The Effect of a Fundamental Particle on the Standard Model of Cosmology

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Abstract: In the first part of this paper, we discuss the effect of a fundamental particle on the evolution of the universe and propose an alternative model for the origin of the universe. In the second part, we propose the electron neutrino as the fundamental particle and examine the effect of neutrino oscillation on solar neutrinos as they exit the solar system and enter the galaxy. We propose a source of dark matter which challenges the Big Bang model of the universe.

Background

Over the last 50 years or so the Standard Model of Cosmology, or Big Bang model, has become the paradigm for the origin and evolution of the universe. The original model has been adapted over the years as weaknesses have been recognised and observations of the universe have required an explanation.

The model has always had its critics and alternative explanations for elements of the model have been advanced, but no alternative proposal for the origin of the universe has gained traction. More recently, various studies have brought the veracity of the BB model into question[i]. It is possible that the BB model will have to be abandoned. What happens then… when science has no plausible alternative?

In this paper we consider the possibility that there is a fundamental particle which is the basis of all other sub-atomic particles, and hence all the atoms that make up the baryonic matter in the universe. This is a departure from the Standard Model of Particles, SMP, where quarks and electrons are considered to be fundamental particles themselves, with no sub-structure. The electron neutrino, several orders less massive than the electron, is considered to be the most likely candidate for the fundamental particle.

If there is a fundamental particle, it is the building block for all other sub-atomic particles, just as the hydrogen atom is the building block for all elements. A fundamental particle would have had a profound effect on the origin and structure of the universe. We explore how the universe could have evolved from fundamental particles, and in doing so, theorise the nature of dark matter and its role in the evolution of the universe.

The Concept of a Fundamental Particle

The Standard Model of Particles does not have a fundamental particle from which quarks and electrons are made. They are assumed to be fundamental particles themselves. The possibility that they are made up of smaller particles is not denied, but the capacity to experimentally investigate the structure of quarks and electrons is constrained. The quotation below (Cox, Brian; Forshaw, Jeff. Universal: A Guide to the Cosmos (Kindle Locations 467-473). Penguin Books Ltd. Kindle Edition) explains why.

"So far, we know that nuclei are made of protons and neutrons and that they, in turn, are built from quarks and gluons. The story seems to stop at quarks, gluons and electrons because the Standard Model of particle physics describes these objects without any need for substructure. In other words, it might not make any sense to ask 'What happens if I chop an electron in half?' or 'What is an electron made from?' The fact that the 'What happens if I chop this thing in half' sequence may eventually come to an end is something that is reasonable in quantum physics, not least because the more we try to pin down the location of very tiny objects the more elusive they become. So while quantum physics does not exclude the possibility that particles like electrons and quarks have substructures, nor does it demand it."

Hence the SMP is accepted as an accurate but incomplete model of sub-atomic particles and forces and is the basis of our understanding of atomic structures. Quarks and electrons are considered as elementary particles with no sub-structure, largely because experimental investigation of any possible sub-structure is practically impossible due to the disappearingly small size of the components of any sub-structure.

While the SMP falls short of proving an accurate model for the smallest particle, it provides a successful and accepted model of the components and forces within the atom. The nucleus of an atom is made up of protons and neutrons which themselves are made up of quarks, all held together by the strong force. Electrons complete the picture of an atom, held in orbital position around the nucleus by the electric force.

Any model of a possible sub-structure of electrons and quarks is theoretical but can be measured against the body of proven and accepted physical parameters. The most likely candidate for the fundamental particle must be the electron neutrino. It is the smallest known particle and is ubiquitous throughout the cosmos. It was generated in cosmological numbers at the early nucleosynthesis stage of production of hydrogen and helium, as well and being produced in similar numbers in the nucleosynthesis of all stars.

If there is a fundamental particle, then we would assume that it was the first particle to come into existence. We wish to examine how the concept of a fundamental low mass particle affects the Standard Model of Cosmology and explore an alternative model for the evolution of the universe from a fundamental particle. While any sub-structure cannot be observed directly, it is possible that the existence of a sub-structure based on a fundamental particle would have inferences on cosmology which can be tested by observation.

Is the Big Bang Model Compatible with the Concept of a Fundamental Particle?

Could the BB model be developed from the assumption that there is a fundamental particle from which quarks and electrons are made? The BB model assumes that the universe cooled as it expanded from an infinitely hot beginning. When highly energetic photons convert to matter it would be expected that the more massive particles would appear first since high energy equates to high mass. If there is a fundamental particle, which is the building block for all other particles, it does not seem logical that composite particles could be created before the fundamental particle from which they are built. If so, the universe would have to have cooled sufficiently for fundamental particles of minimal mass to have formed before fusing to the form more massive composite particles.

The process of expansion and cooling until fundamental particles form would change the dynamics of the BB model completely. If quarks and electrons have a sub-structure, the BB model would have to be modified to include the concept of a fundamental particle, which might prove difficult if the fundamental particle were to be as small as the electron neutrino. If the BB model is not compatible with the concept of a fundamental particle, what is the alternative?

Whatever the initial conditions in the universe, there must have been a stage when hydrogen formed. With the BB model this stage happened as the universe cooled down. If the BB model is invalid, then it is reasonable to conclude that hydrogen formed as the universe heated up. This would mean that rather than starting from a singularity, as with the BB model, the universe was created from something much cooler than the fusion temperature of hydrogen and helium. A logical starting point would be at or near absolute zero since this is the minimum possible temperature and is a temperature which could have been maintained indefinitely before the first particles formed.

This is a radical proposition but is the logical conclusion if we wish to consider the possibility that the hydrogen in the universe formed as the universe heated up. Without knowing the original state of the universe, we theorise how it could have evolved and what we would expect to observe in the universe today if it evolved from a cold state. No doubt the evolution of the universe from a cold state has been considered before but dismissed because nucleosynthesis needs heat. Without an external input of energy, the Standard Model of Particles cannot provide a source for that heat. However, we show that such a beginning would be consistent with there being a fundamental particle from which higher order particles evolved over time, leading to the electron and proton which form the hydrogen atom.

If there is a fundamental particle then it will be the building block with which quarks and electrons are constructed. The number of particles and structure will depend on the particle model used, but whatever model is used, it will lead to an alternative model for the origin of the universe based on evolution from a cold start.

We use Energy Wave Theory (EWT) developed by Jeff Yee to provide a model for particle structures.[ii] All models based on a fundamental particle will have common characteristics and will require the use of particle structures to model all types of other sub-atomic particles formed from it. Using EWT allows us to probe deeper into the consequences of the existence of a fundamental particle.

In the EWT model, particles are formed from a combination of fundamental particles, the smallest known particle – the electron neutrino. As such, combinations of these neutrinos(n) are given terminology nX, where X is the number of neutrinos that combine to form a new particle. For example, two neutrinos combining is an n2 particle. Three neutrinos, an n3 particle. This model is similar to atomic elements, where various elements consist of a different number of protons in the atom's nucleus.

Evolution of the Universe from a Cold State

Like the origin of the singularity in the BB, the starting point for the evolution of the universe from a cold state is speculative, but if there is a fundamental particle it must have been the first particle to manifest itself in the transition to the universe we inhabit today. Quantum physics tells us that both matter and antimatter forms of the fundamental particle would come into being, always in equal numbers.

"It is more logical to assume all space was full of something that converted to the matter in the universe than to assume that everything came from a single point" -James C Baker.

The above quotation gives a starting point for theorising how the universe would have evolved from the initial cold state condition. It would have been a process which converted the "something", into the hydrogen and helium which is the basis of the stars and star formations we see in the universe today. We will assume that the "something" was made up of electron neutrino pairs in a dormant state which could have existed for an eternity before being released to become free matter and antimatter neutrinos. We speculate that there would have been a phase transition which released them in equal numbers at some location in the cosmos, to begin a heating up process of annihilation and particle creation, spreading out spherically from the initial location and releasing more neutrinos from the "something", as the spherical shell of conversion expanded.

We have to assume that an extreme condition arose by chance which triggered the phase change and freed the matter and antimatter electron neutrinos to start the process of hydrogen generation. The phase change would have spread away from the initial location at the speed of light creating more free matter and antimatter electron neutrinos in an expanding sphere of conversion. The heat generated as more and more annihilations occurred would result in the neutrinos (n1 particles) moving with increasing velocity, until there was sufficient energy for collisions between n1 particles to produce n2 particles. Collisions between matter and antimatter n2 particles would be more energetic, increasing the temperature with a knock-on effect leading to the creation of increasingly massive particles, ultimately to the electron and proton.

In the EWT model, structured particles are created from such collisions, with stability and other properties dependent on the particle's geometric formation. For example, the electron is n10, where 10 neutrinos form a three-level tetrahedron, which gives the known properties of the electron. The rest energy of the new, structured particle grows exponentially to the fifth power for each neutrino in combination, thereby not requiring significant numbers of neutrino combinations to reach massively larger energy values compared to a single neutrino.

Composite particles are formed from two or more nX particles and are designated here as cX, where c2 is a composite particle of two nX particles. The proton and neutron are composite particles. In EWT, the pentaquark model of the proton is used, with four quarks and an anti-quark. This is given the designation c5 for the proton. The neutron is a composite of six quarks and so is designated c6. Finally, a combination of protons forms a nucleus of an atom, designated as zX, where X is the proton count.

For example, z1 is hydrogen, z2 is helium, etc, the atomic elements. The formation from neutrinos to atoms, building from a fundamental particle is summarized:

- Structured particles: formed from neutrinos. The neutrino is n1; electron is n10.
- Composite particles: formed from structured particles. The proton is c5; neutron is c6.
- Atomic elements: nucleus formed from composite particles. Hydrogen is z1; neon is z10.

We can see from the above how the elements are built up from the fundamental particle. Structured particles forming from the fusing of neutrinos, composite particles forming from the fusing of structured particles and atomic elements forming from the fusing of composite particles.

The evolution of the universe from a cold state described above, though not technically detailed, is sufficient to draw some conclusions which may be tested by observation of the universe. The fact that the universe is contained in an expanding sphere of conversion with a centre leads to very obviously different observations than would be expected from the Big Bang model. For example, the oldest galaxies would be found towards the centre, youngest away from the centre. It would also provide an explanation of one of the mysteries of the universe.

What Happened to all the Antimatter?

For every matter n1 particle there would have been an antimatter n1 particle. They would have been created in pairs. This equality would have been maintained as the universe heated up, with n1 particles continuing to be produced in pairs and annihilating, an n1 matter particle with an n1 antimatter particle. At some stage, the n1 particles would have sufficient energy to combine with the same matter type n1 particle producing n2 particles, both matter and antimatter, but the symmetry of matter and antimatter particles would be broken at this stage. The n2 particles would be created at random as either matter or antimatter. Random collisions of n1 matter particles with n1 matter particles to produce n2 matter particles, and n1 antimatter particles colliding with n1 antimatter particles to produce n2 antimatter particles would destroy the balance of matter and antimatter.

As the process continued one matter type would inevitably predominate over the other. Ultimately more matter than antimatter electrons and protons must have been produced leading to a predominance of matter hydrogen atoms over antimatter hydrogen atoms. Annihilations between hydrogen atoms would lead to the survival of the excess matter hydrogen atoms along with the energy produced by the annihilations. While hydrogen atom annihilations continued, helium and other light elements would be produced, until the antimatter ran out and annihilations ceased, leaving no more energy to power nucleosynthesis.

What Happened to the Neutrinos Released in the Nucleosynthesis of Hydrogen and Helium?

We know that whatever model we use for the origin of the universe, at the stage when atoms of hydrogen and helium were created in early nucleosynthesis, the ubiquitous electron neutrino was released in inexpressibly large numbers. We know that innumerable electron neutrinos were produced in the early nucleosyntheses phase and continued to be produced as nucleosynthesis spread outwards away from the centre. Where are they now? How could they have affected the evolution of the universe?

With the BB model, neutrinos are thought to provide a randomly distributed neutrino background, much like the Cosmic Microwave Background, with a neutral influence on the motion of galaxies. While this may be a reasonable assumption under the BB model, it is not the case with the proposed alternative cold fusion model. Neutrinos released in the first phase of conversion are annihilated or incorporated in structured particles. Electron neutrinos are subsequently released in the nucleosynthesis of hydrogen and helium and other trace elements, first at the centre and then continuously as the shell of conversion expands away from the centre.

The first neutrinos would follow the shell away from the centre and as more neutrinos were released there would be a build-up of neutrinos following the shell relative to internal neutrinos around the centre. There would be no net gravitational effect on galaxies at the centre, but away from the centre, galaxies would be affected by a net pull away from the centre due to the neutrinos following the expanding shell of conversion. This would result in a gravity differential which would act to move bodies away from the centre, and in particular would cause the Milky Way to move along the radial away from the centre.

Conflicts with the Big Bang Model

1. <u>Dark Energy</u>

   Under the Big Bang model 70% of the energy/mass of the universe is dark energy and 30% is matter (dark matter and baryonic matter combined). Together they make up the total mass/energy content of the universe with a density equal to the critical density for a flat universe.

   The term dark energy is used to describe an unknown and mysterious form of energy which acts as a form of anti-gravity causing the universe to expand at super-luminal speed. This is thought to be possible because dark energy is theorised to expand space itself rather than to cause the motion of galaxies. The Big Bang model does not provide an explanation of how dark energy evolved from the singularity or where the anti-gravity property came from.

   If the gravitational effect of neutrinos from nucleosynthesis is responsible for the radial motion of galaxy structures, then the anti-gravity property of dark matter is not needed in the model. However, it would still require that non-matter energy be 70% of the total mass/energy in the universe since the total matter only accounts for 30% required for a flat universe. This energy content would be made up of all forms of radiation and particles left over from the formation of hydrogen and the other light elements in the conversion process.

   We have developed a model for the universe based on the assumption that there is a fundamental particle from which all mass/energy in the universe was created and have described how the universe could have evolved from particle pairs of the fundamental particle. As the particles were released from their dormant state, particle annihilation would produce radiation, and particle production/annihilation would have continued until the particles reached relativistic speeds. This process would gradually move the balance of matter and radiation towards equilibrium.

   At this early stage in the evolution of the universe the mass/energy distribution would have been 50% matter in the form of n1 particles moving at relativistic speeds and 50% energy in the form of photons (radiation). As n1 particles collided to produce the more massive n2 particles, some of the total energy of the n1 particles will be carried away as photons resulting in a change in the balance of matter to radiation energy. This process would continue as more massive particles formed and net matter energy reduced, and radiation energy increased.

In this way the balance of matter to energy, which started as 50% : 50% when the n1 particle pairs reached thermal equilibrium, becomes 30% : 70% when the conversion of n1 particles to hydrogen and helium is finished. The matter content at this stage would all be baryonic.

2. Redshift

The interpretation of redshift as a purely Doppler effect is necessary to support the Big Bang model. The super-luminal speeds at which distant galaxies move away from Earth under this interpretation are simply not possible under gravity. In the Big Bang model super-luminal speeds are justified by the concept of expanding space under the effect of dark energy. If dark energy does not exist, the purely Doppler interpretation of redshift is wrong.

The possibility that the wavelength of light might be affected by the distance it travels from distant galaxies is normally dismissed because that would not be consistent with the Big Bang model. Yet, the model may not account for photon interactions with intervening matter. If undetectable neutral particles exist in large quantities in space, the possibility of photons striking these particles increases with distance. Photons would lose some energy as they are absorbed by such particles in intergalactic space, thus increasing a photon's wavelength (redshift). If this phenomenon were to occur, it would be expected that photons would lose a greater amount of energy and shift to longer wavelengths proportional to the distance they travelled.

Whatever the explanation for the increase in the wavelength of light with distance, redshift cannot be interpreted as being purely due to the Doppler effect under the cold fusion model. It is most likely that redshift is due to a combination of an effect due to distance plus an effect due to the real motion of galaxies away from the centre.

Observations from the Milky Way

The conversion process would be ongoing and would have led to an expanding sphere of conversion centred on the location where the conversion began. Whatever the speed of the expanding shell of conversion, the process of atom creation would follow at a much slower rate, starting at the centre and moving outwards. The first stars would have formed at the centre, with other stars and galaxies forming over time radially away from the centre. For observations taken anywhere in the universe, the age of galaxies would increase along the radial towards the centre and decrease along the radial away from the centre.

The Milky Way would have formed from the hydrogen created when the expanding shell of conversion passed through our region of the cosmos. All galaxies for which there has been time for light to have travelled to the Milky Way would be theoretically visible from Earth. This means that under the model, when we look towards the centre of the universe all the galaxies which lie between the Milky Way and the centre, and some beyond the centre, are theoretically observable. All the galaxies in this direction are older than the Milky Way.

In the opposite direction away from the centre, all galaxies would have formed after the Milky Way, so all galaxies in this direction would be younger than the Milky Way. The age of the Milky Way will determine what can be seen in this direction. If we assume that the shell of conversion moved at the speed of light, then galaxies up to one half the age of the Milky Way would be visible from Earth in this direction.

The galaxies which we can actually see will be limited by the power of the telescope and the ability of the telescope to “see” through the stars in the disc of the Milky Way itself. Whatever the limitations of the telescopes it should be possible to differentiate between the two models. Under the BB model the limit of visible galaxies is a sphere of radius around 13.8 billion light years known as the observable universe whereas under the cold fusion model the limit of visible galaxies forms an ellipsoid around the Milky Way.

The Hubble Space Telescope and Earth based optical telescopes are limited in the range of the sky they can cover to areas outside the plane of the Milky Way. Under the Big Bang model, the universe is isotropic, and so the fact that part of the universe is obscured by light pollution from the stars in the plane of the galaxy itself is not unduly concerning. A universe with a centre is anisotropic and so it is important to survey the universe as much as possible in all directions to provide a rigorous test for isotropy.

The upcoming James Webb Space Telescope and Euclid space missions will enable a much more detailed survey of distant galaxies than currently available from Hubble and other ground- based telescopes. A survey of distant galaxies which established that the maximum z values (redshift) were the same in all directions would support the BB model. On the other hand, if the maximum observed z values are shown to be direction dependent the current cosmological thinking will need to be revised.[iii]

The most obvious expected features under the cold fusion model are listed below.

- The depth of field of observable galaxies will be much deeper in the direction of the centre than in the opposite direction, but our depth of vision will depend on the power of the telescope.
- Older galaxies will be seen towards the centre.
- The nearest newly forming galaxies will be in the direction of motion of the Milky Way away from the centre.

Dark Matter

Galactic rotation is independent of the model of the universe and so provides the basic argument for the existence of dark matter. Without knowing what dark matter is, or how it originates, the concept of dark matter has become fundamental to the SMC. It provides a tentative explanation of the formation of stars and galaxies following the Big Bang. It is the mysterious form of invisible mass without which these structures could not have formed in the time available under the model. Even with dark matter, the BB model is tested to explain the existence of mature galaxies within 1.5 billion years of the big bang[iv].

The rotational speeds of planets in the solar system decreases with distance from the sun as expected under Newton's Laws of Motion, but the speed of rotation of stars in a galaxy does not decrease with distance from the centre of the galaxy. If Newton's Laws hold for galaxies, the explanation of galactic rotation lies in the concept of dark matter. According to the SMC there is an undetectable mass of dark matter within a galaxy equal to around five times the baryonic mass of the galaxy.

We have no reason to question the proportion of dark matter relative to baryonic matter found necessary to explain galactic rotation but do question the use of dark matter in explaining the formation of stars, galaxies, and galaxy clusters in the BB model. Under the SMC, dark matter must have existed at the time that the first stars formed from hydrogen and helium. Despite the fact that it is not known what dark matter is or how it came into being, under the model it is vital that dark matter existed to help form the first stars within the timescale of the STC.

Under the cold fusion model, after the shell of conversion has passed through a region of space the ratio of baryonic matter, in the form of hydrogen and helium, to energy is 30:70. At that stage there is no dark matter. We believe that the countless neutrinos produced as the first stars burned through their lives, became the dark matter which helped form second generation stars and pull galaxies together. In order to examine this possibility, we consider the structure of the neutrino family in EWT.

Particle Structures

The way in which protons and neutrons combine to form the nuclei of the different elements, and the behaviour of the electrons which combine with the nucleus to make the atomic elements, is well understood. Atoms are known to be spherical in shape with the nucleus at the centre, ringed by shells of electrons. We know that in protons and neutrons, quarks are held together by the strong force, but do we know how they are forced together in the first place?

When we consider particle structures, we must assume that there are some similarities between the structure of composite particles and the structure of atomic nuclei. If there is a fundamental particle, all other particles, such as the electron, are structured particles made up of a particular number of fundamental particles and it is that number which will identify the particle. Any modification to the SMP involving a fundamental particle must show how the fundamental particles are arranged in the structured particle, and how the arrangement of these particles generates the known characteristics of the structured particle. EWT is a model which satisfies these basic requirements, and as such is useful in considering particle structures.

Earlier, we discussed the creation of structured particles as the combination of neutrinos (n1). If we imagine the shape of the n1 particle to be spherical, then the n2 and n3 particles are planar structures. The most likely form of the n4 particle is a tetrahedron which would be the first stable three-dimensional shape.

The mass of each particle from n1 to n128 is calculated and the particle identified where the mass maps to a known particle.[v] When structured particles are assembled from the fundamental particle the shape of the particle structure will be important in giving the particle its characteristics. The tetrahedron shape of the n4 particle provides a base for the higher order particles n5, n6, n7 and n8 which are generated by the addition of a neutrino to each of the four faces in succession. The n8 particle structure formed in this way is spherically balanced and under EWT is identified as the muon neutrino.

The n10 particle is formed in the stable tetrahedron shape and is identified as the electron in EWT. The mass is accurately derived, and the properties of charge and spin deduced. The other members of the electron lepton family, the muon and tau, are mapped to the n28 and n50 particles which are not regular tetrahedron structures and are therefore not stable. Although the muon and tau electrons are not stable, they are perhaps stable long enough to be detected and categorized as a charged particle similar to the electron. The numbers 28 and 50 are important. So are the numbers for the muon neutrino and tau neutrino, which in EWT are 8 and 20. In sequence, they are 8, 20, 28, 50. This is identical to the magic number sequence found in atomic elements, showing there are similarities to the geometric structures that lead to stability.

The two structure shapes, tetrahedron and spherical are balanced, and are likely to be stable structures and as such provide the building blocks for higher order particles. In EWT the properties of particles formed as spherical structures differ from those formed from tetrahedron building blocks as would be expected.

We have seen that the n8 particle has a spherical structure and is identified in EWT as the muon neutrino. The next spherical structure is the n20 particle which is formed by the addition of three n1 particles to each of the four face of the underlying n8 particle. The n20 particle is identified in EWT as the tau neutrino. The next spherical structure is formed by the addition of nine n1 particles to each of the underlying four faces giving an additional 36 particles to give the n56 particle, which is identified as the J/Psi meson in EWT. This is a heavy neutral particle of mass 3.837 GeV and so shares properties with the muon and tau neutrinos which are constructed spherically and are not electrically charged.

(Electron) neutrinos are constantly produced by the nuclear fusion of hydrogen and helium in every star in the universe and radiated in all directions. About 100 billion solar neutrinos from the Sun pass through 1 square centimetre on Earth every second. What happens to all these neutrinos when they are released into the cosmos? The role of the neutrino in the shaping of the cosmos remains a mystery and the physics of the neutrino is the subject of much research, both theoretical and experimental.

We here theorise how the n56 particle may be generated from solar neutrinos. It is known that neutrinos from the Sun change form on the journey to Earth. All neutrinos produced in the Sun are electron neutrinos but by the time they reach the Earth they are observed as a mixture of electron, muon, and tau neutrinos. In the eight minutes or so that it takes for neutrinos to reach the Earth they appear to change in form in a process known as neutrino oscillation, and are observed on Earth in roughly equal proportions of the three known types or flavours of neutrino. Under the SMP the theoretical explanation of neutrino oscillation requires a complex mathematical model.

If it is accepted that the electron neutrino is the fundamental particle from which all other particles are made, there is a more natural explanation for neutrino oscillation. Densely packed electron neutrinos travelling at relativistic speeds would be affected by gravity which would cause them to clump together. Some evidence in favour of this reforming process is an experiment conducted in 2010 in which it was reported that a tau neutrino was detected in a beam of muon neutrinos after it had travelled to a detector 730km from the source. This seems to establish that muon neutrinos reform or morph into the shape of the heavier tau neutrinos when concentrated in a beam travelling in the same direction.[vi]

If this reforming process is applied to electron neutrinos travelling from the Sun to Earth, it is possible that the electron neutrinos clump together to morph into muon neutrinos, and muon neutrinos morph into tau neutrinos on the 150 million km journey. The fact that they are observed on Earth in roughly equal proportions is just the ratio they take after the 8 minutes or so they take to reach the Earth.

Neutrinos are mostly unaffected by their journey through the Earth and pass on into the galaxy unimpeded. They are still very densely packed as they leave the solar system and travel on into the galaxy. Solar neutrinos are produced continuously by all the stars throughout their lifetime and so make up a significant component of every galaxy.

The different flavours of neutrinos travel at different speeds due to their mass differences and so it is unlikely oscillations finish when the neutrinos reach Earth. We would therefore expect the oscillation process to continue as neutrinos move further away from the Sun and into the galaxy. The muon and tau are spherical structures which facilitate the oscillation, and it is possible that given time the neutrinos could morph into the next spherical structure which is the n56 particle. Speculation regarding the existence of a fourth flavour of neutrino is an active topic of current research, both in the field of particle physics and in the field of cosmology.

Consequences of an n56 particle being Produced by Solar Neutrino Oscillation.

The n56 particle is a heavy neutral particle and if the n56 particle is present within a galaxy it could be the source of the gravitational attraction which produces the observed galactic rotation speeds. As a neutral particle it would not be easily detected but since every star in the galaxy would be a source of n56 particles there could be sufficient mass retained within the galaxy to maintain the required gravitational attraction. This is the concept of dark matter.

The planetary rotation of the solar system is calculated using Newton's equations and the masses of the Sun and planets alone, and so there would appear to be no dark matter within the solar system. If the n56 particle exists, it only morphs into existence at a distance beyond the outer reaches of the solar system.

The concept of dark matter within galaxies, affecting the rotation of stars in a galaxy, but not the rotation of planets around the Sun is accepted in the Big Bang model. However, dark matter has another role in the BB model which is to provide the mass to form the first stars and galaxy structures. The oldest galaxies are thought to be over 13 billion years old which means that galaxies formed within 800,000 years of the Big Bang. In the Big Bang model, dark matter is required provide the gravity to pull the hydrogen atoms together to form the first stars, and without dark matter stars and galaxies could not have formed in that time. If the n56 particle is the dark matter particle produced by stars, then it was not in existence when the first stars formed and could not have helped in their formation.

How Would the Universe have Evolved after Hydrogen Creation?

The release of the first neutrinos would have happened at some location in the infinite cosmos, creating the expanding sphere of conversion which is the universe in which the Milky Way exists. This location would be the centre of the universe. It is the shell of conversion which is expanding outwards and within that shell, stars and star structures have formed. The first stars would have formed at the centre, the location of the appearance of the first free neutrinos. The light elements would have formed as the sphere of conversion spread outwards. Diffuse atoms of mainly hydrogen and helium spread over several light years would have been drawn together under gravity to form the first stars. Unlike with the BB model there would be no dark matter available to assist in the formation of the first stars, so it would have taken an incredibly long time.

There are thought to be three generations of stars with each generation forming increasing amounts of metallic elements as they explode in supernovae and reform. Astronomers grouped stars in the order in which they were observed and so classified present-day stars as Population I. These are stars like the Sun which are relatively high in metallicity. Population II stars are low in metallicity but are not pure gas giants. Examples of both Pop III and Pop II stars are observed. Population III stars are theorised to be the first stars to form from the hydrogen and helium which made up the very early universe. Pop III stars have not been observed but might provide much insight into the early universe when new generation telescopes are able to probe the universe in greater depth.

Population III stars are thought to have been extremely large stars, many times more massive than the Sun. They are thought to have had relatively short lives of around one billion years during which they would have radiated neutrinos throughout their lives. The lives of most of Pop III stars would have ended with massive supernova explosions in which up to 99% of the energy was ejected as electron neutrinos. The first dark matter neutrinos, possibly in the form of n56 particles, generated from Pop III stars would have speeded up the formation of the second-generation Pop II stars and helped in the grouping together of these stars to form galaxies and galaxy structures.

Over time, galaxies would have evolved with Pop II and Pop III stars forming and galaxies grouping together to form massive galaxy structures with the help of increasing amounts of dark matter. The evolution of the universe under this model clearly leads to a different explanation of the formation of galaxies and galaxy structures than given by the Big Bang model. Unlike the Big Bang model, time is not a limiting factor when explaining the formation of the observed large galaxy clusters structures, some exceeding one billion light years across.

Whether or not the n56 particle exists, ever since the first Pop III stars formed and ended their lives as neutrinos in supernovae explosions, neutrinos have been ejected from stars in some form or other. From the beginning, neutrinos from one source will have collided with neutrinos from another. These collisions would have slowed neutrinos down and begun the formation of dark matter, in which neutrinos move around in random directions colliding with other neutrinos, creating an amorphous mass of cold neutrinos.

After the Pop I generation of stars. dark matter created in this way would have been the basis of the formation of the next generation stars and the galaxies in which stars accumulated. Second generation stars would have formed into galaxies, drawn together by the dark matter neutrinos. The proportion of dark matter within galaxies would have increased from the time Pop III stars generated the first dark matter, until the present day where dark matter in galaxies such as the Milky Way makes up 85% of the matter content.[vii]

Within a galaxy there will be a boundary around each star, between the neutrinos constantly streaming from the star and the amorphous mass of cold neutrinos, moving, and colliding at random between stars. The pressure of the outflowing neutrinos from stars balances the pressure of the cold neutrinos around and between stars.

A galaxy would resemble a sponge with spherical holes in which the stars were located. The ejected neutrinos being absorbed by the surrounding mass which would be prevented from collapsing into the holes by the ejected neutrinos until the star burned out. When a star ends in a supernova the cycle of star formation begins again.

Other observed features of the universe might be more easily explained by the cold fusion model, but it is only by simulating the development of galaxy structures under this model that proper comparisons can be made. If the matter content in the early Universe was 30%, as in the SMC, then under the cold fusion model 30% was in the form of the light elements of mainly hydrogen and helium with no dark matter. Dark matter in the form neutrinos, probably the n56 particles, only came into existence while the first-generation Pop III stars were burning. Neutrinos have been emitted continuously from the different generations of stars with the proportion of dark matter in the universe now being 25% and baryonic matter being 5%.

Conclusion

The Standard Model of Particles does not have a fundamental particle from which all sub-atomic particles and hence all atoms are made. Although it has demonstrated huge successes in providing experimental predictions, it leaves some phenomena unexplained and falls short of being a complete theory of fundamental interactions. It is accepted that electrons and quarks could have a sub-structure but the SMP has operated successfully without one. However, the Standard Model of Cosmology relies on the SMP as a starting point for explaining the origin of the universe and if there is a fundamental particle it might lead to a different explanation of the origin of the universe. In this paper we have analysed the logical consequences which follow if there is a fundamental particle from which all other particles are made. We have used EWT as a model for particle structure based on the electron neutrino as the fundamental particle, but the conclusions we draw are not specific to that model.

Under the Standard Model of Cosmology, the universe expands and cools until quarks form from energy and combine to form protons and neutrons. Proton formation has not been replicated experimentally and the precise process by which quarks could have formed and then combined to produce protons is simply not known. If quarks themselves have a sub-structure the process by which protons form becomes even more complicated, and we question whether the SMC could support the construction of the protons from a fundamental particle as small as the electron neutrino.

The formation of hydrogen must be explained by any viable theory. If hydrogen did not form as the universe cooled down, then it must have formed as the universe heated up. We conclude that if this was the case the first free fundamental particles, which we assume to be electron neutrinos, must have been released from a dormant state, initially at some location in the cosmos, and then in an expanding shell of conversion from that location. The location where the first free neutrinos were released would now be the centre of the universe. Annihilation of neutrinos, and then higher order particles would cause the universe to heat up leading to the production of hydrogen and reaching the temperature for nucleosynthesis. Stars and galaxies would form from hydrogen and helium as the shell of conversion expanded away from the centre.

The most significant effect of the fundamental particle, irrespective of particle model, is that the process of heating up from a cold start, through repeated annihilation and higher order particle production, changes the balance of matter and antimatter leading to the inevitability of a predominance of one over the other.

The development of the universe from a cold state leads to a different explanation of galaxy formation than that predicted by the Big Bang model, most obviously, older galaxies than the Milky Way towards the centre, younger galaxies away from the centre. The recent survey of galaxies by Javanmardi, B. and Kroupa, P. (2016) found anisotropy in the all-sky distribution of galaxy morphological types. The survey covered a limited range of distances and used observations from ground-based telescopes and so is limited in scope, but observations from the upcoming space missions James Webb Space Telescope and Euclid, and possibly existing observations from Hubble, should be capable of investigating if this anisotropy is a universal phenomenon.

The evolution of the universe from a fundamental particle in a cold state leads to an energy content of 30% matter in the form of hydrogen and helium and 70% energy in the form of photons. The first stars formed from the hydrogen and helium, without the presence of dark matter. As these stars burned through their lives to end in supernovae, countless neutrinos were produced, and these neutrinos, possibly in the form of n56 particles, were the dark matter which helped form the second and third-generation stars and drew them together to form galaxies and huge galaxy structures. We conclude that neutrinos, in some form or other, make up the dark matter content of the universe.

The above argument is independent of the particle model used, but we consider the application of EWT on the oscillation of neutrinos from the Sun. We argue that the n56 particle falls within the neutrino family and that n56 particles would ultimately be produced in the oscillation of solar neutrinos, in inter-stellar space, at some distance beyond the solar system. The n56 is a heavy particle, of mass 3.837 GeV according to EWT and so is a candidate for dark matter.

NOTE

Energy Wave Theory is a theory based on the wave structure of matter, where particle matter forms from standing waves, and a particle’s energy increases exponentially as neutrinos combine to create standing waves with greater amplitude and length. Thus, EWT relies on the assumption of the existence of a medium for the propagation of waves. This tends to cause mistrust in the possible validity of the model due to the fact that since the turn of the 19^{th} century an aether has been dismissed as a medium for the propagation of electromagnetic energy. Prior to that, the existence of an aether was universally assumed as a necessary condition for the propagation of light. The famous Michelson Morley experiment in the late 1800’s, carried out to confirm its existence, failed to detect an aether. This experiment cast doubt over the existence of an aether, although the Nobel prize winning scientist Hendrik Lorentz provided an explanation of the experiment’s failure to detect it.

In 1905, Albert Einstein published his paper on Special Relativity in which he discarded the concept of an aether after which the idea of an aether was generally abandoned. Subsequently quantum field theory was developed underpinning the SMP without the concept of an underlying medium. However, following publication of his paper on General Relativity in 1915, in which he introduced the idea of spacetime, Einstein began to have second thoughts on the need for a medium and in 1920 delivered a paper entitled "Ether and the Theory of Relativity" at the University of Leiden[viii]. In the concluding paragraph of that paper, he said:

"*According to the general theory of relativity space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time (measuring-rods and clocks), nor therefore any space-time intervals in the physical sense."*

Einstein continued to believe in the aether and referenced it in several subsequent papers. It is ironic that even though the Theory of General Relativity underpins the Standard Model of Cosmology, the concept of an aether is considered redundant.

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