



A THEORY OF NETWORK AND ANALOGY OF SPACE ENTITIES

Physics

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ABSTRACT

Universe is composed of 68% of dark energy, 27% of dark matter and only 5% of ordinary matter (stars, planets). Present universe composed of visible galaxy matter influenced by dark matter holding them together at small scales due to gravity the mysterious forces at large scales whereas space between galaxies expand due to dark energy or repulsive gravity. Dark matter can be realized by its density and its influenced gravity force on visible matter but dark energy is mysterious force occupies huge volume of space (68%) hence its significance. Sarkatov three conditions for particle asymmetry are baryon number violation, charge and parity violation (CP violation) and last one is out of thermal equilibrium, these condition are only at theoretical but practically complex stage which cannot be proved in lab particularly baryon number. Particle asymmetry creates during preheating stage where violent non-perturbative event a major cause for matter asymmetry. Eternal theory suggests there is still prevalence of cosmic field in the universe and also it say infinitely expanding universe. The behavior of inflation field is increasing on random and at surrounding areas it remain at high energy. Dark energy is invisible and mysterious force but it is same like even disguised as cosmic inflation field due to both blind understanding of universe expansion.

KEYWORDS

Universe, Particle Asymmetry, Cosmic Field, Dark Energy

INTRODUCTION

Space objects are several kinds from visible stars and galaxies and radiation, black holes, dark matter and dark energy. Stars are formed of gases of hydrogen and helium which is most abundant elements in the universe. A group of stars formed as galaxies one of the galaxy in the universe is our Milky Way galaxy. These stars and galaxies warp or bend space time i.e. make curved path around it.

Black hole is massive dense object (matter is crushed in zero volume) its gravity distort space and time. Black hole has event horizon around it, where space curvature is so extreme the light bends or takes circles when it passes near it.

Dark matter an invisible matter its presence identified by galaxies bound within it gravity. The mysterious matter makes space curvature around it, where galaxies trace paths. Dark matter present both inside and outside of galaxies. Dark matter not interact with light (not emit, absorb, reflect) so dark color. Galaxies spin so fast so gravity from visible matter is not enough to hold them together so dark matter is invisible glue.

Space curvature is property where objects curve the path around it. Space is three dimensional and linked with time of one dimensional so space and time cannot be separated hence viewed in four dimensional structures. The strength of gravitational pull of any object makes space curvature which may at one place time slowly passes or time rapidly passes hence depend upon gravity force. So every point on space has different time evolution due to gravity field variance.

Every object identified including dark matter takes nearly spherical shapes (prolate, oblate or spherical) so it masses makes space curvature. Sphere object formation happen due to at centre of point attraction the mass is accumulated at every line of 360 degree angle. We can also interpret these spherical objects make concentric circles around it. Different circles formed around on object have different curved space time. i.e., one nearer circle hence more gravity force than far circles.

The CMB (cosmic microwave background-old light) used to find density of matter through temperature fluctuations (Planck satellite) when passes inside and outside of matter in space.

CMB also used to find curvature of space time i.e. bending of cmb by matters (ordinary and dark matter) through telescopes. These cmb bend light at various angles show that founded density of matters move inwards or move outwards or flat (parallel path)

The shape of universe found not only through bend of cmb light (microwave) but take consideration of space expansion. Established theories say the expansion of space is parallel lines means its flat shape of universe. If CMB bend inwards then it takes spherical shape, on other if space shape is saddle as it name that cmb bend outwards. Among above three shapes of universe one type of universe shape

explains objects start expands and again come to start position. But the shape may be complex expands in random directions.

The above detailed information are to understand the present universe objects properties which are basic concepts so what happened before the present universe (origin of matter) and why universe expanding by mysterious force, This study highlights the creation and reason of particles over antiparticles (matter asymmetry) and secondly to identify origin of space driving force (dark energy) also its nature.

A. Connectivity: Cosmic Field Converted into Matter Asymmetry

Universe evolved from billions of years ago driven by cosmic inflation then big bang to present day large scale structures of matters with radiation alongside void spaces. Cosmic inflation theory is modern theory about initial state of universe explaining what happened in space towards matter and radiation formation. The cosmic inflation field occupied tiny space of which means the field existed in volume below the size of an elementary particle. The temperature is very hot and the field energy is extreme dense in that era. The beginning of cosmic inflation happened within fraction of time made the exponential expansion of universe that is incredibly but true. Also expansion marked faster than light. Hence the energy (cosmic inflation) changed into hot elementary particles like quark, electrons during and slowdown of universe expansion. While universe expansion, the temperature is very much cooling state and cosmic field evenly extended, so as flat surface space. It is viewed that universe expansion everywhere at even scalar field (cosmic field). According to cosmic inflation theory (before big bang) universe was filled with field-energy (false vacuum) [1]. Theoretically speaking noted as false vacuum means energy density under high energy state and instability. Once field changes into particles it comes to low energy stable state called true vacuum. Once the cosmic field expands, the universe becomes super cooled. At the end of cosmic field standard model particles are created through a process "Reheating". In general fast moving cosmic field at a time becomes slow down since scalar field (high energy field) interact with its child field (low energy field) so hitting of fields make oscillations hence particle creation. Also interaction it mean earlier moving scalar ϕ field (low energy) slow down then later coming scalar field (high energy) interaction of those fields.

The preheating is rapid production of abundance of particles so it is non-perturbative means we not able to count with time [2]. Preheating precede reheating means occur early in reheating epoch. Both stage of heating produce standard model of particles along radiation, also dark matter produced according to modern theories. Now at end of reheating process makes the universe transfer from inflation condensation towards thermal stage, where newly created particles and their interaction lead to thermal equilibrium so as set stage for standard big bang. In brief through such processes matter and radiation where be originated in the universe hence particles like quarks, electrons and protons created in the universe at dense thermal plasma state. After sometime the universe cooled down so as hot quarks, electrons combined to form as proton and neutrons finally the nuclei

formed into hydrogen and helium with ratio of thrice is to one third.

The cosmological reheating lead to pair production of particles and antiparticles happen at the end of cosmic inflation. These inflation fields comes at minimum energy level and behave as a higher massive particle like bosons so their oscillation results in lower mass but higher energetic standard model particles, (lighter particles) hence resulting decay of field creates particles-antiparticles pairs.

The clarification of reheating stages the preheating is resonance type where field oscillations vary with period, so small starting disturbances results in very fast growing oscillation. One common example is spring, hitting a spring at a fraction of second make the spring oscillation lasting for more time, to say spring oscillation takes to stop after 20 or 30 seconds. So spring resonance resemble to cosmic field oscillation..This type of preheating is collective interaction of oscillating inflation fields develop exponentially leads to explosive particle production with minimal radiation but no defined temperature so at excited state. The next stage of reheating is slow process of particle production due to slow down and interaction among remnant fields hence radiation dominant in universe with thermal equilibrium (defined temperature)[3]

The other mode of gravitational pair production during inflation occurs due to the expansionary space curvature (due to cosmic field) acts on fields so field excite from their ground state hence produce pair of particles and antiparticles i.e., metric space (gravity field) function as external force interact with fields leads to creation of particles. Gravitational particle production is very less compared to preheating it happen during the acceleration stage where universe is cold state.

Matter and antimatter have same mass but opposite electric charge, spin and magnetic moments. When matter and antimatter interact with each other lead to annihilation and become pure energy. Now universe only have matter (no antimatter) like stars, galaxies and dark matter. The electron antimatter partner is positron, for proton there is antiproton. One matter is present in excess than antimatter but universe should have equal amount of matter and antimatter according to natural physical process but it not happen due to process like baryogenesis. Reheating epoch at the end of cosmic inflation field is an event created the matter-antimatter asymmetry. We can differentiate matter and antimatter by fundamental energy concepts, We not see gamma rays of range (volts) due to matter and antimatter not get annihilated so this observable evidence shows that all matter like star and galaxies are ordinary matter, if antimatter and galaxies interact in their boundaries results in brightness that is not observed yet.

Hubble parameter H is an important factor in cosmic inflation. At the end of inflation period H drops suddenly allowing field energy into particles and hot radiation. Hubble scale is a key for pair production at different time period like gravitational pair (during inflation) preheating (reheating initial stage) and reheating (last stage) so the H decreases as inflation falls from its higher potential. As preheating particle production in which a small change results in abundance of particles. Large Hubble scale like 10^{14} GeV so larger number of heavy particles produced, if the scale below 10^{14} GeV means interaction and oscillation happen at very lower level [4] so when Hubble decreases further there is low energy left only radiation through decays. Thus Hubble scale denotes different production mechanism for particle pairs.

The important unsolved problem is matter and antimatter asymmetry. It means quarks has anti quarks, proton has antiproton and every particles has antiparticles since they are partners of each other, while matter is excess in the universe than antimatter so as creation of asymmetry. Sakharov provided certain condition that leads to particle asymmetry; there are three conditions [5]. The first is baryon (proton) number violation we can realize them by incident of proton decay. When a proton decay it converted into positron (partner of electron) and mesons, Baryon (proton) is composed of three quarks and meson has one quark and one anti quark. While symmetry baryon equal to 1 so after proton decay it converted to meson of two opposite quarks lead to baryon equal to 0 and produce a lepton (positron). Cosmic field oscillations results into GUT bosons. The GUT boson can decays into one extra quark.[6] This rare excess of one quark from billion of pair production. GUT boson violates baryon number and CP. Hence GUT boson decay obey Sakharov condition of matter asymmetry.

The second condition of Sakharov is charge, parity (CP) violation these can observed in weak interactions as we know particles and antiparticles has opposite charge so as these type of interaction not produce equal number of left handed (chirality) and right handed (chirality) hence event creating particles are not perfectly balanced by event creating anti particles, Weak interaction not act sanely on matter and antimatter a reaction known as CP violation. Beta decay ($n \rightarrow p + \bar{e} + \nu_e$) (electron emission) i.e., creates electron + antineutrino as an example violate CP symmetry, this explain particle-antiparticle asymmetry so easy to understand matter asymmetry in case of electron emission in one direction and positron emission in other direction. The Sakharov third condition is that universe expands faster than heavy boson decay, so the decay become incomplete due to out of thermal equilibrium (lower temperature) and these decays produce excess of matter.

Also an universe expand the density get reduced(lower temperature) so it have no time to annihilation of both matter and antimatter, Forward reaction creates matter and back reaction creates antimatter but in thermal equilibrium and steady state both matter and antimatter should get annihilated according to physical law.

Currently there is no experimental evidence of particle interaction where the conservation of baryon number is broken perturbatively.[7] However Standard model is known to violate the conservation of baryon number. To account for baryon violation a baryogenesis such event (including proton decay) can occur in Grand unification theory via hypothetical massive boson.

So the study founded of matter asymmetry assume that preheating is complex production of pairs due to sudden, very rapid field oscillations, most of pairs destroyed particularly antimatter as intense radiation due to higher energetic field oscillations created radiation in that epoch so excess of matter. There is no rule for production of matter than antimatter but intrinsically matter dominated space in preheating epoch, further the resulting production of matter or antimatter can be interact with cosmic fields hence they disappears as radiation or secondary emission, so chances for excess of matter in universe all happen within second.

B. Sameness: Cosmic Inflation Field as Dark Energy

The universe with galaxies evolved and combined, star generation are produced metal like rocky planet formed after big bang approximately 6 billion years to now universe expansion slow down due to gravity but began to accelerate by mysterious force the dark energy. The observable universe since from big bang due to cosmic inflation once unobservable universe. Dark energy is intrinsic property of space itself viewed as cosmological constant and not as physical substance. The space continuously expand so new volume is created from dark energy and increases proportionally making energy density per unit volume constant.[8] Generally visible matter get diluted as volume increases but dark energy not being less dense due to expansion so adding of new dark energy towards universe there will be constant density maintenance. Dark energy has negative pressure means it separate bigger objects like galaxies apart due to this intrinsic property for example it pushes two galaxies in opposite direction and occupy space between them not only dark energy fills up the empty space between galaxies but continuously pushes them so as its pressure expand universe. Dark energy's negative pressure act opposite to gravity so latter attracts space bodies. Dark energy present in galaxies, solar system even in earth.

While expansion of space between galaxies happen the solar system our galaxy and galaxy group which are bounded by gravity do not expand Dark energy works at large scale effect in space but very weak on small scales so atoms, solar system which held by strong force not get affected.

The distribution of dark energy is uniform in every places in universe, it also exist inside galaxies. The density of dark energy is less than the density of ordinary matter, so its negative pressure effectiveness is negligible thereafter the dominant gravity hold star, dust, gas inside galaxy.

The universe expansion happens in all directions, the expansion is uniform (isotropic). From earth we can observe universe in all 360° directions. Universe expansion not happen from single centre but expand everywhere like all galaxies move away from each other. The space density and expansion rate are same in every direction.

The expansion speed dependent on distant a 1 billion light years recedes at 21,500 km on other more distant galaxies recedes at 6, 87.000km/s which is more fast than speed of light.[9]

The universe has finite age(13.8 billion years) so we see the light take some time to reach us hence a sphere around earth formed approximately 93 billion light years in diameter (observable universe) in any directions.[10] At the edge one can look at every direction so as detect cosmic microwave background (CMB) the left radiation from big bang event. Due to universe expansion the light approximately emitted 13.8 billion years ago now away from earth is 93 billion light years.

After big bang cmb origin roughly at 3, 80,000 years, these are radiation of early universe's matter which is hot dense state so as cmb travel towards our Planck satellite from its origin. The satellite measures temperature fluctuations through its sensitive instruments and show how hot early dense universe at that time. While cmb travel in paths it interact with galaxies help us to know the galaxies distribution in areas by detecting the temperature differences. One important thing about cmb is its origin is high energy visible light when it reaches earth becomes microwave frequency hence visible light travelling as microwave still some reaching and some not yet reached earth due to expanding space.[11]

During big bang universe still very hot so space opaque to radiation hence hot dense plasma with protons but free dense electrons not bounded so the produced radiation absorbed by free electrons, so light (cmb) not travel freely once recombination happen due to cooling effect (3000K) (space expansion) now light (cmb) freely travel straight line. The cmb released from hot dense plasma of particles like protons, electrons and photons. Such elementary particles and photons continuously collided and interacted thereafter universe cooled so electrons bound to atoms, so photon freely travel in space,

After longtime from cmb, galaxies structures are formed so each galaxy experience cmb, for example our milky way galaxy later time formed by earlier elementary matters, simultaneously in the period of cmb origin, these matters become contribute to galaxy formation hence we see cmb signal in all directions from earth(360°).

The big bang was happened every point in the universe at same time so later cmb is observed from every point in earth. Any observer anywhere in the universe would feel like they are at the centre of their own 360 degree observable universe.

The universe expansion can be found by Hubble constant. The Hubble constant is 73 to 74km/s/mps (mega par second).[12] The Hubble constant mentioned above is only for present universe expansion rate. Different era in evolution i.e., expansion of universe have different Hubble constant rate called Hubble parameter. Hubble constant measures current rate at which universe is expanding the cosmological constant is a theoretical force (dark energy) that drives this expansion and causes to acceleration.

Cosmological constant (Λ) lambda represent the static energy density and its value is 10^{-29} g/cm³ i.e., vacuum energy fills up space. The positive lambda Λ expansion of universe this positive value enabling galaxy formation and structures.

Einstein shows in an equation $\Lambda = 4\pi G\rho/c^2$ (cosmological energy density of universe to keep radius of universe constant and zero pressure). The modern positive $\Lambda = 10^{-52}$ m²so 70% of current universe $\Lambda \approx 0.7$ hence constant energy density with negative pressure in total universe.[13]

The acceleration equation " $a'' > 0$ and early universe (after inflation) is expanding but decelerating, then 7.8 billion years ago its accelerating from decelerating and now current era (9 to 13 billion years) the accelerating is small but increasing at 10^{-15} m/s² where objects separated by 1 mega par/sec and it is estimated in future the expansion of universe is relative velocity between distant galaxies will increase at exponential rate.

Hubble space telescope used to measure dark energy through cmb and help us to know look back time of universe. On other one of the moving galaxies light is red shift stretched towards earth exhibiting space expansion. By observation of spectral lines shift variations one can know how distant and speed the red shift matter moving related to the

known spectral of lines of star (longer wavelength)Notably some telescopes observed early distant galaxies radiation and these light radiation are converted as images.

Before big bang the universe expansion is at very rapid state within fraction of second it happened. This period marked as accelerated universe or initial acceleration. After the inflation gravity played a dominant role that that makes up matter to pull inward also radiation, so the expansion rate slowed down continuously for billion of years. The next phase of universe expansion about 6 billion years ago to present day the universe continuously expanded so as matter diluted at large extent hence gravity become ineffective and a repulsive force dark energy makes the space expansion rapid up again till now this force continuing in space.

The eternal inflation theory predicting that our universe is just one of countless pocket or bubble universes within an infinitely expanding multi-verse. The rapid expansion due to cosmic inflation doesn't stop everywhere at once, while inflation stops in some region, it continuous indefinitely in others, driving space outwards faster than speed of light.

The behavior of inflation field is inherently random while the field decays in certain localized patches to end inflation triggering a localized big bang (like our observable universe)-quantum fluctuation cause the field to remain at its high energy in other surrounding area.[14]

So the study explain that dark energy disguised in universe era as its wasted its energy due to overcome gravity or like colliding its pushing matters once space expanded enough it regain its energy. One event in expansion era is cmb has no void so where no cosmic expansion happen unlike matter where there are void spaces between matter so cosmic expansion happen.

Hence cosmic inflation field from early universe still functioning in universe in the name of dark energy so cosmic field not ended with matter creation, it continues itself as antigravity.

CONCLUSION

The study purpose is to find out the reason of matter-antimatter asymmetry combined with the process of particle creation. The second purpose of the study is to know the mysterious force dark energy properties and how it exists or where it comes from the space itself. The findings of study of particle asymmetry arose from preheating stage which is a non-perturbative complex process where most of the antiparticles destroyed in that epoch. Regarding dark energy problem it is not a new force that comes to picture after billion of years from universe origin. The dark energy is same as the cosmic inflation field both are interchangeable energy that arose in early universe. Some modern theories explain cosmic field energy still persists in the universe. Matter asymmetry and dark energy problem both solutions lies within the context of established physical standard law so it help to understand the reader to gain scientific knowledge. Further research may confirm findings with alternative view of time line of universe it will add incremental knowledge of both matter asymmetry and dark energy nature.

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