

Dynamics of the Universe and the Growth of Structures: Dark side of Special Relativity, Curvature and Space-Time

Pathma Abhayapanie Liyanage

PAL Foundation, 139/3, Salgas Mawatha, Mattegoda, Sri Lanka



Abstract – The special relativity explains how the matter transforms into energy. According to that matter can be generated with negative energy and matter can destroy with negative energy. The negative energy can be identified as dark energy. According to this matter generation, which is the process of black holes, emitting radiation from the quasar is the evidence. Matter generation as radiation matter. Matter destroying is the process of stars. The energy and dark energy get negated in the supernova and nova explosions. Stars emit the light by the speed of light is the evidence of the matter destroying process.

The matter creation process makes the universe grow and the matter destroying process makes the universe to shrink, combining this process makes the universe to curvature. Also, matter generation makes the universe expansion power of $-pc^2$ and matter destroying make the universe to compression power of pc^2 . This makes state equation same as the curvature. Therefore $k < 0$ is for the expanding universe. When matter creation and matter destroying get equals, then $k = 0$ and flat universe results. After starting dying the matter generation process, $k > 0$ and compression universe results.

A black hole formed from anti-matter, which created with the positive matter, and created positive matter (the process of $m = E/c^2$) attract to the black hole make a galaxy. Inflation is the period of the first step of matter generation. Then dark energy got inflationary expansion and positive energy get compression by the speed of light ($E/c^2 + (-E)$). Created matter makes neutral atoms make the HI region. The matter makes a connection with dark energy make ionized matter and make the HII region. Then nebulae created in the HII region by dark energy and positive matter. Sufficient density of matter and dark energy formed a star and make the process of $E = mc^2$ and negated in a supernova and nova explosions. The remaining matter creates dwarfs or neutron stars. Remaining dark energy creates pulsars.

Therefore special relativity theory of matter generation and matter destroying explain the universe how to origin and evaluation as well as why it is happening. It explains the dynamics of the universe especially expansion and compression and how it is happening. How the power for the universe created by matter generation and matter destroying. It also explains the inflation and collapse of the universe. It explains the universe's constitution of matter, anti-matter, energy, and dark energy. As well as it explains how the universe structures of galaxies and stellar and how those are evolved.

Therefor ultimate fate describes by matter generation and matter destroying is nothing, expanding, flat, compression, nothing, and yet another universe to begin again. Also, universe dynamics consist of complex scale factors. If the scale factor is real, then expansion related to the positive matter. If the scale factor is complex, then expansion related to the negative matter.

Keywords – Origin of Universe, Black Holes, Stellar, Dark Energy, Dark Matter, Fate of the universe, Inflation, Dynamics of the Universe

I. INTRODUCTION

Our universe explained as homogeneous and isotropic. This is explained by RobertsonWalker metric as follows[19].

$$ds^2 = c^2 dt^2 - R^2(t) \left[\frac{dr^2}{1 - kr^2} + r^2(d\theta^2 + \sin^2 \theta d\phi^2) \right]$$

where k is the curvature, and t is the time measured by a fundamental observer (at rest with local surroundings), and R is a time-dependent scale factor.

- $k = 1$, Universe is closed
- $k = 0$, Universe is flat
- $k = -1$, Universe is open

The General Relativity solution for the scale factor R is given by the Friedman equation as follows.

$$\ddot{R} = -\frac{4\pi G}{3}R \left(\rho + \frac{3P}{c^2} \right) + \frac{\Lambda}{3}R \quad (\text{Force Equation})$$

$$\dot{R}^2 = \frac{8\pi G}{3}\rho R^2 - kc^2 + \frac{\Lambda}{3}R^2 \quad (\text{Energy Equation})$$

where P is the pressure and Λ is the cosmological constant.

Energy density changes in the expanding universe as follows.

$$\dot{\rho} + 3\frac{\dot{R}}{R} \left(\rho + \frac{P}{c^2} \right) = 0 \quad (\text{Fluid Equation})$$

The above equations explain how is the universe origin, evaluation, and how it looks likes.

It is useful to define the parameter as the ratio of the density (of matter, or radiation, or other components) over the critical density. The critical density is the density value for which the geometry of the Universe is flat ($k = 0$). Universe critical density is given by:

$$\rho_{critical}(t) = \frac{3H^2(t)}{8\pi G}$$

The mass density ρ_m of the Universe is usually written in terms of a dimensionless parameter Ω_M given by:

$$\Omega_M \equiv \frac{8\pi G \rho_0}{3H_0^2}$$

and the cosmological constant Λ in terms of a dimensionless parameter Ω_Λ given by:

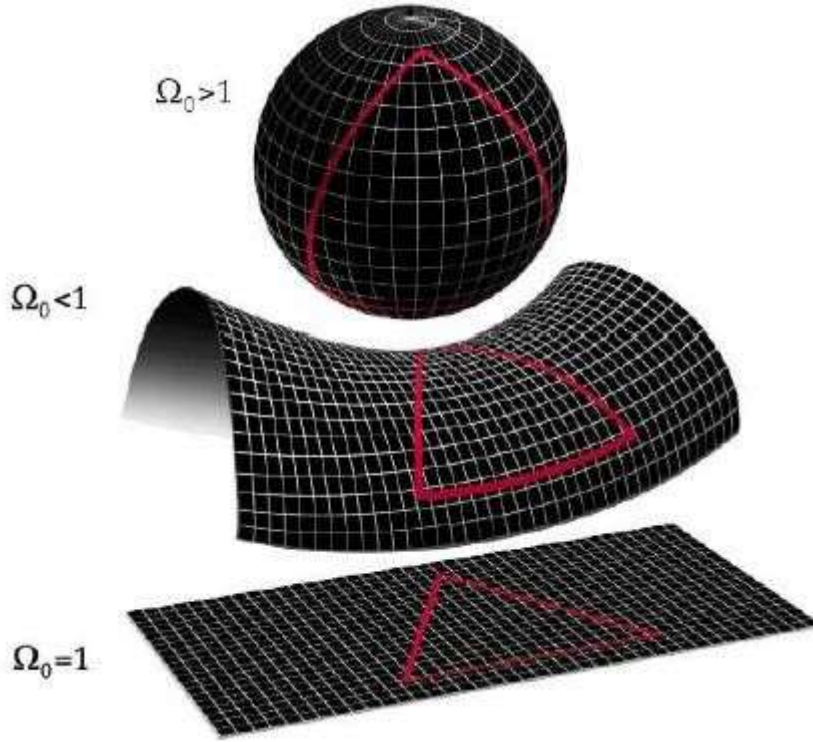
$$\Omega_\Lambda \equiv \frac{\Lambda c^2}{3H_0^2}$$

where H_0 is the value of the Hubble constant today.

There is a third density parameter, which defines the “curvature” of the Universe denoted by Ω_k . Together, these three density parameters are given by:

$$\Omega_M + \Omega_\Lambda = 1 - \Omega_k$$

The universe can have three possible curvatures depending on the value of k and Ω .



1.1 Λ CDM model

Considering the dynamics of the universe, the scale factor is the sum of three parts: matter, radiation, and the cosmological constant. The energy equation can then, in general, be written as:

$$\dot{R}^2 = \frac{8\pi G}{3} \left(\rho_{m,0} \left(\frac{R}{R_0} \right)^{-3} + \rho_{r,0} \left(\frac{R}{R_0} \right)^{-4} + \rho_v \right) R^2 - kc^2$$

by using $a = R$, with $R_0 = 1$ [so that $a = 1/(1+z)$],

$$H^2 = \frac{\dot{a}^2}{a^2} = \frac{8\pi G}{3} \left(\rho_{m,0} a^{-3} + \rho_{r,0} a^{-4} + \rho_v \right) - \frac{kc^2}{a^2}$$

It can be rearranged by using the density parameters as:

$$H^2 = H_0^2 \left(\Omega_{m,0} a^{-3} + \Omega_{r,0} a^{-4} + \Omega_{\Lambda,0} - \frac{kc^2}{H_0^2} a^{-2} \right)$$

According to the above definitions, the universe describes by Λ CDM (Lambda – Cold Dark Matter) model, which is the currently accepted model for explaining the universe (Silk, 2000).

The Λ CDM model explains origin and evolution to the present state of the universe as follows.

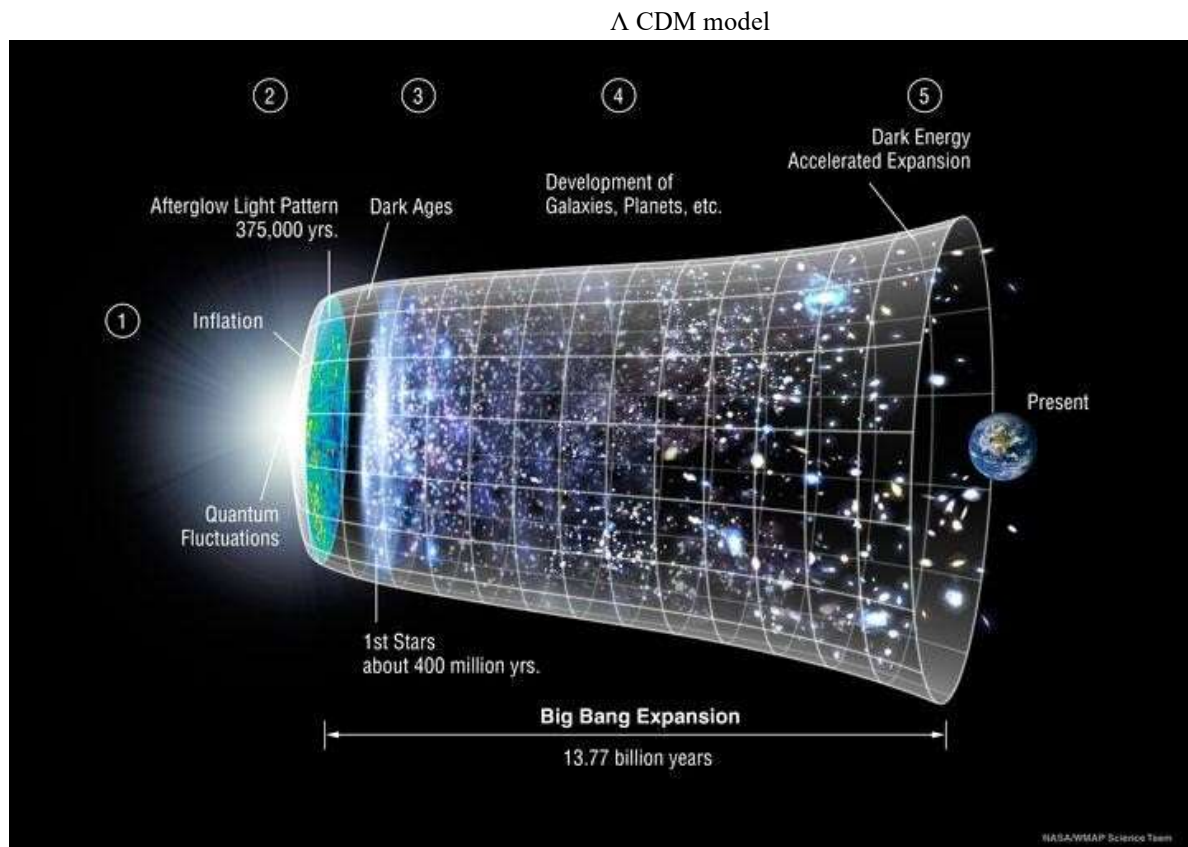
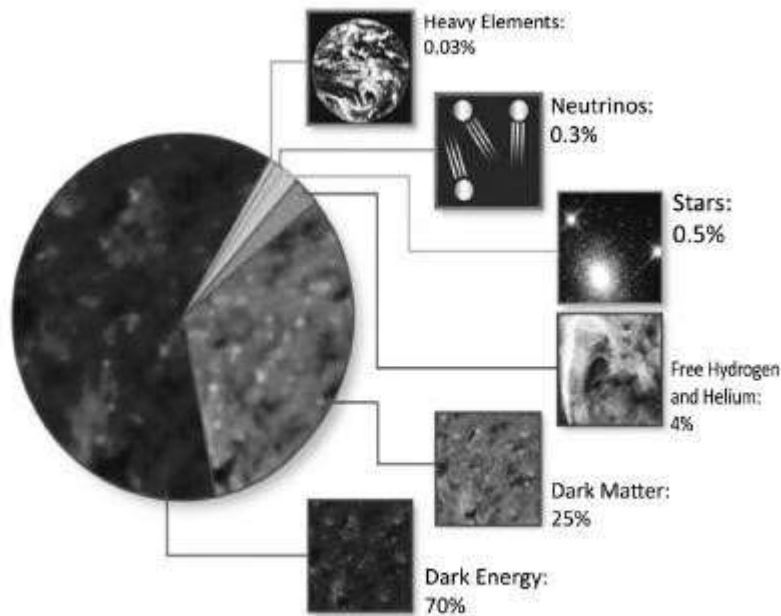


Image credit: <https://lambda.gsfc.nasa.gov/>

The present Constitution of the Universe according to the Λ CDM model is

- Baryonic matter: 24%
- Dark matter: 4.6%
- Dark energy: 71.4%



An approximate outline of composition of cosmos

Image Credit: WMAP team: map.gsfc.nasa.gov/universe/uni_matter

1.2 Big Bang

The Λ CDM model explains the origin of the universe from Big Bang, then inflation, Big Bang Nucleosynthesis, and expanding universe [7].

Before the Big Bang, higher density and higher temperature initial state present. After the Big Bang, the inflation happened and the universe gets an incredible burst of expanding in a short period. Universes fill with neutrons, protons, electrons, antielectrons (positrons), photons, and neutrinos, after a second of Big Bang. Then the universe gets cool, neutrons decay and make protons and electrons. Then in the decoupling era, electrons, protons, and neutrons recombination occur and make atoms. Which is called Big Bang Nucleosynthesis and expanding of the universe continues.

The Big Bang Model is supported by several observations.

- The expansion of the universe
- The light elements of H, He, Li abundance
- The cosmic microwave background (CMB) radiation

Timeline of Big Bang

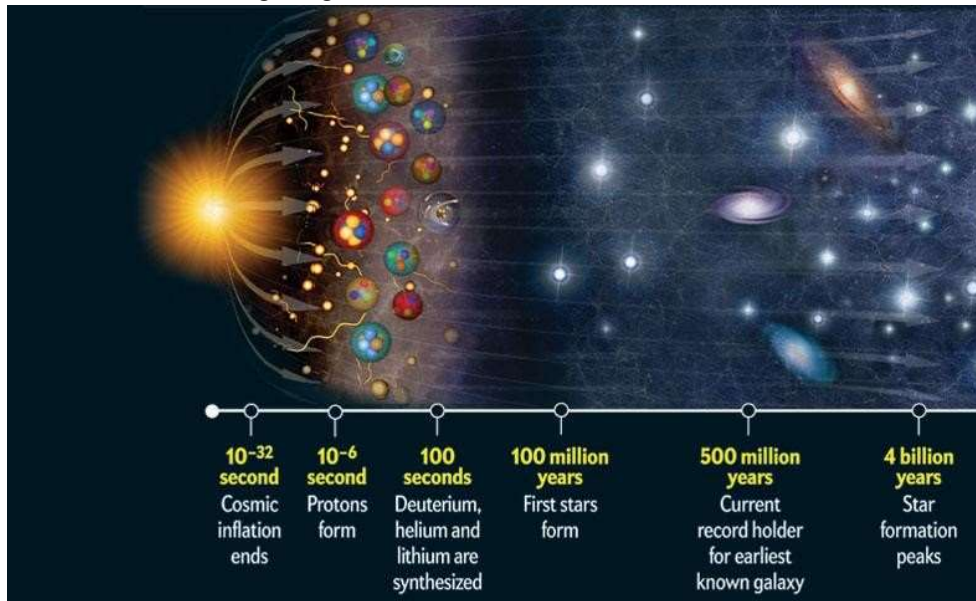


Image Credit: www.futurism.com

1.3 Big Rip

Since strong gravitational pull, the Universe's growth was getting slow. But recently observed that the expansion is increasing, since the effects of dark energy. If dark energy wins in its battle with gravity to such a point that Big Rip to occur, it can rip apart individual atoms. This Big Rip would leave the Universe full of single, disconnected particles [8].

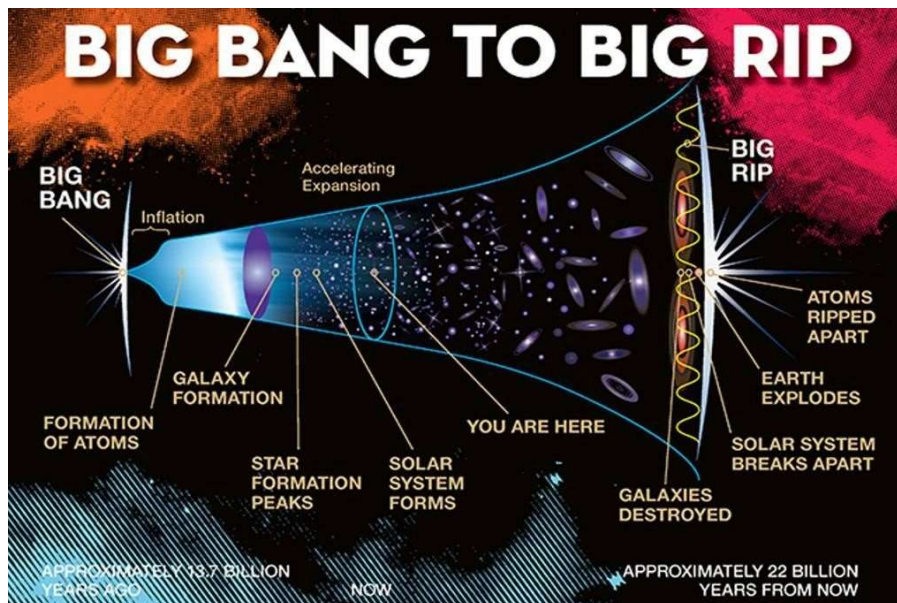


Image credit: www.wired.co.uk/article/big-rip-end-of-the-universe

1.4 Big Freeze

The Universe will continue until the entropy will reach a "maximum value". Once entropy reaches its maximum, that heat in the system will be distributed evenly. Then no more room for usable energy, or heat, to exist and the Universe would die from

"heat death". In Big Freeze, mechanical motion within the Universe will cease. During this Big Freeze, no new stars can form and time becomes an endless void in which nothing ever happens as there is little to no energy left in the Universe [1].

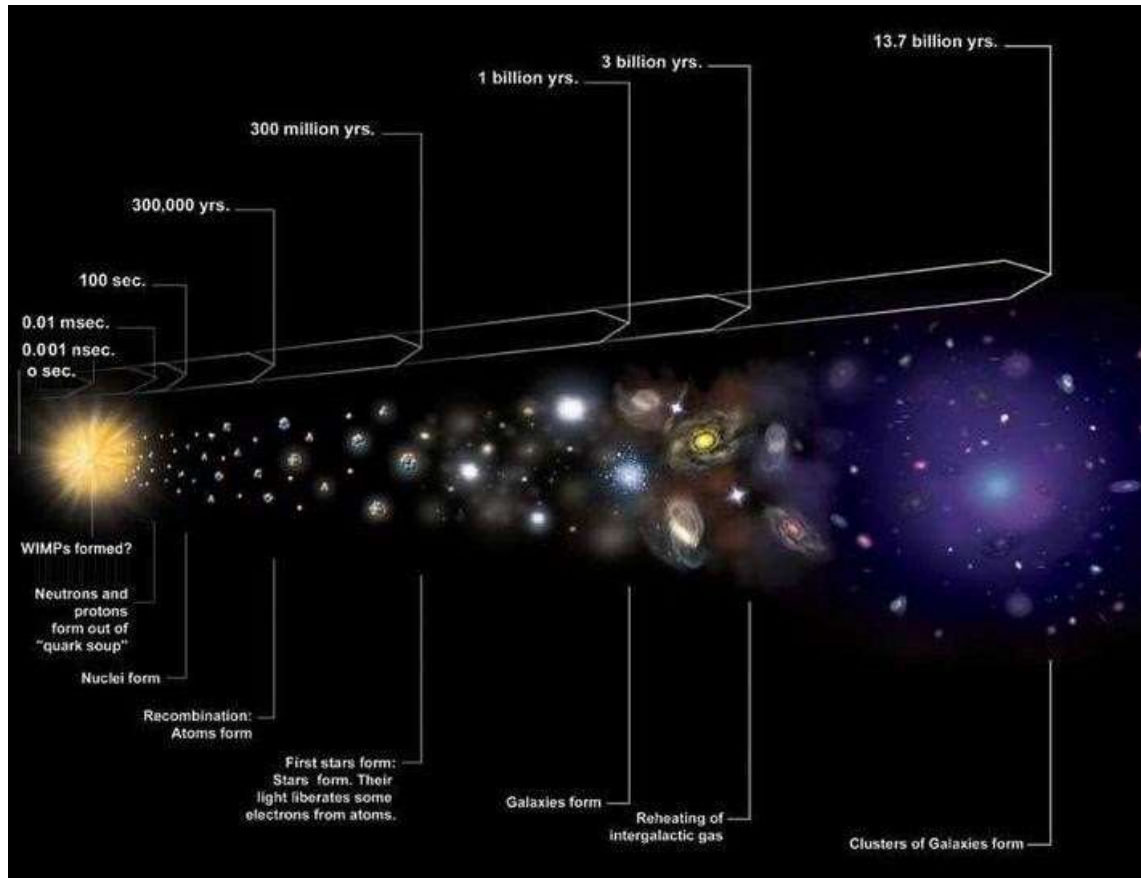


Image credit: www.angelfire.com

1.5 Big Crunch

If gravity win in its battle with dark energy, instead of expanding forever, matter in the Universe reaches a point where it starts to decrease over time. This would cause the Universe to shrink and ultimately stars, planets and entire galaxies to collide into each other and the Universe collapse in on itself [22].

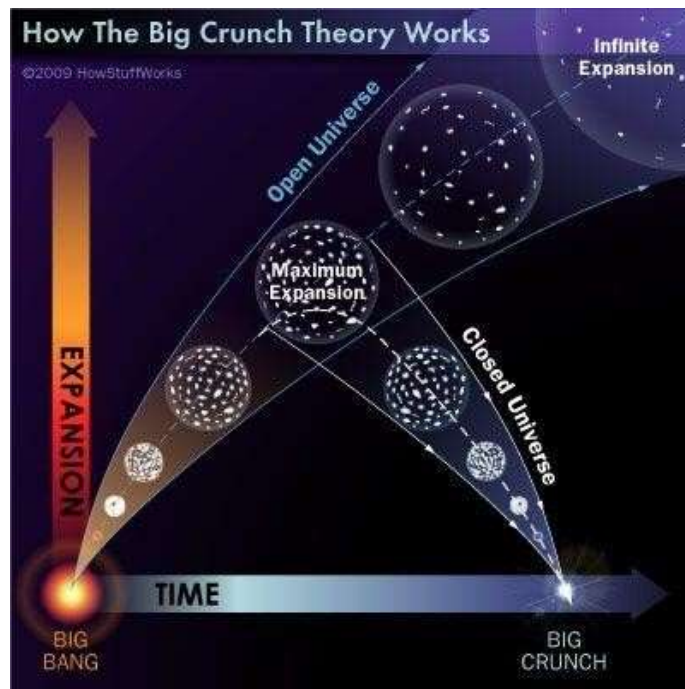


Image credit: www.pinterest.com

1.6 Big Bounced

The Big Bounce is a theoretically explained scientific model related to the beginning and end of the known universe. It explains the Big Bang where the first cosmological event was the result of the collapse of a previous universe and cyclic repetition as an oscillatory universe.

This theory states that the universe will continuously repeat the cycle of a Big Bang, followed up with a Big Crunch [15].

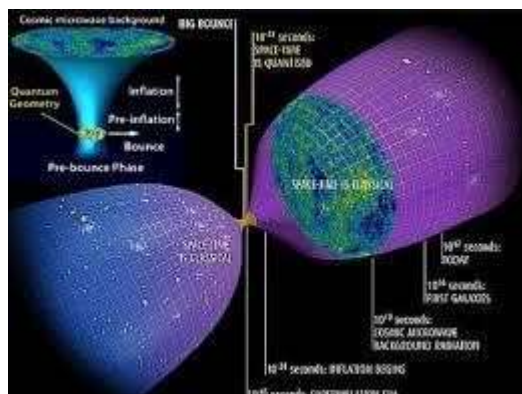


Image credit: www.factslegend.org

1.7 Big Slurp

According to Big Slurp theory, the quantum fluctuation bubble from an alternate Universe can appear in our universe makes a phase transition in the Universe. Higgsfield associated with the Higgs-particle will trigger the Big Slurp in the bubble differing from the Higgs-field in our Universe. The bubble will expand at the speed of light in

all directions, if the new value results in lower energy and if the bubble is large enough. Then all elementary particles will be pulled together.

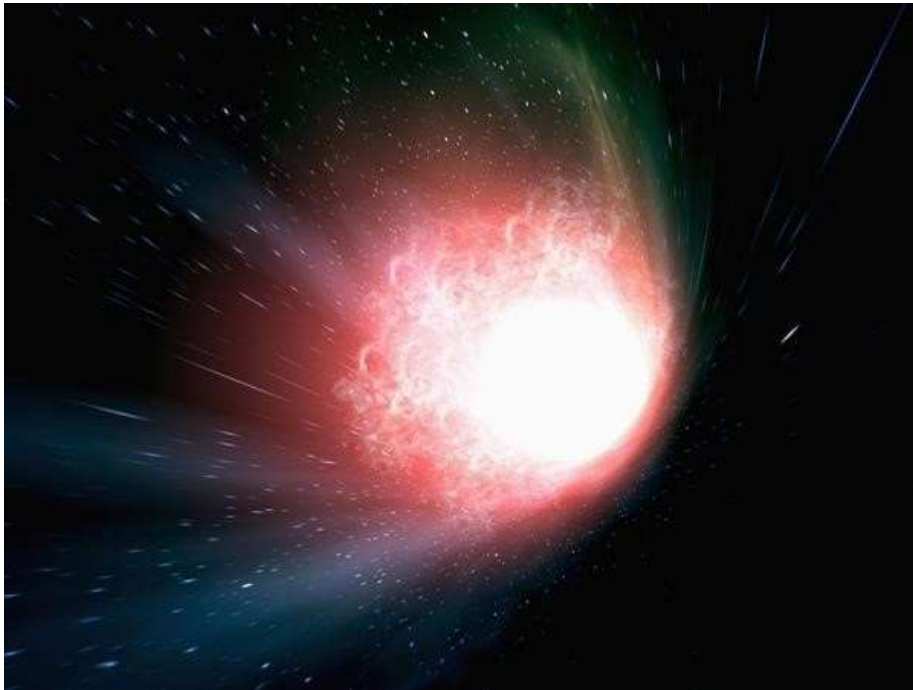


Image credit: www.futurism.com

During this phase transition, empty space became filled with an invisible substance now known as the Higgs field. If a dense Higgs field exists, a 'bubble' of this state could appear anywhere in the Universe, at any time and turning the Higgs field from the state it is in now into a new one, entering all space, this bubble could then expand at the speed of light. The energy level of the universe changes and the universe is destroyed at light speed.

II. MATERIAL AND METHODS

2.1. Theory of Special Relativity

Albert Einstein's theory of special relativity that expresses the fact that mass and energy can be interchanged into each other [6]. $E = mc^2$,

In the equation, the kinetic energy (E) of that body is equal to the increased relativistic mass (m) of body times the speed of light squared (c^2).

2.2. Matter Generation Process

According to the Einstein equation, Energy $\rightarrow$ Mass transformation of special relativity, $E = mc^2$ $m = E/c^2$

it explains applying pressure of speed c (when applying speed of light to the m, it will transform to energy $E = mc^2$) to the energy E will transform to mass $m = E/c^2$. It can also express as,

$$m = E/c^2 \quad 0 = - \\ E/c^2 + m$$

It explains mass can be generated with energy -E, compression by the speed of light, and $m = E/c^2$. Therefore force applied for compress E by the speed of light will get the opposite force to expand the speed of light for the

density generated. Compression force applied according to the special relativity equations since the generated energy is with the speed of light opposite compression force will apply for generating matter.

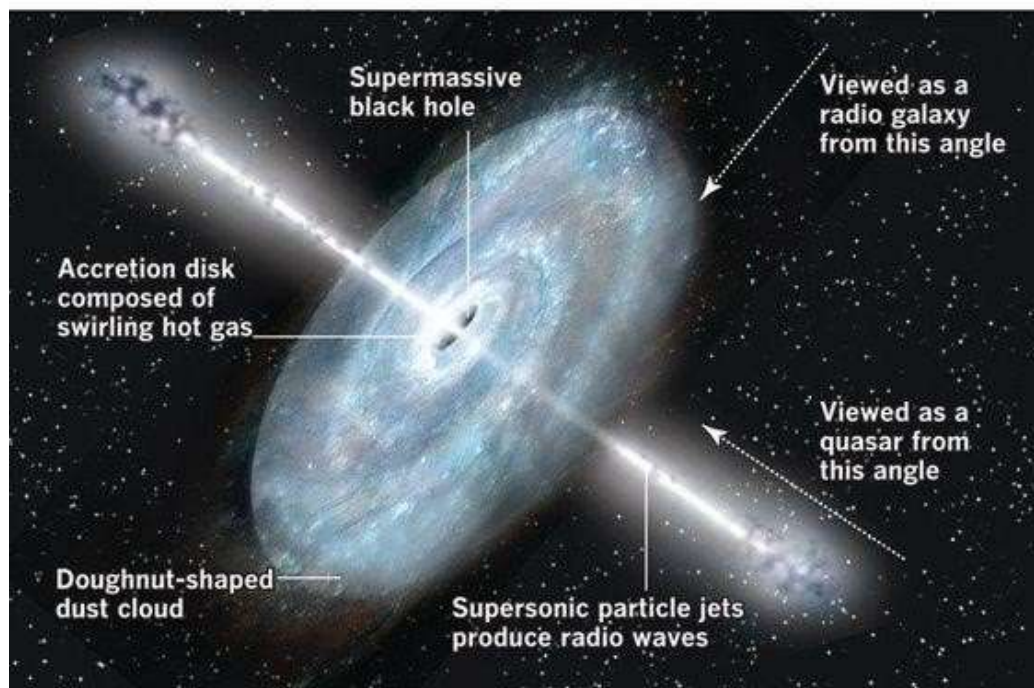
Positive density generated and applies expansion of speed c will generate radiation matter. Negative density generated and applies expansion of speed of light will generate dark energy. The negative density can be explained as anti-matter. The Following explains the steps of mass generation.

$$\begin{aligned}
 E &= -E \\
 (E/c^2) * c^2 &= (-E/c^2) * c^2 \\
 \rho * (\text{expansion of speed } c) &= -\rho * (\text{expansion of speed } c) \\
 \text{Radiation matter} &= \text{Dark energy}
 \end{aligned}$$

2.3. Evidence of Matter Generation

The matter will generate with equivalent anti-matter or dark energy. Dark energy is negative energy and has negative pressure. Consider the properties of anti-matter. It is with negative pressure and compresses by as matter. And a black hole is like massive anti-matter, which contains all anti-matter of masses of a galaxy.

The luminous glow of a quasar is powered by the accumulation of matter into a giant black hole at the center of a galaxy.



Source: Nature. Graphics reporting by BRADY MACDONALD

LORENA INIGUEZ ELEBEE Los Angeles Times

Image credit: www.dailymail.co.uk/

Quasar is the process of mass generation. It is observed that quasar emits radiation, which is like the generation of radiation matter [9]. Considering the steps of matter generation, it will generate expansion power of the speed of light to the universe by the equivalent amount of matter generation

Consider the mass generation process, which generates radiation matter with anti-matter. Generation of radiation matter like energy is released in the form of electromagnetic radiation in a quasar.

Cloud in the interstellar medium composed of neutral atomic hydrogen called the HI region. From the generated matter form the HI region and it contains the neutral atomics. Region of interstellar atomic hydrogen that is ionized called the HII region. From the dark energy and the matter form the HIII region. HIII region has ionized matter since the matter gets ionized by dark energy presence.

2.3.1. Similar observations of Matter Generation

The following observations are similar to radiation matter generated with an expansion speed of light. but they don't observe dark energy potion since there observations related to partial physics and quantum physics.

Researchers in Denmark recently claimed to have proved that the process the same as Big

Slurp theory, known as a „phase transition“ could already be occurring in the Universe (Fang, 1980). A „phase transition“ is similar to the incident of water turns to steam. According to the Higgs theory, causing a shift in the fabric of space-time, a phase transition occurred one-tenth of a billionth of a second after the Big Bang.

Empty space became filled with an invisible substance during this transition, now known as the Higgs field. If a dense Higgs field exists, a 'bubble' of this state could appear anywhere in the Universe, at any time. Ant its equations suggest that this bubble could then expand at the speed of light, entering all space, and turning the Higgs field from the state it is in now into a new one.

According to the rules of quantum mechanics, random particles can momentarily pop out of a vacuum; can observe regularly in particle physics experiments.

Also in Big Slurp theory miss interpreted this mass generation as alien bubble and expansion of speed of light make destroy the universe at speed of light. This Higgs field of a bubble is the mass generation of the universe and it can expand in the speed of light, which is the initial property given to the generated mass, since the energy compression of the speed of light.

Furthermore, it gives the Big Bang inflation to expand the speed of light, which also proves in Higgs theory and explains more in the latter [5].

2.4. Matter Destroying Process

According to the Einstein equation, Mass -> Energy transformation of special relativity, $E = mc^2$

$$-E + mc^2 = 0$$

It explains when mass m apply speed of light, with the energy $-E$, where $E = mc^2$, will get destroy mass m and energy $-E$ resulting nothing.

Steps can be explained as follows.

$$-E + mc^2 = 0$$

$$-E + E = 0$$

Considering the steps of mass destroying with energy, it needs matter to apply the speed (according to Einstein) or expansion (as explain in matter generation) of the speed of light.

Possible scenarios are if the universe expanding the speed of light, the matter can get the expansion of speed of light. Also universe compress by the speed of light, then matter can be travel to the compression point by speed of c .

Also, there is an opposite force for the matter to apply the speed of light, which is the compression power of the speed of light. Therefore matter converting energy will have equivalent compression power of the speed of light to the universe.

2.4.1. Evidence of Matter Destroying

Matter converting to energy is the process of starts. Therefore stars will generate the power for the universe to compression.

For the process of mass transform to energy, there should be Dark energy exist. Then only the matter gets expansion of speed of light. Consider the process of stars, stars convert matter into and emit energy as light. So light, which has the property of speed of light. Light to get the speed of light, stars generate opposite compression power of the speed of light.

Consider the star formation process. According to matter-energy transformation, the process of stars needs dark energy to present. Otherwise matter needs to get the velocity of the speed of light. If the dark energy present, the matter will expand in the speed of light by creating light energy. Therefore star formation process is matter gets companion with dark energy. Therefore star is a special object made up of matter and dark energy. When the dark energy presence, matter will starts nuclear fusion to create energy.

It is only the process of matter transform into energy. In the process of matter destroying with dark energy is the next step. Consider the life cycle of stars.

If the star formation get enough to matter and dark energy, according to the mass, large star or small star formed. If not sufficient dark energy, then results in brown dwarf. After the energy created by destroying mass, stars get the stage of Supernova or Nova.

Supernova is a powerful and luminous stellar explosion, which results in a neutron star, a black hole, or completely destroyed. Nova is a transient astronomical event that causes the sudden appearance of a bright, which is not a powerful explosion as a supernova and results in a white dwarf or black dwarf. Supernova or Nova is the stage of energy and dark energy get negate by the explosion.

Therefore supernova and nova are like the energy destroying step of matter destroying. If the star gets the equivalent amount of matter and dark energy then the supernova will result in nothing and completely destroyed.

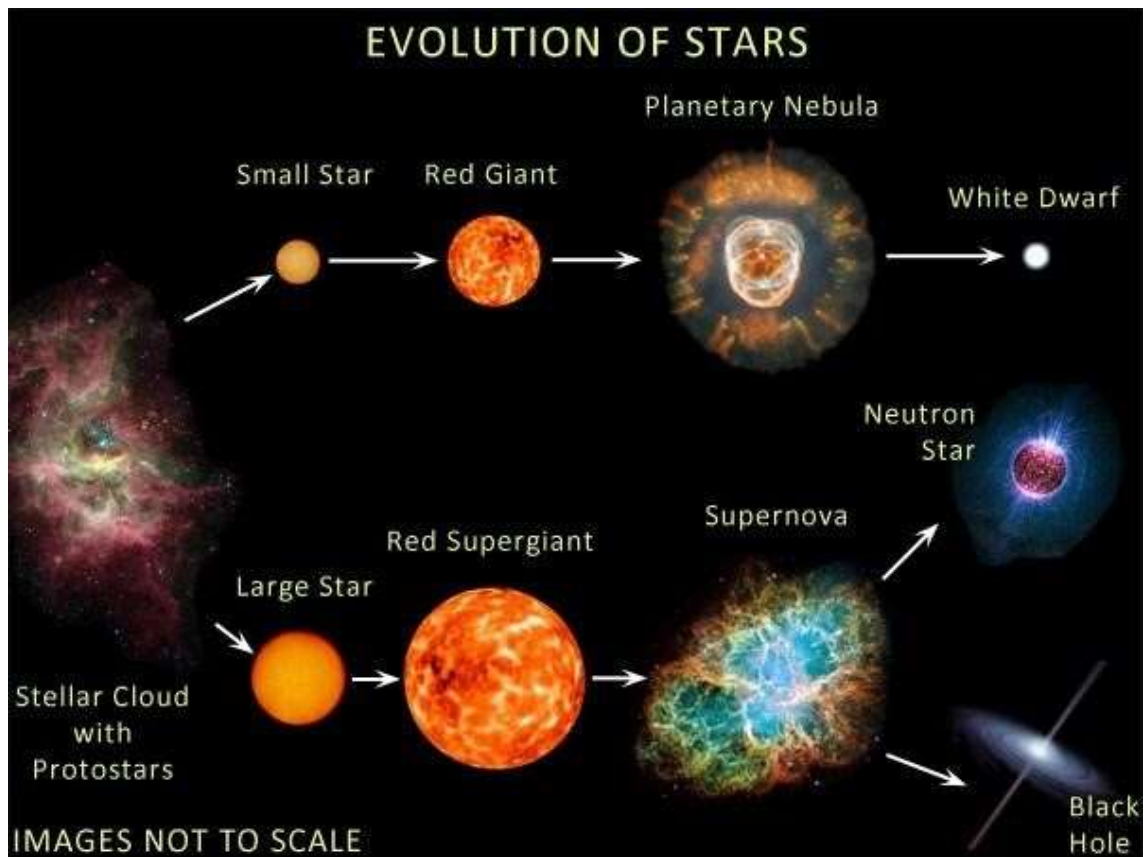


Image credit: www.nurmuhammad.com/star-formation-levels-of-the-heart/

If the star has more matter than dark energy, an equivalent amount of matter and dark energy gets destroyed and the rest of the matter formed as a dwarf.

If the matter quantity larger than the dark energy portion of a supernova stage of the star, remaining matter forms as a neutron star. The neutron star is very high density, composed predominantly of closely packed neutrons. After a supernova explosion, by the gravitational collapse of the remnant of a massive star, neutron stars will form.

Since the nova results only white dwarf or black dwarf, nova forms from a star has more matter than the dark energy.

If the dark energy portion larger than the equivalent matter quantity, then forms a pulsar (not the black hole). A pulsar is a highly magnetized rotating object that emits beams of electromagnetic radiation out of its magnetic poles. It is like a quasar. Since black holes form only the center of a galaxy, remaining dark energy forms as a pulsar.

2.5. Special Relativity and Fluid Flow

Consider the fluid equation.

$$\dot{\rho} + 3\frac{\dot{R}}{R}\left(\rho + \frac{P}{c^2}\right) = 0 \quad (\text{Fluid Equation})$$

Considers a state where $\dot{\rho} = 0$, then

$$P = -\rho c^2$$

Which is explained as the pressure of vacuum energy, where $\dot{\rho} = 0$ cosmological constant dominates the universe.

Consider an initial stage with no matter in the universe and nothing all over. Then according to the fluid equation $(\rho) + (-\rho c^2)$ can be generated without effect to the equation. In the fluid equation, it was written as

$$(\rho) + ([-\rho * c^2]/c^2)$$

According to the special relativity, it explains as

density ρ + negative density $(-\rho)$ * expand speed c * compressed by speed c density ρ + dark energy $(\Lambda = -E)$ * compressed by speed c density ρ + anti-matter $(-\rho)$

it is comparable with special relativity energy $\rightarrow$ mass transformation.

$$0 = E - E$$

$$0 = (E/c^2) * c^2 + (-E/c^2) * c^2$$

$$0 = \rho * c^2 + (-\rho) * c^2$$

$$0 = \rho + ([-\rho * c^2]/c^2) \text{ (equivalent to fluid equation)}$$

It can explain as positive density can generated with negative density expand by speed of light and apply compression of speed light again. This expansion of speed of light apply, since the opposite force to compression of energy by speed of light.

It explains how the initial mass generated as positive density and dark energy compressed by the speed of light. Not the positive density expands by speed light nor the positive mass and anti-matter. It also explains dark energy as negative pressure. density ρ + dark energy $(\Lambda = -E)$ * compressed by speed of light

2.6. The General theory of Curvature

The Robertson-Walker metric explained our universe as homogeneous and isotropic as follows.

$$ds^2 = c^2 dt^2 - R^2(t) \left[\frac{dr^2}{1 - kr^2} + r^2(d\theta^2 + \sin^2 \theta d\phi^2) \right]$$

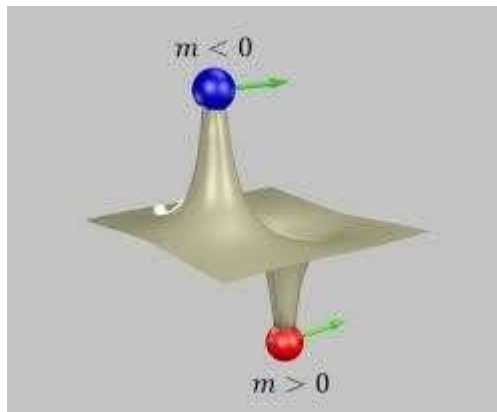
where k is the curvature, and t is the time measured by a fundamental observer (at rest with local surroundings), and R is a time-dependent scale factor.

According to the curvature, geometry of the universe explain as follows.

- $k = 1$, Universe is closed
- $k = 0$, Universe is flat
- $k = -1$, Universe is open

The universe consists of matter, energy, dark energy, and anti-matter. From that universe, geometry contains matter only.

Negative and Positive Mass



Friedmann's energy equation explains the conservation of energy and it can rearrange as follows.

$$\frac{1}{2}m\dot{R}^2 = \frac{4\pi G m R^3 \rho}{3} - \frac{1}{2}mc^2k + \frac{4\pi G m R^3 \rho_v}{3}$$

K.E.
P.E.
constant
cosmological

particle E.
constant

Where k is the curvature. Therefore the curvature explains the constant particle energy and depends on the matter change of the university. Energy also expresses as matter from special relativity.

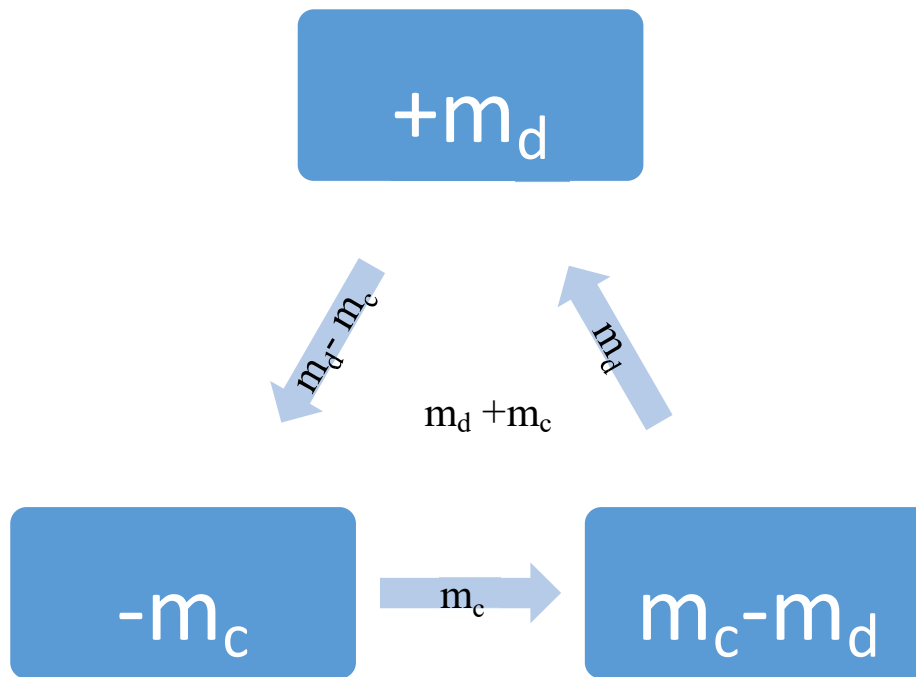
$$m = E / c^2$$

if the matter space increasing, the universe is open and $k < 0$, if matter increasing only and $k = -1$. If the matter space decreasing, the universe is closed and $k > 0$, if matter decreasing only and $k = +1$. Then curvature k can express as

$$k = \frac{(+m) - (-m)}{(+m) + (-m)}$$

Where (+m) = generated mass in the universe

(-m) = destroyed mass in the universe, mass can be destroyed creating equivalent energy in star, equivalent $m = E / c^2$ General curvature can be as follows.



Then
$$\frac{m_d - m_c}{m_d + m_c}$$

Where m_c = matter created, m_d = matter destroyed

when $m_d = 0$, then $k = -1$, open universe. when $m_d = m_c$, then $k = 0$, flat universe. when $m_c = 0$, then $k = +1$, closed universe.

2.7. Expanding Universe

After the origin of the universe, it contains only radiation matter and dark energy. Since matter and anti-matter gets expansion of speed of light.

Consider the curvature of this time. curvature $k = \frac{m_d - m_c}{m_d + m_c}$

Then the universe has only matter creation, $m_c > 0$ and no matter destroy since no star formation yet. Therefore $m_d = 0$.

Then curvature $k = -1$ until the $m_d > 0$.

The matter destroying starts only after star creation. Stars convert matter of star to energy and $m_d = E/c^2$. Therefore, m_d is the equivalent amount of matter of the energy created in a given time.

After the stars forming $m_d > 0$ and $k < 0$, until the $m_d = m_c$. Therefore, until the $m_d = m_c$, the universe will expand and open. In this expanding universe, $m_d < m_c$. Matter creation also makes dark energy/anti-matter creation and matter destroying makes a reduction of matter. This makes Ω_Λ dominated the universe.

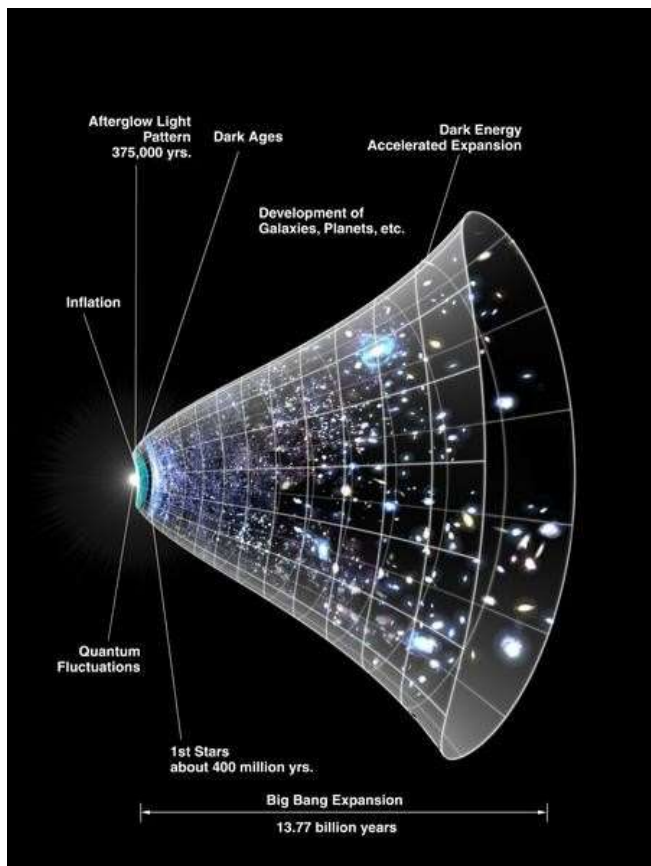


Image credit: commons.wikimedia.org/wiki/File:CMB_universe_expansion

For the universe to become flat, i.e. $k = 0$, matter creation of the universe should equal the equivalent matter destroying by creating energy in the star at the moment.

Therefore the expansion of the universe depending on the process of black holes, which creates matter (with anti-matter to grow black hole) and the process of stars (which converts matter to energy).

Power for the expansion is obtained from matter creation, which creates a pull of expansion of speed of light. This was responsible for the process of black holes. Opposite power generates by matter destroying, i.e. converting matter to energy makes compression of the speed of light. This was responsible for the process of stars.

2.8. Exhausting Universe

If the $m_d = m_c$, which is matter creation of the universe and matter destroying by creation energy are equal, the universe gets flat. But the matter creation $m_c > 0$ and matter destroying $m_d > 0$, the process of black holes and stars remain. Which makes the universe to exhaust.

Therefore the process of black holes and the process of stars get equivalent to make the universe flat. Since the matter generation still exists, there is enough raw material, i.e. matter is there for star formation and the process of the star.

Therefore $m_d > 0$, if the $m_c > 0$. Never becomes $m_d = 0$, if $m_c > 0$.

For the creation of matter, there should be compression of the speed of light with the expansion of the speed of light. In the exhausting of the universe, all the forces of the universe get balance.

Flat Universe

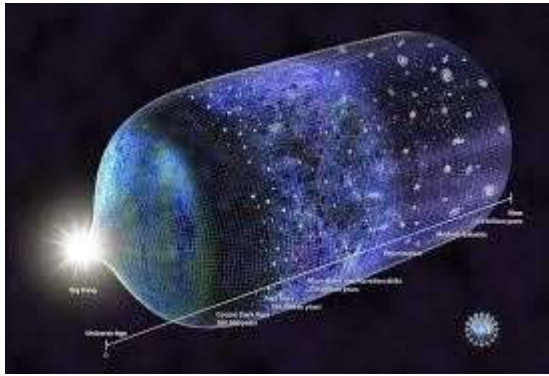


Image credit: www.fineartamerica.com

This will make $\Omega_m = \Omega_\Lambda$. Then it will come matter-dominated universe and pressure of the universe comes to zero i.e. $P = 0$. Then there will no way to make $P = -\rho c^2$. This will cause since the expansion pressure of black holes balances the compression pressure of the process of stars. Then the process of black holes of matter generation is going to die.

It creates $m_d > m_c$ and $k > 0$. This will makes the compression universe.

2.9. Compression Universe

In the flat universe, $m_d = m_c$. When the process of matte generation i.e. the process of black holes going to die, then $m_d > m_c$. Then $k > 0$. Then the universe becomes closed and compression.

This also can cause to die the process of the star, since the lack of enough raw materials of matter. But $m_d > m_c$. Since the matter destroying the process of a star creates compression power of the speed of light, now more than the expansion power of the speed of lite, created by black holes. Then the universe began to compress. Also, matter quantity also reduced.

If all the black hole process becomes die there will be a no matter generation process in the universe. Then $m_c = 0$.

$$k = \frac{m_d - m_c}{m_d + m_c}$$

And $k = +1$.

Compression universe

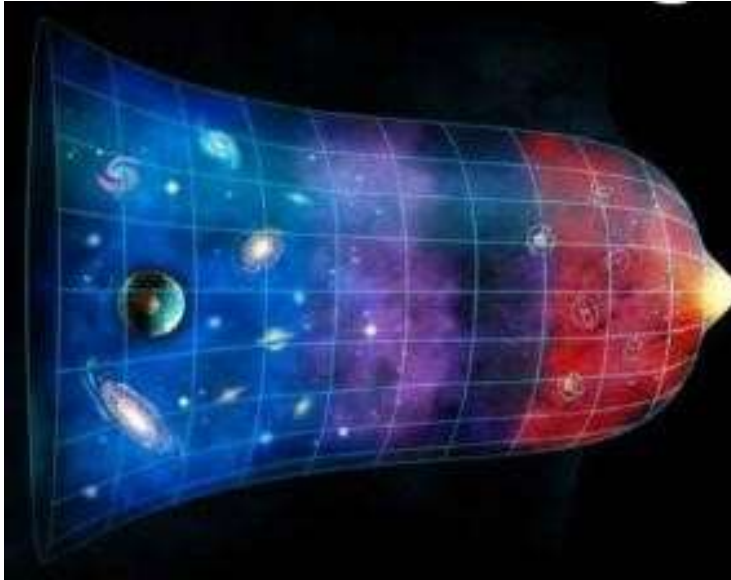


Image credit: www.mathsone.com

III. RESULTS

3.1. Theory of Space-Time

In physical cosmology, the expansion of space in homogeneous and isotropic models of the universe within the context of general relativity is governed by Friedmann equations.

$$\ddot{R} = -\frac{4\pi G}{3}R\left(\rho + \frac{3P}{c^2}\right) + \frac{\Lambda}{3}R \quad (\text{Force Equation})$$

$$\dot{R}^2 = \frac{8\pi G}{3}\rho R^2 - kc^2 + \frac{\Lambda}{3}R^2 \quad (\text{Energy Equation})$$

Universe critical density is given by:

$$\rho_{critical}(t) = \frac{3H^2(t)}{8\pi G}$$

The mass density ρ_m of the Universe is usually written in terms of a dimensionless parameter Ω_M given by:

$$\Omega_M \equiv \frac{8\pi G\rho_0}{3H_0^2}$$

where H_0 is the value of the Hubble constant today. And the cosmological constant Λ in terms of a dimensionless parameter Ω_Λ given by:

$$\Omega_\Lambda \equiv \frac{\Lambda c^2}{3H_0^2}$$

where H_0 is the value of the Hubble constant today. There is a third density parameter, which defines the “curvature” of the Universe denoted by Ω_k . Together, these three density parameters are given by:

$$\Omega_M + \Omega_\Lambda = 1 - \Omega_k$$

the Ω_Λ is according to the matter generation is the density of anti-matter. Not the dark energy. Therefore early universe Ω_m and Ω_r dominated. After the star formation, only Ω_Λ gets created.

Consider the force equation.

$$\ddot{R} = -\frac{4\pi G}{3}R\left(\rho + \frac{3P}{c^2}\right) + \frac{\Lambda}{3}R$$

The force
from
existing

The force
from matter
creation,
destroying

The force
from
existing

Force equation explains the forces for the acceleration of the universe. The ρ represents the existing matter density and Λ for existing dark energy. Therefore P represents the pressure generated by matter creation and matter destroying. When matter created, expansion pressure of $P = -\rho c^2$ created and matter destroying, compression pressure of $P = \rho c^2$ created. The total pressure is applied to force equation and these expansion and compression pressure explained by special relativity matter creation and matter destroying process.

When matter creation applies $P = -\rho c^2$. But the positive matter gets only $1/3$ of positive pressure for it. This is according to the term of force equation. Consider

$$\rho + 3P/c^2$$

$\rho + 3 * (-\rho c^2)/c^2$ which says, when applying a pressure P for negative matter, $1/3 * P$ applies for the positive matter.

In the origin of the universe, matter creates from applying pressure $P = -\rho c^2$. According to the force equation pressure apply for positive matter is $1/3 * \rho c^2$.

$1/3 * \rho c^2 = \rho * 1/3 * c^2$ Consider the fluid equation and this $1/3$ not apply for ρ , and then it is applicable for c^2 . Therefore expansion applies for the positive matter $= c/3^{1/2}$. Therefore positive matter will not get the expansion of speed of light, but get $1/3$ of expansion speed of light. This expansion matter will be generated as a radian matter. The pressure of radiation matter is $1/3 * \rho c^2$.

The force for the universe to accelerate and decelerate is also according to the matter generation and matter destroying. Since mass generation creates expansion power of the speed of light and matter destroying by creation energy makes compression power of the speed of light.

According to the force equation, positive matter creates desolation power (ρ with a minus sign), and dark energy itself negative sign gets deceleration power to the universe. Therefore dark energy accelerates the universe is false. But the gravity of masses makes deceleration power.

Consider the state equation.

$$P = w\rho c^2$$

According to the force equation and fluid equation, w is dependent only matter generation and matter destroying. i.e. process of black holes and stars. The P is the total pressure apply from matter generation and matter destroying, which is control the universe is expanding or compressing or flat. Therefore P is a function of matter generation and matter destroying, and the state parameter w .

State parameter, $w = \frac{m_d - m_c}{m_d + m_c}$ when $m_d = 0$, then $w = -1$, black hole dominates. when $m_d = m_c$, then $w = 0$, matter dominates. when $m_c = 0$, then $w = +1$, starts dominates.

w not gets 1/3 when the radiation matter dominates the universe, according to the force equation, w gets -1 in radiation dominant era and positive radiation matter applies only $1/3 * \rho c^2$.

3.2. Inflation

Consider the mass generation process.

$$\begin{aligned} E &= -E \\ (E/c^2) * c^2 &= (-E/c^2) * c^2 \end{aligned}$$

$$\rho * (\text{expansion of speed } c) = -\rho * (\text{expansion of speed } c)$$

$$\text{Radiation matter} = \text{Dark energy}$$

In matter generation, it-self gets the expansion of speed of light, since the matter created by compressing speed of light. This will generate the inflation expansion for the generated matter. This process gets small-time fraction since it will generate a sequence of steps and inflation expansion of small-time fraction will result.

This results in radiation matter get to expand the speed of light. The Big Bang inflation was predicted as 10^{-32} seconds of inflation.

Consider the Friedmann energy equation.

$$\dot{R}^2 = \frac{8\pi G}{3} \rho R^2 - kc^2 + \frac{\Lambda}{3} R^2 \quad (\text{Energy Equation})$$

According to the steps of matter generation, the first 2 steps contain energy and dark energy(Λ) only. The ρ is not yet generated and k also 0. then

$$\begin{aligned} \dot{R}^2 &= \frac{\Lambda}{3} R^2 \\ \dot{R} &= \sqrt{\frac{\Lambda}{3}} R \\ \frac{dR}{R} &= \sqrt{\frac{\Lambda}{3}} dt \\ R &\propto \exp\left(\sqrt{\frac{\Lambda}{3}} t\right) \end{aligned}$$

Therefore the first 2 steps in matter generation, there is an exponential expansion and result in inflation. In the second step compression of the speed of light also results in the expansion of the first step.

Here Λ is a negative value and the square root of negative Λ is a complex number. Therefore the real part is applicable to positive matter and complex part applicable to the negative matter. Then here exponential expansion applied to the negative matter of dark energy. Positive energy gets compression of the speed of light to create matter.

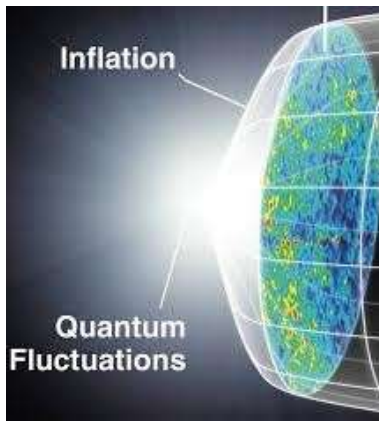


Image credit: leospa.ntu.edu.tw/theory-2/inflation-and-early-universe/

In the inflation, dark energy expand to get the speed of light, no anti-matter generated, and therefore no structure formations.

In inflation, the universe consists of only radiation matter and dark energy. Since the higher expansion matter is generated as radiation matter and negative matter as dark energy, not the anti-matter.

In the third step, ρ will be generated and k gets -1. Also, positive matter density and dark energy get generated and those will negate since the equal amounts. Then,

$$\dot{R}^2 = -k c^2$$

$$R = c t + \text{constant}$$

It explains $R \propto t$, but $R = ct$ (time * speed of light). In this expansion, according to the force equation matter gets only $c/(3)^{1/2}$ expansion and radiation matter generated. Since the relative expansion, dark energy does not create anti-matter. But dark energy and matter formed a structure of stars. Then the matter destroying process starts as $-E + mc^2$.

When the $m_d > 0$, the matter destroying process will happen in the process of stars. To destroy the created energy with dark energy, a supernova or nova process should start. But supernova and nova create the last stage of the star. Therefore dark energy portion always grater than the matter quantity of the universe, until dark energy and energy get destroyed.

Therefore the expansion of the universe gets a complex number which is a complex part only. Which is according to the Energy equation. Then expansion applies only to the dark energy portion of the universe and matter quantity gets a relative expansion to the dark energy. Therefore matter the size will remain the same without expansion. If matter gets expansion matter size also should be expanded.

When the matter of destroying the process starts, it will generate the compression power of the speed of light. Then overall universe expansion reduces below the speed of light. To create dark matter, expansion needs to get the speed of light. This will creates antimatter and form black holes. Then structures create around black holes as galaxies.

3.3. Flat Universe

In Flat universe curvature = 0. Consider . $k = \frac{m_d - m_e}{m_d + m_e}$

when the matter creation(m_e) equals matter destroy(m_d), then $k = 0$. But the matter generation and destroying(process of stars) not stopped. Then,

$$\dot{R}^2 = \frac{8\pi G}{3}\rho R^2 + \frac{\Lambda}{3}R^2$$

It gives $R = \exp\{[(8\pi G + \Lambda)/3]^{1/2} * t\}$

Considering the current values ($\Omega_m=0.3$ and $\Omega_\Lambda=0.7$) as well as matter destroying, $(8\pi G + \Lambda)/3$ gets negative value. Since matter gets destroyed in star but not negate with dark energy (supernova/nova has to come in the last stage of a star). Therefore $R = e^{-|r|t}$, where

$$r = \frac{8\pi G}{3}\rho + \frac{\Lambda}{3}$$

Therefore R will get smaller value.

Flat universe

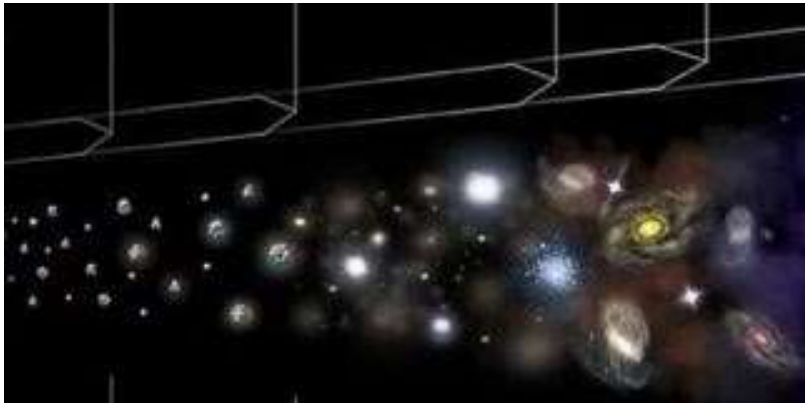


Image credit: www.nasa.gov

3.4. Collapse

Since the matter generation process exists, the matter destroying process i.e. process of the star is not stopped. Therefore it can assume if $m_c > 0$, then $m_d > 0$.

But in a flat universe, within $R > 0$, then sometimes get cannot create any matter since space expands smaller value or no expansion. Therefore matter generation will reduce and get stopped. ie. $m_c = 0$. Then no matter or dark energy gets generated.

Then $k = +1$.

Since. $k = \frac{m_d - m_c}{m_d + m_c}$

then the universe will be closed and collapsed. When $k = +1$, and if positive matter and dark energy are equal, then $R = -ct$. Universe collapse by the speed of light in the complex part. Since the universe collapse in the speed of light, matter flows final point to speed of light, then matter will convert to energy.

According to the steps of matter destroying, the final step of the universe is only energy and dark energy.

$$-E + mc^2 = 0$$

$$-E + E = 0$$

Before the final step, all matter gets $E = mc^2$ and transform into positive energy. Here is the same as inflation. Consider the last step, it has only dark energy and positive energy.

$$\dot{R}^2 = \frac{\Lambda}{3} R^2$$

$$\dot{R} = \sqrt{\frac{\Lambda}{3}} R$$

$$\frac{dR}{R} = \sqrt{\frac{\Lambda}{3}} dt$$

$$R \propto \exp\left(\sqrt{\frac{\Lambda}{3}} t\right)$$

Then Λ is a negative value and the square root of negative Λ is a complex number. Therefore this exponential expansion of anti-matter creates dark energy. Finally, energy and dark energy get negate and the universe becomes nothing.

Collapse



Image credit: www.insidetheperimeter.ca

3.5. The Fate of the Universe

Possible scenarios for the evolution of the universe described as the ultimate fate of the universe. For the description of the evaluation of the universe, some major parameters used; ρ – density of matter k – curvature of the universe

Ω – density parameter

According to the Friedmann equations, the universe describes by various models ($\Lambda=0$). Models of universe

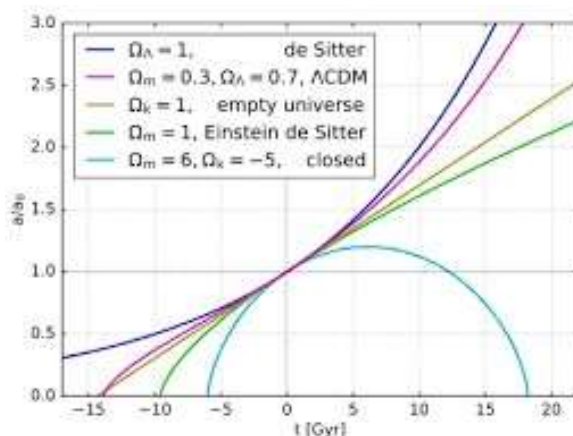


Image credit: en.wikipedia.org/wiki/Age_of_the_universe

- Milne model $\rho = 0, k < 0$

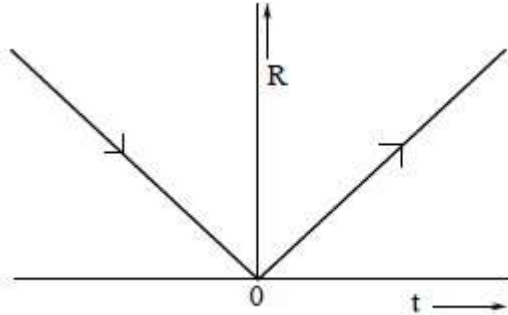
In here

$$\dot{R}^2 = -k c^2$$

$$R = \pm \sqrt{|k|} c t + \text{constant}$$

Also

$$R(t) \propto t$$



Expansion of the universe for the Milne model ($\rho = 0, k < 0$)

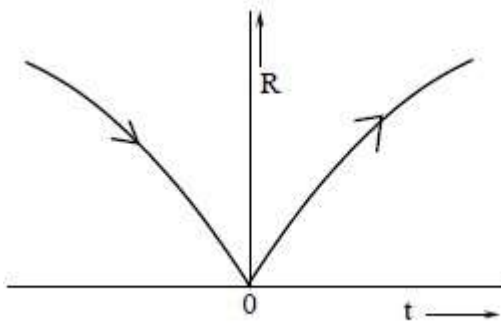
- Einstein de Sitter (EdS) model $\rho > 0, k = 0, \Omega = 1$

In here

$$R(t) \propto t^{2/3}$$

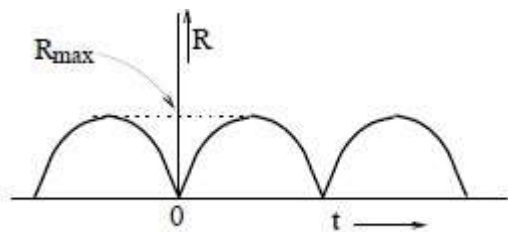
This assumes matter dominated universe and

$$\rho \propto R^{-3}$$



Expansion of the universe for the EdS model ($\rho > 0, k = 0$)

- Closed models (Oscillating universe) $\rho > 0, k > 0, \Omega > 1$ In here universe collapsed to a big crunch.



Expansion of the universe for the closed model ($\rho > 0, k > 0$)

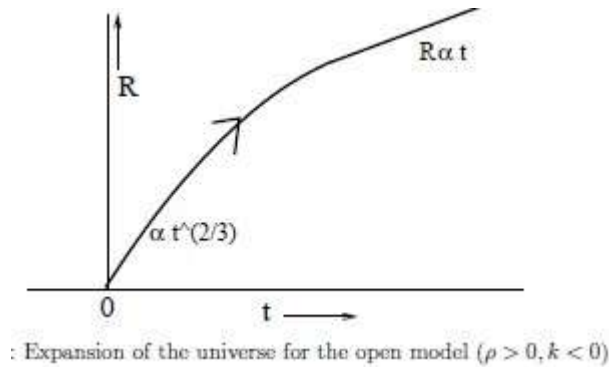
- Open models $\rho > 0, k < 0, \Omega < 1$

If t is larger than R , ignore k and

$$R(t) \propto t^{2/3}$$

If t is larger than R , k dominates

$$R(t) \propto t$$



- Radiation-dominated era $\rho_r \gg \rho_m, k=0$
Here $\rho \propto R^{-4}$ and $R(t) \propto t^{1/2}$

According to the universe describe by matter generation and matter destroying, there will be inflation, expansion, flat, compression, and collapse universe exists. Universe starting from nothing and end with also nothing. Then there will be nothing until another universe begins again and there will be a cyclic process.

The fate of the universe

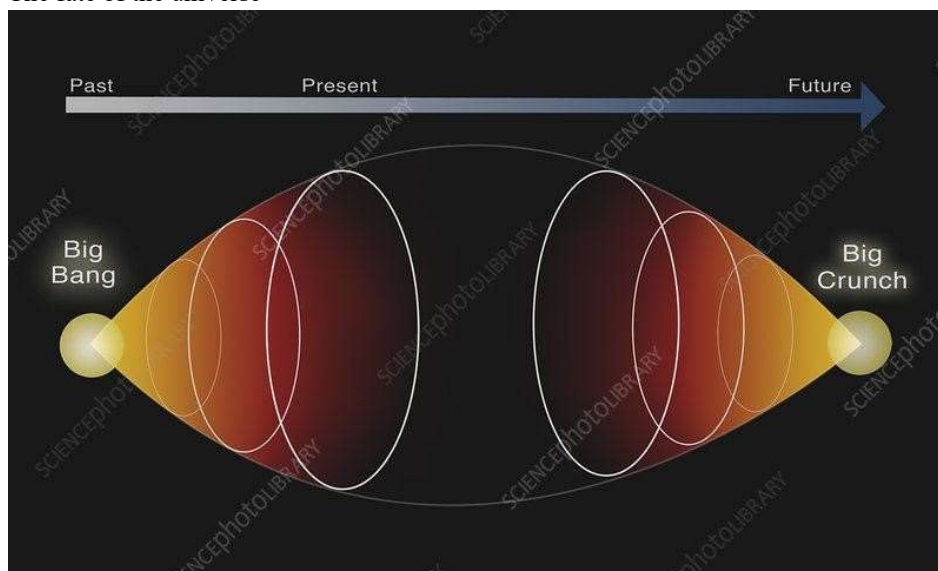


Image credit: www.sciencephoto.com

This is something different from the existing Big Bounced theory. Big Bounced theory explains the universe starting from dense matter state with Big Bang and in the end, it collapses to the dense state by Big Crunch. Then from this dense state of matter, another universe begins.

But this matter generation and destroying theory explain universe begin from nothing and ends with nothing. There will be a nothing period. Therefore this will explain four eras for the universe: nothing, expansion, flat, and compression. Then nothing again.

According to the current accept model of Λ CDM, after the origin universe radiation matter (Ω_r) dominated the universe. Then after nucleosynthesis matter gets created and matter (Ω_m) dominates the universe. After that dark energy (Ω_Λ) dominated. According to the matter generation, the first matter generated as radiation matter (Ω_r) and dominated the universe. is the density of anti-matter. Not the dark energy. Therefore early universe Ω_m and Ω_r dominated. Then after nucleosynthesis matter gets created and matter (Ω_m) dominates the universe. After the star formation, anti-matter created. The process of stars reduces the matter (Ω_m) density and anti-matter (Ω_Λ) gets dominated.

The fate of the universe describes by matter generation and matter destroying model as follows.

- Inflation($\rho = 0$, $k = 0$, Dark Energy and Energy only)

$$R \propto \exp\left(\sqrt{\frac{\Lambda}{3}} t\right)$$

Since the Λ is negative inflation in dark energy, opposite compression in positive energy makes positive matter.

- Expansion($\rho > 0$, $k < 0$)

When $k = -1$, positive matter and dark energy are equal, then

$$R = ct$$

When $-1 < k < 0$, since the matter destroying process,

Dark Energy > positive matter

Then R gets complex value. Therefore expansion applies to complex parts of dark energy or anti-matter. Then positive matter gets a relative expansion, that's why positive matter remains the same size without expansion.

- Flat($\rho > 0$, $k = 0$)

$$R = \exp\{[(8JIG + \Lambda)/3]^{1/2} * t\}$$

Since the matter destroying process and all related dark energy of matter destroying process not destroyed, $\Lambda > 8JIG$, therefore expansion in the complex part of dark energy. Since the universe is flat

$$R = e^{-xt}, \text{ where } x = [(8JIG + \Lambda)/3]^{1/2}$$

- Compression($\rho > 0$, $k > 0$)

When $0 < k < +1$, since the matter destroying process, Dark Energy > positive matter

Then R gets complex value. Therefore expansion applies to complex part of dark energy or anti-matter. Then positive matter gets relative compression, that's why positive matter remains the same size without compression.

When $k = +1$, and if positive matter and dark energy are equal, then $R = -ct$ for complex part of dark energy.

- collapse($\rho = 0$, $k = 0$, Dark Energy and Energy only) in the last step of the universe

$$R \propto \exp\left(\sqrt{\frac{\Lambda}{3}} t\right)$$

Since the Λ is negative, collapse in dark energy, opposite compression in positive energy makes positive matter. Positive matter traverse speed of light, since the compression speed of light, makes positive energy. The last expansion makes all anti-matter portions to dark energy and will negate with positive energy.

IV. DISCUSSION

4.1. Growth of Structure

One of the central problem in cosmology is the origin and evolution of the structure in the universe (galaxies, large-scale structures).

According to the Λ CDM model, the structure arises through the growth of density perturbations which originate in the early universe. Quantum fluctuations in the inflation, amplified by the exponential inflation of the universe results in the growth of density fluctuations.

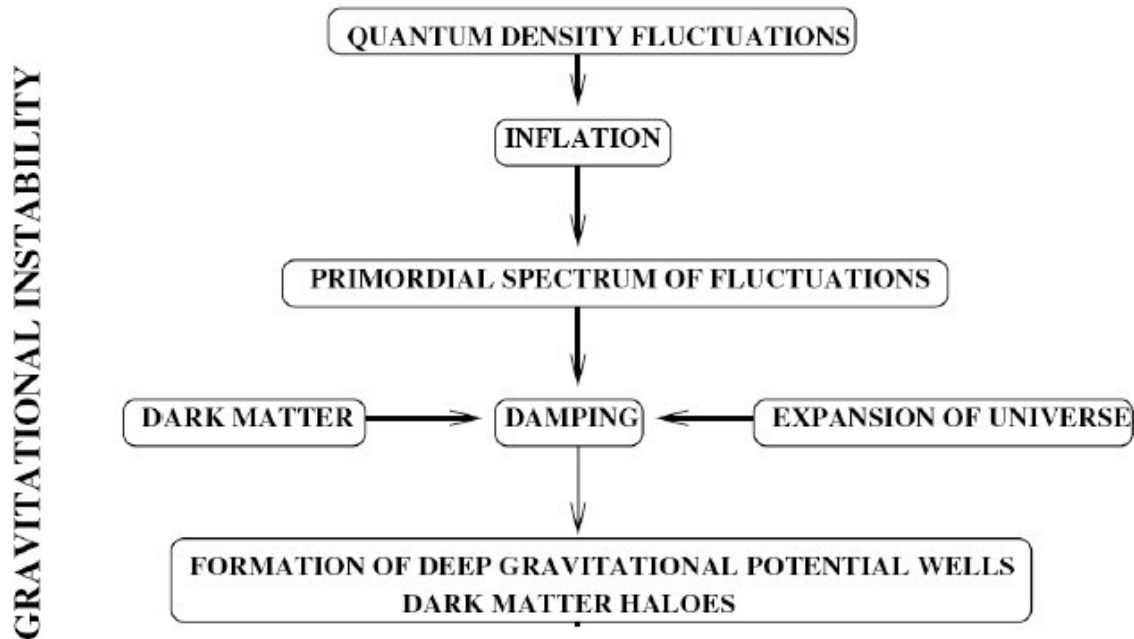


Image credit: www.astro.caltech.edu

Also, it is explained as galaxies formed by gravitational collapse, not from the origin of the universe. The criterion for Gravitational collapse was explained as Jeans Criteria for. It is explained by density fluctuations and galaxies and clusters formed by large density fluctuations.

The Big Bang model itself did not explain the method of structure formation. But the special relativity matter and anti-matter generation model explains how the structure formation, simply it is since the anti-matter attraction of the matter.

Special relativity explanation of matter generation process and matter destroying process with the matter, anti-matter, energy and dark energy will explain the galaxy creation, HI region, HII region, black holes, quasars, planets, stars, dwarfs, supernova, nova, neutron stars, pulsars and nebulae as growth structures of the universe. It explains these growth structures related to matter generation and matter destroying, which govern the expansion and compression of the universe.

4.2. Galaxy

Consider the hole inside a water tank.



Then water waves organize like a galaxy. Then consider a hole in the universe. Matter around the hole organizes the same as a whole inside a tank. The structure called a galaxy.

Consider a black hole in the universe. As explained earlier a black hole is a massive collection of anti-matter. The equivalent matter generated by a black hole is around the black hole. The black hole has negative pressure and attracts matter towards the black hole. Then the matter will move around the black hole as water waves around the hole.

Galaxy



Image credit: futurism.com/galaxy-classifications-from-dwarfs-to-spirals-and-beyond

4.3. Blackhole

The matter will generate with equivalent anti-matter or dark energy. Dark energy is negative energy and has negative pressure. Consider the properties of anti-matter. It is with negative pressure and compresses by as matter. And black hole like massive antimatter, which contains all anti-matter of masses of a galaxy [20].

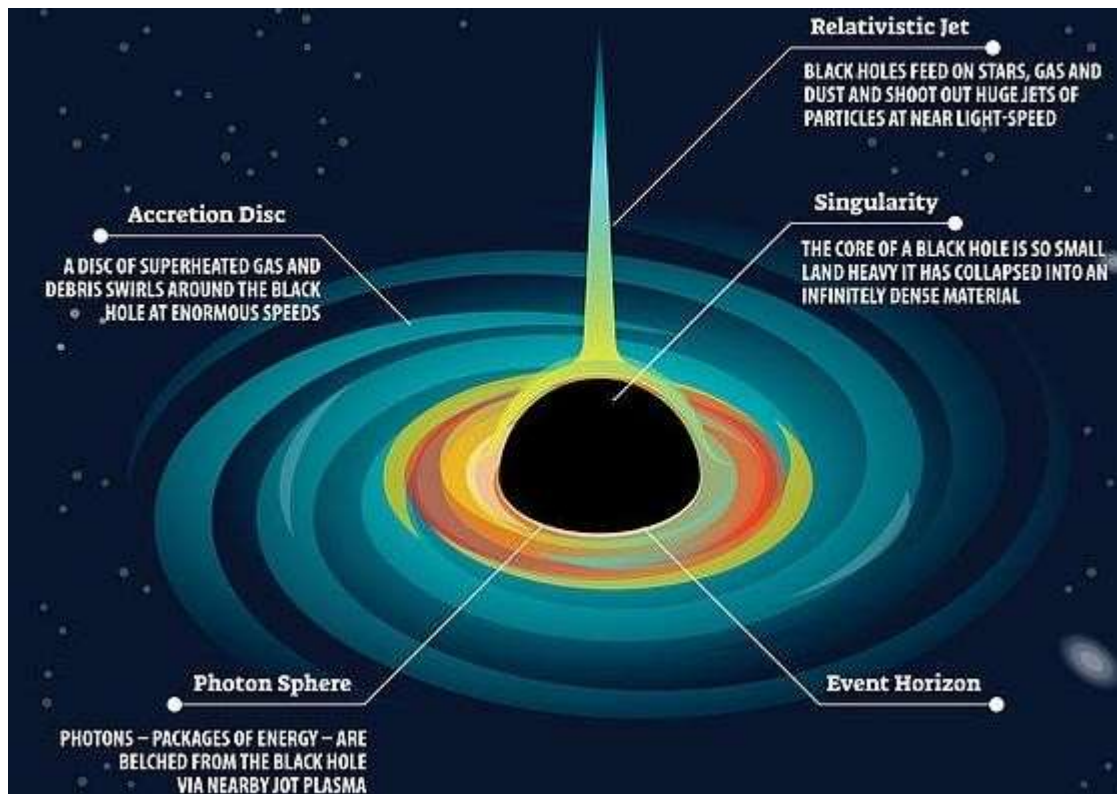


Image credit: www.dailymail.co.uk/sciencetech/

Quasar is the process of mass generation. It is observed that quasar emits radiation, which is like the generation of radiation matter. Considering the steps of matter generation, it will generate expansion power of the speed of light to the universe by the equitant amount of matter generation

4.4. Quasar

Consider a black hole with a quasar.

A quasar is an extremely luminous active galactic nucleus (AGN), in which a supermassive black hole with surrounded by a gaseous accretion disk [16]. Its energy is released in the form of electromagnetic radiation, which can be observed across the electromagnetic spectrum.

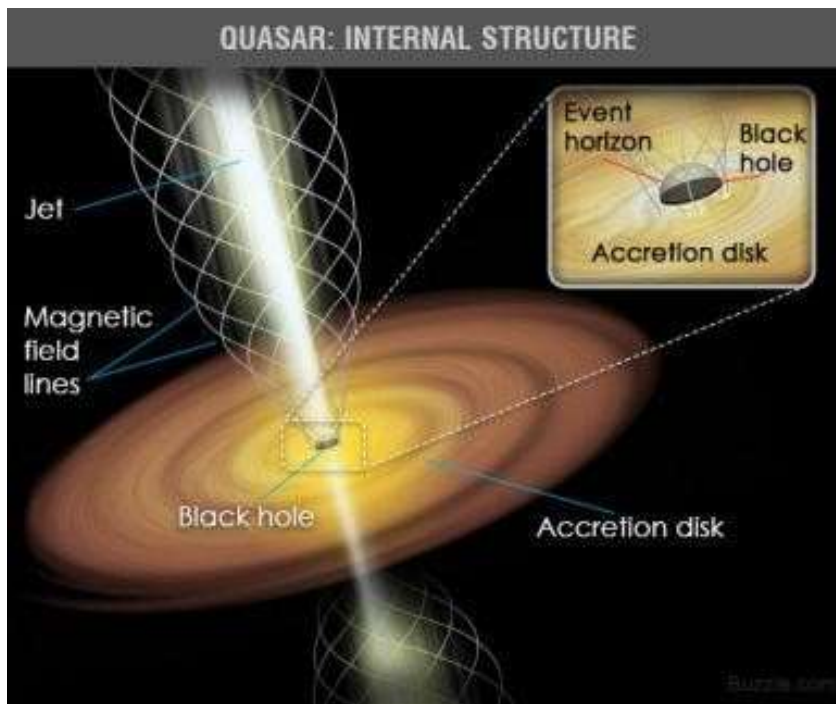


Image credit: empoweryourknowledgeandhappytrivia.wordpress.com/2015/05/19/quasar/

Consider the mass generation process, which generates radiation matter with anti-matter. Generation of radiation matter like energy is released in the form of electromagnetic radiation in a quasar.

4.5. Planets

From the matter generation, matter generates as radiation matter. After the nucleosynthesis, baryonic matter generated. From a massive collection of baryonic matter, planets are formed [18].

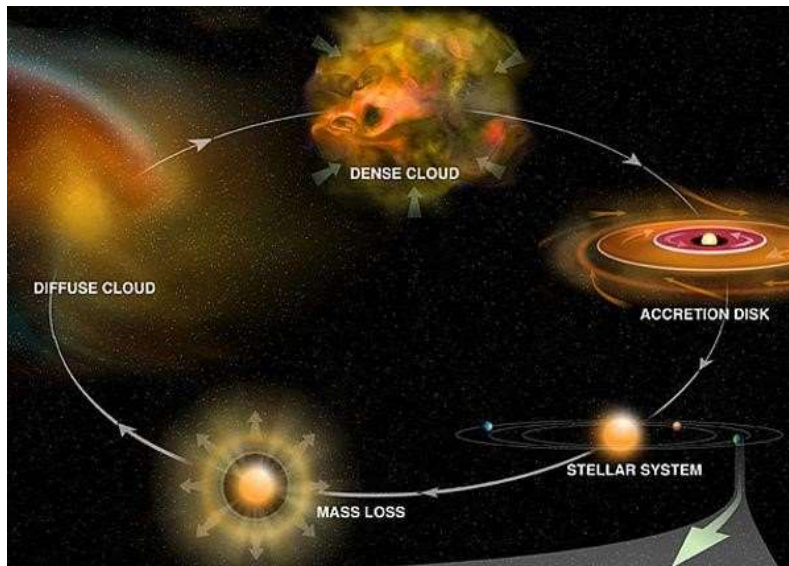


Image credit: www.everythingselectric.com/planet-formation-theory-debunked/

4.6. Stars

Apart from the formation of planets, baryonic matter and dark energy also get connected and form an object called a star. Since the negative pressure of dark energy, the structure is large, since more matter gets attract. Stars are formed in the HII region, which is the region of matter and dark energy connected. Since the dark energy connection, the matter got ionized.

Consider the star formation process of the current explanation. For low-mass stars, after nuclear fusion, the core will collapse. Then expelled of outer layers of the star will form a planetary nebula. The remaining core formed as a white dwarf and eventually cools to become a black dwarf. For high-mass stars are born in nebulae and evolve as a giant star. Then massive star will undergo a supernova explosion. Then it will become a neutron star or the core is swallowed by its own gravity and become a black hole that readily attracts any matter and energy that comes near it.

According to matter-energy transformation, the process of stars needs dark energy to present. Otherwise matter needs to get the velocity of the speed of light to transform into energy. When the dark energy is present, the matter will expand in the speed of light by creating light energy. Therefore, star formation process is the process of matter gets companion with dark energy. Therefore, star is a special object made up of matter and dark energy and reaches sufficient density. When the dark energy presence with sufficient density, matter will start nuclear fusion to create energy.

It is only the process of matter transform into energy. In the process of matter destroying with dark energy is the next step. Consider the life cycle of stellar.

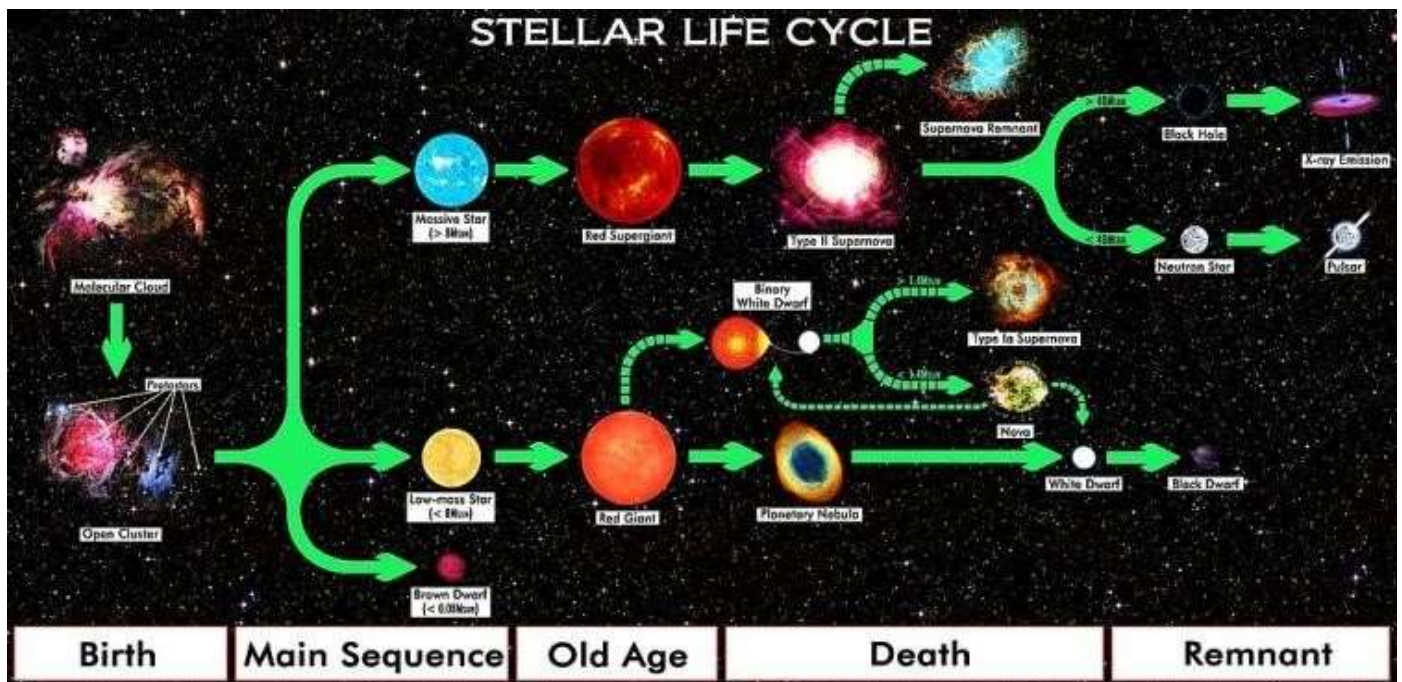


Image credit: www.nurmuhammad.com/star-formation-levels-of-the-heart/

If the star formation gets enough density of matter and dark energy, according to the mass, large star or small star formed. If not sufficient dark energy, then results in brown dwarf. The mass transformation to energy process over, stars get the stage of Supernova or Nova.

4.7. Supernova and Nova

Supernova is a powerful and luminous stellar explosion [2], which results in a neutron star, a black hole, or completely destroyed. Nova is a transient astronomical event that causes the sudden appearance of a bright, but not energetic as a supernova (José and Hernanz, 2007), and results in white dwarf or black dwarf.

Therefore, supernova and nova are like the energy destroying step of the matter destroying process. If the star gets an equivalent amount of matter and dark energy, then the supernova will result in nothing and completely destroyed. Considering the nova, which is results in only white dwarf or black dwarf, therefore nova form from the star which has more matter than the dark energy.

Nova and Supernova

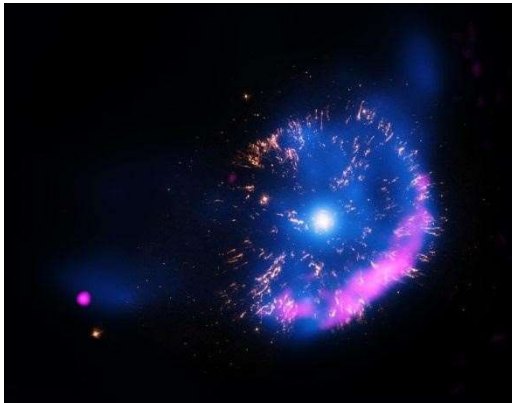


Image credit: pediaa.com/difference-between-nova-and-supernova/

4.8. Neutron star

Consider the properties of a neutron star. A neutron star is the collapsed core of a giant star from a supernova [3]. Therefore, neutron star results from a supernova if the matter quantity larger than the dark energy potion of the star.

Neutron Stars



Image credit: www.astronomytrek.com/list-of-different-star-types/

4.9. Pulsar

A pulsar is a highly magnetized rotating object and its magnetic poles emit out beams of electromagnetic radiation [12]. It is like quasar in a black hole. After the Supernova stage, it is explained as it will create a black hole. According to the matter destroying process, the dark energy larger than the equivalent matter quantity in the supernova, then remaining dark energy form a pulsar(not a black hole). Considering the properties of a pulsar, which is similar to a quasar. Then it is more like a pulsar, not a black hole. (Since the explained matter generation, a black hole only form in the middle of a galaxy and pulsar is quasar like object).

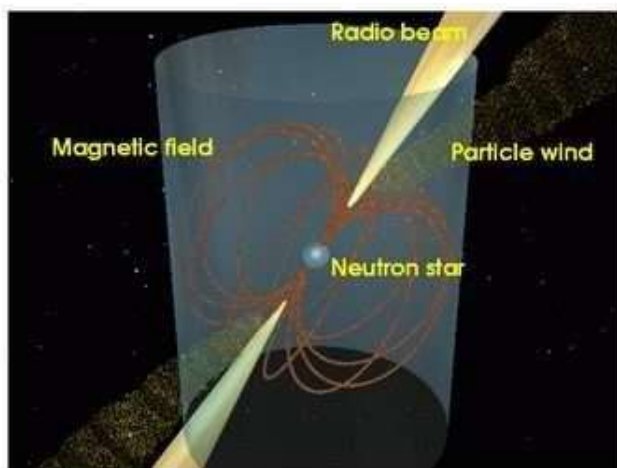


Image credit: phys.org/news/2006-03-part-time-pulsar-yields-insight-cosmic

4.10. Dwarf

When the formation of a star, if it was unable to produce a sufficient density of matter and dark energy, it will form a brown dwarf (Ma and Ge, 2013). Also if the star has more matter, an equivalent amount of matter and dark energy gets destroyed in the nova phase, and the rest of the matter formed as a white dwarf. Considering the nova, which is results in only white dwarf or black dwarf [4], nova form from the star which has more matter than the dark energy.

White Dwarfs	Brown Dwarfs	Black Dwarfs
		

Image credit: www.astronomytrek.com/list-of-different-star-types/

4.11. Nebulas

All the nebulas are in a phase of the star life cycle. Also, it is found in the HII region which is the region of matter and dark energy. When the dark energy present, the matter gets ionized and creates nebulas. Therefore, the HII region also gets ionized, since dark energy.

Nebular – Star life cycle

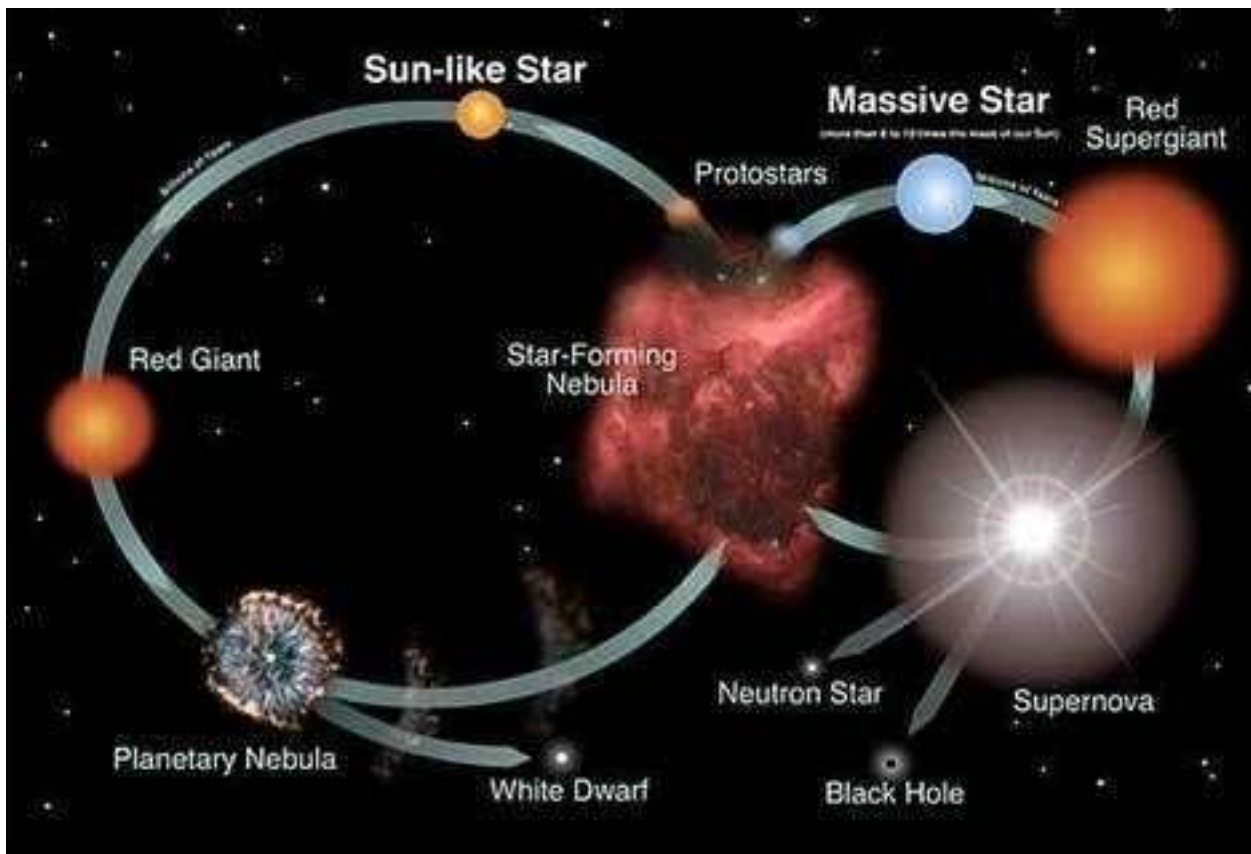


Image credit : www.startalkradio.net

Nebulas can be classified as follows.

➤ Supernova remnants

A high-mass star reaches the end of its life, a supernova will occur. The expanding shell of remaining matter and dark energy as gas forms a supernova remnant, a special diffuse nebula [23]. Although much of the optical and X-ray emission from supernova remnants originate from ionized gas, a great amount of the radio emission is a form of non-thermal emission called synchrotron emission. High-velocity electrons are oscillating within magnetic fields originates from this emission. Since the dark energy, the matter gets high velocity as explained in the matter destroying process and emits X-ray and radio emission.

➤ Planetary nebula

A planetary nebula is a type of emission nebula consisting of an expanding, glowing shell of ionized gas ejected from red giant stars late in their lives (Frew, and Parker, 2010). All planetary nebulas are a phase of the end of the life of a star of intermediate-mass, about 1-8 solar masses.

According to the process of matter destroying, it is formed from a star, which has more matter portion. Therefore planetary nebula also has more matter quantity than dark matter. A planetary nebula should result after a Nova explosion.

➤ Emission nebula

An emission nebula is a star-forming nebula formed of ionized gases that emit light of various wavelengths [24]. High-energy ultraviolet photons emitted from a nearby hot star is the source for ionization gas.

According to the properties, emission nebula has more dark energy than the matter. Therefore it emits light, light absorbs by dark energy portion is less.

➤ Reflection nebula

Reflection nebulae are clouds of interstellar dust that might reflect the light of a nearby star or stars [25]. The energy from the nearby stars is unable to create an emission nebula, since insufficient to ionize the gas of the nebula, but is sufficient scattering to make the dust visible.

According to the properties, dark energy and matter portions are equivalent. Therefore it only reflects in nearby stars, not emit light. Therefore dust is not visible.

➤ Dark nebula

Type of interstellar cloud that is so dense that it obscures the visible wavelengths of light from objects behind it called a dark nebula or absorption nebula. It obscures the visible light, such as background stars and emission or reflection nebulae [13].

According to the properties, the dark nebula can form from dark energy. Therefore it absorbs the light of the behind objects.

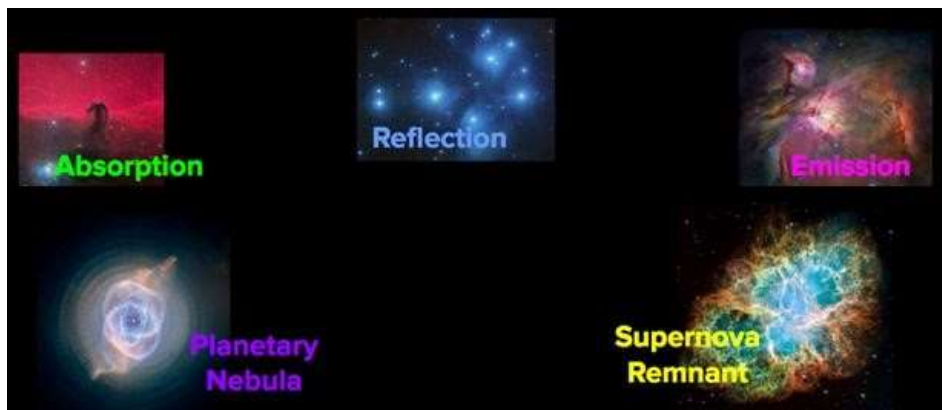


Image credit: astroa.physics.metu.edu.tr/twn/types

V. CONCLUSION

The Λ CDM is the standard model describing the origin and evolution of the universe. It explains the origin of the universe was Big Bang, before it very hot and highly dense state. Then inflation in small time and universe expands exponential rate. In this universe filled with radiation matter. Then big bang nucleosynthesis happens and baryons created in decoupling (radiation and matter equilibrium) era explained by CMB. Then becomes the matter-dominated era.

There are other theories explain the universe is Big Rip, Big Freeze, Big Crunch, Big Bounced, and Big Slurp. Big Rip is dark energy accelerates the expansion of the universe and would leave the Universe full of single, disconnected particles. Big Freeze is universe reaches its maximum entropy, then no more room for usable energy, or heat, to exist, and the Universe would die from 'heat death'. Big Crunch is since gravity, the universe reaches a point where it starts to decrease over time, and the universe collapse itself. Big Bounced derives from cyclic repetition interpretation of the Big Bang and Big Crunch. Big Slurp is a quantum fluctuation bubble that will expand at the speed of light in all directions and all elementary particles in-universe will be pulled together.

The special relativity explains how the matter transforms into energy. According to that matter can be generated with negative energy and matter can destroy with negative energy. The negative energy can be identified as dark energy. According to this matter generation is the process of black holes, emitting radiation from the quasar is the evidence. Matter destroying is the process of stars; energy and dark energy get negated in the supernova and nova explosions. Stars emit the light by the speed of light is the evidence of the matter destroying process.

The matter creation process makes the universe grow and the matter destroying process makes the universe shrink, combining this process makes the universe to curvature. Then curvature k can express as $k = \frac{m_d}{m_d + m_c}$

Where (m_c) = generated mass in universe

(m_d) = destroyed mass in the universe

Also, matter generation makes the universe to the expansion power of $-pc^2$ and matter destroying make the universe to compression power of pc^2 . This makes state equation same as the curvature.

State parameter $w = \frac{m_d - m_c}{m_d + m_c}$

Where (m_c) = generated mass in universe

(m_d) = destroyed mass in the universe

Therefore $k < 0$ is for the expanding universe. When matter creation and matter destroying get equals, then $k = 0$ and flat universe results. After starting dying the matter generation, $k > 0$ and compression universe results.

A black hole formed from anti-matter, which created with positive matter(the process of $m = E/c^2$), and created positive matter attract to the black hole make a galaxy. The inflation is the period of the first step of matter generation(which is $E + (-E)$). Then dark energy got inflationary expansion and positive energy get compression by the speed of light($E/c_2 + (-E)$).

Created matter makes neutral atoms make the HI region. The matter makes a connection with dark energy make ionized matter and make the HII region. Then nebulae created in the HII region by dark energy and positive matter. Sufficient density of matter and dark energy formed a star and make the process of $E = mc^2$. Which creates E and $-E$. Then E and $-E$ negated in the supernova and nova explosions. The remaining matter creates dwarfs or neutron stars. Remaining dark energy creates pulsars.

Therefore special relativity theory of matter generation and matter destroying explain the universe how to origin and evaluation as well as why it is happening. It explains the dynamics of the universe especially expansion and compression and how it is happening. How the power for the universe created by matter generation and matter destroying. Also, explain the inflation and collapse of the universe. It explains the universe's constitution of matter, anti-matter, energy, and dark energy. As well as it explains how the universe structures of galaxies and stellar and how those are evolved.

Comparing with Big Slurp theory, it is like the origin of the universe describe by matter generation. Then is the Big Bang inflation. This is not described as dense and hot matter exist, before the universe. The universe was origin from nothing. Then the universe expands as the Big Rip, while the dark energy wins the game. But until the matter destroying the process to get equal the matter generation process. Then is the flat universe, until dark energy loses the game. This is not like the Big Freeze, the universe did not come to maximum entropy, if entropy going to reduce, accordingly the universe will compress to adjust to entropy. Then the universe gets the compression and collapse as Big Crunch. The Big crunch results in the dense and hot matter, but this results in nothing. Then create nothing as the origin, then another universe to begin like Big Bounced theory. As the Big Bounced, the universe starts from dense hot matter and ends with the dense hot matter, but in matter generation and matter destroying, the universe starts with nothing and also ends with nothing.

Therefor ultimate fate describes by matter generation and matter destroying is nothing, expanding, flat, compression, nothing, and yet another universe to begin again. Also, universe dynamics consist of complex scale factors. If the scale factor is real, then expansion related to the positive matter. if the scale factor is complex, then expansion related to the negative matter.

REFERENCES

- [1] Artyom, V. Y. , Artyom V. A. and Pedro F. G. Astronomical bounds on future big freeze singularity, arxiv:0705.4108v1, 2007.
- [2] Bathe, H.A., Supernova mechanisms, Rev. Mod. Phys. 62, 801, 1990.
- [3] Bauswein, A. and Janka, H.T., Measuring neutron-star properties via gravitational waves from neutron-star mergers, arxiv:1106.1616v2, 2011.
- [4] Bessell, M., The Formation and Evolution of White Dwarfs, Proceedings of the Astronomical Society of Australia, 3, 1978
- [5] Bezrukov, F., The Higgs field as an inflation, arxiv:1307.0708v2, 2013.
- [6] Bodanis, D., A Biography of the World's Most Famous Equation, 2005.
- [7] Boesgaard, A.M., Big Bang Nucleosynthesis: Theories and Observations, Ann. Rev. Astron. Astrophys. 1985.23: 319-78, 1985.
- [8] Briscese, F., Elizalde, E., Nojiri, S. and Odintsov, S.D., Phantom scalar dark energy as modified gravity: understanding the origin of the Big Rip singularity, arxiv:0612220v2, 2007.
- [9] Elvis, M., A Structure for Quasars, The Astrophysical Journal, 545: 63E76, 2000.
- [10] Fang, N.Z., Entropy generation in the early universe by dissipative processes near the Higgs phase transition, Elsevier 95-1, 1980.
- [11] Frew, D.J. and Parker, Q.A., Planetary Nebulae: Observational Properties, Mimics, and Diagnostics, arxiv:1002.1525v1, 2010.
- [12] Hui, C.Y. and Becker, W., X-ray emission properties of the old pulsar PSR B2224+65, Astronomy & Astrophysics, 467, 1209–1214, 2007.
- [13] Itzgerald, M., Stephens, T. and Witt, A., Surface brightness profiles of dark nebulae - The Thumbprint Nebula in Chamaeleon, The Astrophysical Journal, 208, 1976
- [14] José, J. and Hernanz, M., Nucleosynthesis in classical nova explosions, Nuclear and Particle Physics, 34, 12, 2007.
- [15] Khoury, J., Ovrut, B.A., Seiberg, N., Steinhardt, P.J. and Turok, N., From Big Crunch to Big Bang, arxiv:0108187v4, 2002.
- [16] Lobanov, A.P. and Roland, J., A supermassive binary black hole in the quasar 3C 345, Astronomy & Astrophysics, 431, 831–846, 2005.
- [17] Ma, B. and Ge, J., Statistical Properties of Brown Dwarf Companions: Implications for Different Formation Mechanisms, arXiv:1303.6442v1, 2013
- [18] Mamajek, E.E., Initial Conditions of Planet Formation: Lifetimes of Primordial Disks, arxiv:0906.5011v1, 2009.
- [19] Mambrini, Y., Histories of Particles in the Dark Universe, 2013.
- [20] Merritt, D., Alexander, T., Mikkola, S. and Will, C.M., Testing Properties of the Galactic Center Black Hole Using Stellar Orbits, arxiv:0911.4718v1, 2009.
- [21] Silk, J., The Big Bang: Third Edition, Henry Holt and Company: New York, 2000
- [22] Singh, P. and Toporensky, A., Big Crunch Avoidance in $k = 1$ Semi-Classical Loop Quantum Cosmology, arxiv:0312110v3, 2004.

- [23] Vink, J., Supernova remnants: the X-ray perspective, arxiv:1112.0576v2, 2012
- [24] Walker, R., Emission Nebulae in Spectral Atlas for Amateur Astronomers: A Guide to the Spectra of Astronomical Objects and Terrestrial Light Sources. Cambridge: Cambridge University Press, 173–196, 2017
- [25] Witt, A., Multiple Scattering in Reflection Nebulae. III. Nebulae with Embedded Illuminating Stars, The Astrophysical Journal Supplement Series, 35, 1977.