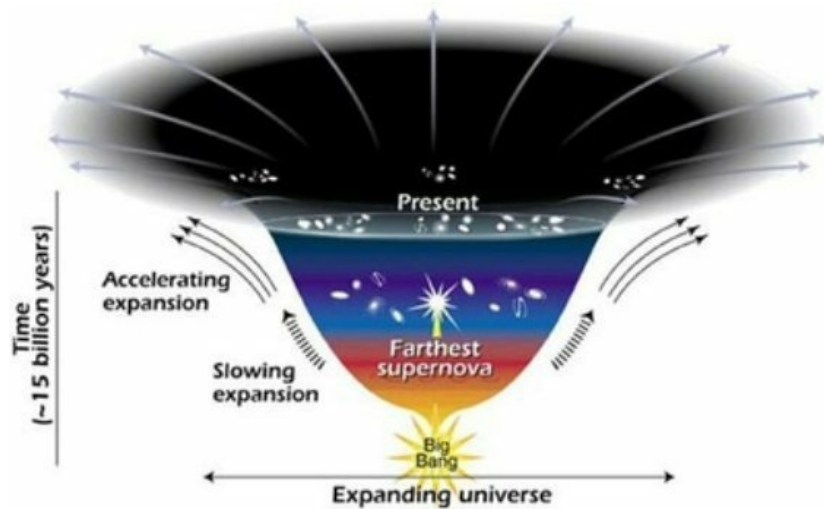
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DARK ENERGY –

The Biggest Mystery in the Universe



We have been able to measure the distance between the sun and the earth very accurately. The invention of the astronomical unit has helped greatly. Radar beams which bounce off all solar system bodies allow us to take such measurements. 149,597,870 kilometres which is also 1 astronomical unit is the current distance between the sun and the earth. The distance has been calculated to increase by 15cm every passing year.



The sun as we know is built of gases which are constantly burning in order to release heat and energy. One reason for this moving away could be the loss of mass by the sun. As it becomes lighter it may be losing its gravitational grip which causes it to slip further away from the earth.

Dark matter may also cause it to move further away. This matter fills a large part of the universe. Normal matter which is visible to our eyes and measured with instruments makes up only 5% of the universe. Dark matter takes up 27%. The remaining 68% is defined as Dark energy.

Properties of dark matter

A Dutch astronomer, Jan Hendrik Oort discovered dark matter in the year 1932. He has been called one of the century's foremost explorers of the universe by the New York Times obituary. His ground breaking discoveries indicated to us that there is much more out there in our solar system than we knew about.

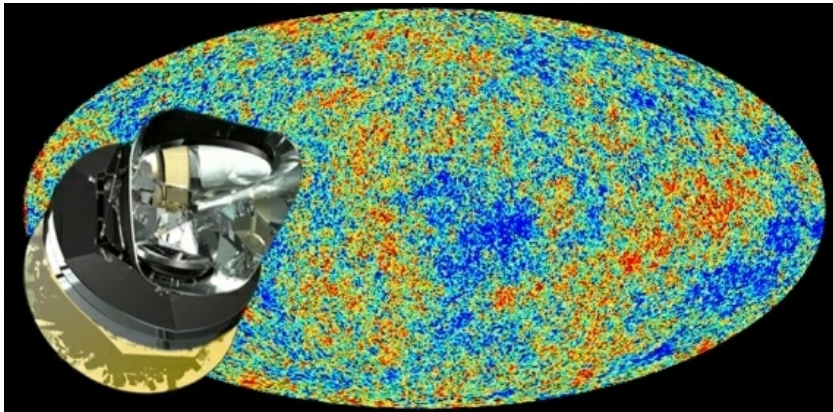
Jan described dark matter to be the cause of the gravitational pull which pulls and keeps all the galaxies together. It was also thought that this gravity would slow the expansion of the universe as time went on. In 1998 however the Hubble Space Telescope made another discovery about the expansion of the universe. It had not been slowed down despite the presence of gravity. The expansion was occurring even faster than what it had been before.

Some mysterious thing was responsible for this expansion. It was given the name of dark energy. Dark energy can be described to be the property of

space. Einstein discovered that it is possible for more space to come into being.

Planck which is a more sensitive satellite orbiting in the sky has made a thrilling new discovery lately. It was launched in 2009. It has managed to map the cosmic microwave background allowing scientists to look at remnants of light about 370,000 years after the occurrence of the big bang. Light has been thought to be trapped in some hot plasma which cooled. This caused the light to be set free from it.

There are tiny imprints representing quantum fluctuations which occurred after the birth of the universe. It is this substance from which all the matter which formed the stars and the galaxies came from.



Planck is a more sensitive satellite with a higher resolution capability. Light patterns even one twelfth of a degree can be measured on the sky.

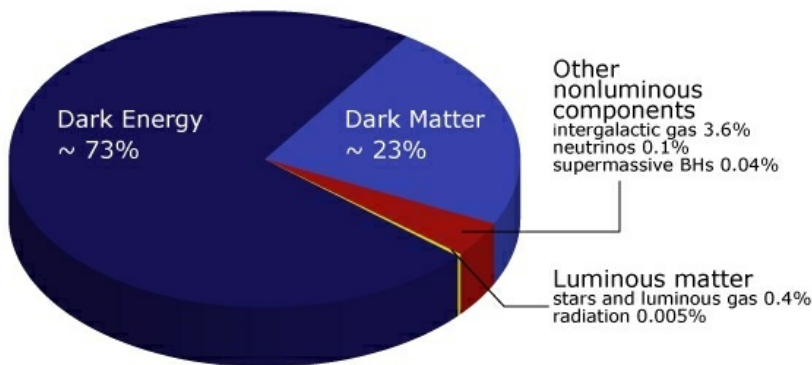
The version of Einstein theory containing the cosmological constant states that empty space has its own energy. This energy will not be diluted even as the space expands. This property of space can cause the expansion of the universe to become faster.

Space is also thought to get its energy from virtual particles which would appear and disappear. The calculation of energy however was not possible to calculate with enough accuracy.

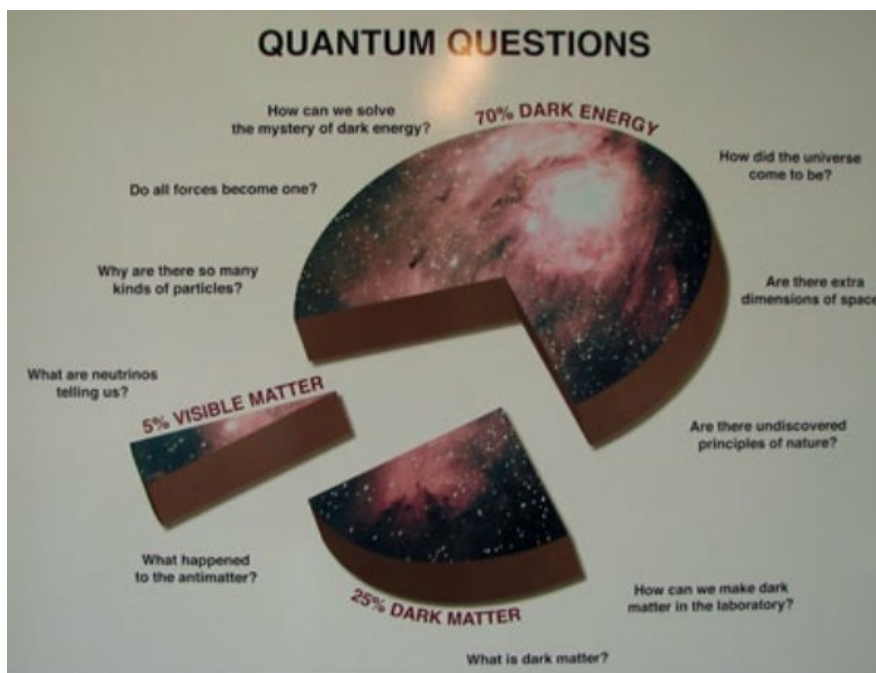
The South Pole has harsh living conditions compared to anywhere else on earth. From the month of March through to September the sun will not shine there. A telescope placed there collects data in that 24 hour state of darkness. The atmosphere will be stable as the heating and cooling action of the sun

will not affect data. The atmospheric air is also thin here. The wind which blows here comes from one direction and is calm.

This place on earth offers the closest atmosphere most similar to space conditions. Funding for a space mission which can be carried out on earth is not very likely to get from NASA. At least humans can repair any problems with the instruments directly.



Astronomy is a science which depends hugely on our sense of sight. Solving the mystery of dark matter would help scientists understand the structure of the universe. The understanding of dark energy will allow the scientists to predict what the future of our universe is going to be. If this dark matter is going to continue causing our universe to expand then what future do we have?



Scientists think that hypothetical particles known as axions and neutralinos

could be the ones composing this dark matter. Baryons which are particles made from protons and neutrons cooled to separate from photons which are packets of light. This happened when the universe had just formed. This has left behind a cosmic microwave background which has been discovered recently. Early Sound waves are also present here.

Astronomers have been able to measure the rate of the expansion of the universe by comparing these original cosmic microwave background oscillations with the distribution of galaxies at the different stages of history. The peak of these oscillations caused matter to attract more matter as a result of increased gravity between them. This is what caused galaxies to form and then progress into clusters of galaxies.

As this dark energy keeps on making our universe expand, galaxy clusters will not grow as easily. They will grow apart and we will end up with a lot lonelier and colder universe.



The South Pole Telescope has the ability to track these galaxy clusters over time. Any change in the density of this dark matter will cause an alteration in these galaxy clusters. Any change in the properties of this dark matter as well will cause a difference to these clusters. It is possible to view the same spot 24 hours a day over the whole year from the South Pole.

Scientists are now getting to work at measuring gravity and trying to understand how exactly it works. They are measuring table top gravity as well as gravity in the universe. This is because the mere existence of dark matter is its gravitational effects on the galaxies. Dark energy has been

assumed to exist because of its effect on the expansion of the universe.

Einstein's gravity equation is working so far as many scientists have reported. By treating the Earth and the moon like two dropping balls towards the sun because of gravity, it is possible to measure the moons orbit with precision. This is what helps the scientists still trust his equation. If there was even the slightest deviation then scientists would have to re-evaluate his original equations. They may even have doubts on the existence of dark matter and the resulting dark energy.

There is no place or object in the universe which is stationary. Everything is in constant motion. This means everything is being affected both by time and space.

Dark energy contradicts most of the understandings which we have at present on how our universe works. All energy according to Einstein is supposed to have a source. Matter and energy can interchange between themselves. The largest example of energy is the sun. It is however powered by mass which is then converted into energy.

Quantum mechanics can allow something to come into being from nothing for a very tiny instant. This might be what is providing this large space with energy. This matter might be what fills up what we think is otherwise empty space.

Dark energy might be latent. It might start to show its fundamental forces once the universe has finally expanded to reach to a certain size. The force might even be very temporary causing the universe to accelerate and go ahead for a few billion years before finally slowing down. However all these are still assumptions until further experimentation provides us with the concrete answer.

The force of gravity is stronger between things which are closer together. As they move apart the force decreases between them. The continuous expansion of space is causing gravitational force to weaken as well. Dark energy which makes almost 74% of our universe at present is still not understood by anyone.

When Albert Einstein was applying his general relativity theory to space-time

structure, his equations did not work if he considered the universe to be static. He invented the cosmological constant in order to balance things out and fix the problem which he was facing.

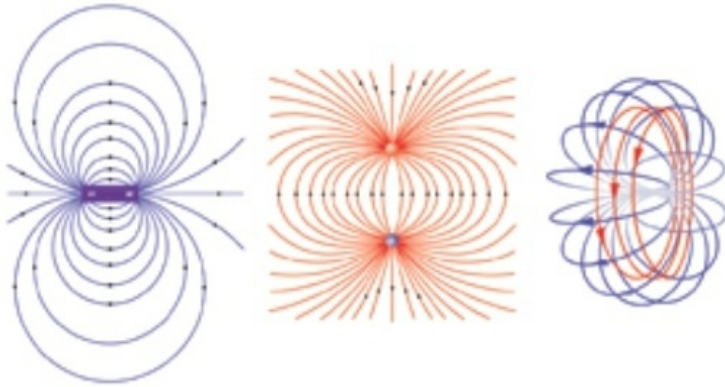
Edwin Hubble later on discovered that the universe was expanding, something which was not known at the time to Einstein. This discovery served to revolutionize astronomy. This new discovery caused Einstein to call the cosmological constant the biggest blunder of his life. He also discarded the cosmological constant. However astronomers today use the cosmological constant to refer to one theory and that is of dark energy. This theory states that dark energy has always been steady without any changes and it will remain constant as it has always been even with the passage of time.

Another theory which comes second states that this new force which is dark energy will just eventually fade away just as it begun. This is the quintessence. Experiments today are in way and the cosmological constant may be defined as being correct. If this happens then Einstein's theory will be proved to be correct even if he himself thought that it was wrong and a mistake on his part.

This dark matter might be composed of particles which have an unusual shape and also an electromagnetic field which is shaped like a donut. This field is called an anapole. This shape was discovered by Professor Robert Scherrer and Chiu Man Ho. It is believed that this may be responsible for the unique properties of dark energy. A particle named as Majorana fermion was proposed to make up dark energy.

Normal particles would possess two poles, a north and a south, positive and negative. Anapole matter however will not react due to only one pole. This matter works with the same principle of magnetism which causes magnets to stick onto a refrigerator.

Neutrinos have been discovered too in the quest for dark energy. Dark matter is not visible at all under telescopes as it does not interact with either light or electromagnetic radiation. Dark matter is not thought to carry any electrical charge either.



Other scientists have observed dark matter particles which do not carry any electrical charge. They however also have electric or magnetic dipoles. These particles will interact with electromagnetic fields without being in motion. Anapole particles need to be moving in order to react. The higher the speed, the stronger will be the resulting reaction. Because this dark matter does not move much presently, it does not react. This is why it may have escaped detection for so long.

These dark matter particles are thought to be massive particles which resulted from the big bang. These particles are called dark as they are not able to scatter or even emit light. They do not interact with ordinary matter and can just pass right through it. They have no nuclear force which usually traps protons and neutrons into atomic nuclei.

An atom would have almost 99.9% empty space. However despite this, things do not fall or pass through others. It is the electromagnetic field which keeps them levitating around. So when we are sitting on a chair we are in reality not touching it at all. The shell surrounding each atom repels each other.

The entire universe might just blow itself away if this were the case. However atoms also share electrons because not all electron shells are full. The electrons travel to go back and forth in these atoms at a pretty fast rate. Once these electrons come together then we get the formation of molecules.

Scientists study neutrinos

NOvA is a recently completed experiment in the United States. It is a powerful neutrino experimental based on high acceleration. Construction

began on this project back in 2009. It was completed just last month.

A 14,000 ton detector has been built on the Ash River in Minnesota. This will detect the neutrinos after a 500 mile trip. These neutrinos travel close to the speed of light and pass through the earth. During the course of the next 6 years, uncountable neutrinos ranging to over tens of thousands of billions will be aimed every passing second. The detector however is expected to catch very few as these particles do not interact with matter.

The first neutrinos had been observed by this NOvA far detector in November 2013. Since then work was begun to upgrade their acceleration to make their beam become the most intense in the whole world. Neutrinos are thought to have a mass, but their weight is thought to be less than electrons by even a million times.

Facts about time.

Time has been found to slow down, the further away we move from the earth. This has been measured by placing 2 clocks, one on earth as a control and the other travelling in a rocket around the earth. Coming back the times registered will be different on both. The clock in the rocket will return back to its normal time measurement.

Planck time is the smallest unit of time. It is the amount of time light would take to travel 1 planck length. This distance is so tiny that it is almost impossible to measure it.

Time cannot exist on its own without space, neither can space exist without time.

Einstein's theory also suggests that space-time gets distorted and twisted when it encounters a heavy spinning object such as the planet earth.

What is a hologram?

When we take a laser beam and split it into two. One beam is directed to the object which will contain the hologram and reflected from it. It will go on to the thing onto which the resulting image will be recorded onto. The second beam will be directed onto where the recording is and where the first beam has been directed to. The interference pattern which the beams made when

they cross each other is the one which gets recorded.

Our vision is a sort of hologram

When we look at a box, it is not translated as being a box in our brain. Our neurons which fire up create ripples of electrical energy. An interference pattern is created as a result. We manage to create an internal hologram of the object which we are observing.

Upto 98% of the optic nerves from a cat's eye can be removed and its complex visual tasks will not be affected. The remaining 2% can still get the job done well enough.

Our memory as a hologram

An experiment conducted on a large number of mice and cats involved teaching them how to run through a maze. A treat was given to them at the end. Parts of their brains were then removed by surgery. Different parts of the brain were removed. Each time however, the animals managed to get to their destination correctly. This showed that no matter which part of the brain was removed, there was no memory impairment. This suggests that the brain works like a hologram.

People who have had brain surgery never suffer from any memory loss. They remember all their family members and many other things. This implies to the use of a form of holography for our memory.

Quantum computers from holograms

Photons can be used to create computers for solving complex problems. Interferometers however can be rendered useless as their components interact and do not work then.

Making holograms of interferometers can freeze their properties leading to stable computers. These can then be used for quantum computations. A tempered piece of glass can lock these photons protecting them from environmental factors.

Do we live in a holographic universe?



Indigenous people believed that we exist in an illusionary world. So do some religions of the world. Research is being carried out at present on the universe being a hologram. Grids are thought to make up our hologram. Electromagnetic energy at a physical level is responsible for our awareness of our consciousness. This hologram is believed to have a start and an end too. With the collapse of the existing grids, the hologram ends.

An experiment has been set up in Illinois by physicists working at Fermilab. This laser based experiment aims to find out whether our three dimensional world is actually the creation of a two dimensional matrix.



Many scientists today are regarding nature as a computer. There are certain laws which govern the working of everything. These are expressed in mathematical formulae. Nature will conduct its real time computation to calculate where the moon should be. We can perform our digital calculation about where the moon may be.

A physicist known as Aspect discovered that particles of a subatomic nature are able to converse with each other statement of no communication being able to travel faster than light.

If we are looking at one fish in an aquarium, but we are viewing it through 2

cameras installed at right angles the images we see will be two different ones. The fish is one but the angles we view it from will be different. The movements it makes however will be similar. Bohm offers this as an explanation of Aspect interpretation.

Bohm states that we may view objects as being separate when they are interconnected to each other. We are able to view only a part of their actual reality. These parts are not separate, but can be described to belong to one whole hologram. At the deeper level which this reality may have created, everything connects to everything else. Nature forms a seamless web where the electrons which are in the human brain are connected to even salmon, stars twinkling in the skies and every heart which beats on earth.

A superhologram can also enable us to some day delve into the past and pick out events totally forgotten all about. The proper tools to operate this hologram would be required for this to be possible. The hologram could then be a cosmic storehouse of all things which are described as matter and possess energy. These can be snowflakes, quasars, gamma rays and blue whales too. Bohm also says that other things may be hidden in the hologram which we can leave to our imagination at the present.

Stansilov Grof was conducting research into using LSD as a psychotherapeutic tool. This is when he had a female patient who started assuming she had changed into a reptile species belonging to a prehistoric period. She also described her male partner very accurately to have a coloured patch of scales on his head. Grof later found out that coloured scales on the heads of reptiles play an important part as being a trigger of sexual arousal in the females. This patient had no prior knowledge about these reptiles.

Grof found out many patients identified themselves with almost every species of animal that may exist on earth. Some individuals however managed to give descriptions of funerals in depth and also Hindu mythology scenes of which they had no previous experience. This branch of psychology got referred to as transpersonal psychology. However if we view it from the hologram angle, then it gives us some idea of the connectivity between every atom, organism, and also regions which have no time-space divisions between them.

Lyall Watson watched a woman who after performing a ritual dance could

cause trees to appear and disappear too. Science may not be able to offer an explanation by a holographic model can. All this could just be a projection of some sort. We may not have programmed our minds with the thoughts which can achieve such feats.

If the universe were a hologram, then there would be no limits as to how we could alter reality. The power of the mind can bend spoons and cause objects to levitate in the air. Reality would just be like a blank canvas onto which we can etch whatever we decide to. It would make magic our birthright. Random events would be determined by the hologram though.

After studying black hole properties and the limits which such matter and energy can hold information types, scientists regard the universe as a 2 dimensional surface with formulas written on. Our 3 dimensional view would just be viewing the same objects from different angles just the fish stated above.

Holographic principle

String theories combined with quantum gravity state that a volume of certain amount of space can actually have been encoded on the boundary to that region. This would preferably be lit up codes which control what goes on in that space.

This principle has been originally inspired by black hole thermodynamics. Volume is considered to be an illusion. This makes the universe a hologram with information subscribed onto its boundary.

Craig Hogan, a Fermilab physicist however claims that quantum fluctuations would occur in spatial position which would cause background noise detectable by gravitational wave detectors. This has not been the case so far.

The holographic principle also states that there is a limit to the amount of information which can be stored in a given space which also has a finite energy amount. This is similar to black hole dynamics principle.

Can time move slower for moving objects?

Time is measured by clocks. However is something is moving close to the

speed of light then its time will slow down. If we have two twins working on the same project and one leaves for space while the other stays on earth, they age differently. When the space twin arrives he will have aged 10 years and his twin on earth will have aged by 32 years. The astronaut was travelling at relativistic speeds which have caused his clock to slow down. Time is thought to be affected by gravitational force. Time on earth tends to go by less faster.

All types of clocks have been tested in this experiment. Analog clocks, clockwork clocks, our own biological clocks, digital watches and atomic clocks too. They all register a slow down in time when we take them along a moving path.

Black holes

A black hole is thought to be a certain region of space where the gravitational field is highly intense keeping all matter or radiation within itself and preventing any escape. Even light cannot get out. This is what makes black holes invisible. All matter is squeezed to fit into a small space because of the high level of gravity.

Black holes are thought to exist in the centre of galaxies. This is due to them absorbing material around them and also merging with other similarly created black holes. The boundary of this region from which escape is impossible is known as the event horizon.

The presence of a black hole can be detected from its interaction with other matter and also with electromagnetic radiation of which light is an example. Our own Milky Way galaxy has been calculated to contain a black hole which is about 4.3 million solar masses.

The matter which spirals into these black holes will be torn apart and will glow very brightly as a result. This creates the brightest objects to exist in the universe. They are known as quasars.

The gases which swirl around the black hole turn it into an electrical generator. These jets of electricity are spouted out up to billions of kilometres into space.

However, just as black holes exist so we have white holes too. These spray out matter instead and they light up looking like fountains. This white hole

cannot be entered into from the outside, unlike the black hole. Matter and light escape from it. These holes also attract matter just like any other mass. Any object falling into it will however not reach the white holes event horizon. A white hole event horizon in the past is believed to become a black hole event horizon in the future. The object which falls into a white hole will reach its black hole horizon.

Black holes and white holes are thought to be the same object. They interchange with the same time reversal within themselves through a thermal equilibrium state.

Conclusion

The mystery of dark energy thus continues. The expansion of the universe was discovered in the year 1998. Dark energy is still known to just exist but has not been detected directly. There still is a possibility that it may not exist at all. However it has properties which we have not been able to find with any other material. This is why it is hard to imagine and to explain.

It could be described as an anti-gravity force. Dark energy is said to have expanded greatly over time. However there are still new theories such as the one by Christos Tsagas which suggests that our movement in the galaxy is giving us a wrong impression of expansion. When we view something with which we are moving along then it will look as if it is in motion too, whereas if we are moving against it, we will encounter resistance.

Einstein's equations and theories are still being put to the test by scientists. They still need to be proved to be 100% correct. A lot of research is going on in this area as well.

Time has been seen as to eventually grind to a halt by some professors. It could be that we are heading towards a timeless universe. The expansion of the universe could seem to just be an indication of the slow passage of time. Time emerged when the Big bang occurred. Just as it emerged, it can also just disappear.

Meanwhile the mysterious substance known as dark energy carries on quietly. Scientists have decided after considerable experimentation that there is a 99.996% chance that it does exist after all. Even if we have not been able to nail it with a definite conclusive theory, it is still believed to continue

existing.

Dark energy is thought to be responsible for the parts of the cosmic microwave background maps which appear to be hotter than others. The recent discovery of the Higgs boson and other types of particles may also mean that modifications could be added to Einstein's theory of general relativity.

Waiting for the next generation of the cosmic microwave background should be able to shed more light on this matter.

With all the advances in technology there is little hope that this dark matter mystery will be resolved effortlessly. This journey is the most exciting and elusive one that scientists may ever have made.

Some predictions have been made in religious texts like the bible about the sun becoming dimmer far into the future. The scientists are now being able to explain such things with measurements and equations. Some people even believe that dark energy could be God himself as it states in the Bible that he is the force which holds the universe in place.

The discovery of this dark matter particle by scientists is bound to bring about a lot of excitement and challenges to other theories. The quest to solve this mystery is leading to a number of other types of discoveries too.

The future seems bright as these new discoveries will lead to the invention of quantum computers which will help us make even further advances in science and astrology.

Results from data collected by all the complex machinery invented by hard working scientists will reveal much more on this dark matter mystery in the future. Until then we all just need to wait patiently for the outcomes.

Our discoveries may also lead us to improved space travel. Who knows where travelling through black holes may lead us. We may be able to find a shorter route to the planet Pluto.

The necessary setup for the detection of dark matter requires a great amount of professional expertise and funding too. It is managing to bring together

scientists from all over the world to share their infrastructure. This will greatly benefit the next generation of scientists as they will have an already collaborated design structure to continue their work on.