Small Bang – A New Model to Explain the Origin of Our Universe.

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An expanding universe

In the early 20th century astronomers discovered that the Universe contains billions of galaxies, each containing billions of stars, but astronomers also believed in a static Universe model in which galaxies remain stable in space and maintain the same distance away from each other over time.

Thus when Albert Einstein developed the theory of general relativity in 1914, he included a cosmological constant in his equations, which generated either an attractive, no or repulsive force between the galaxies depending on the value of the cosmological constant. Einstein's cosmological constant modification generated a new force from the vacuum of space against the gravitational forces generated between galaxies which allowed for an equilibrium condition and kept the Universe static.

This static Universe model began to be questioned from the work of the Indian astronomer, Vesto Melvin Slipher, who in 1912 first observed that the Andromeda galaxy was moving away from the Milky Way galaxy.

In 1917, the Dutch astronomer Willem de Sitter formulated a theory based on Einstein´s equations (without the cosmological constant) according to which the Universe is expanding. In 1922, the model of one expanding universe was adopted by the Russian physicist Alexander Friedmann within a mathematical formulation that was based on general relativity, which eventually formed the basis of modern cosmology.

The work of Slipher was used by Georges Lemaître, who in 1927 concluded that galaxies could behave as dots painted on a balloon, which separate from each other when the balloon is inflated. So Lemaître developed a theoretical model in which the velocity of galaxies increase with distance, also proposing what he called the "primeval atom hypothesis" which states that in an initial moment the whole Universe (not only matter but space itself) was compressed into a single dot, which Lemaitre called "a primeval atom" or "a cosmic egg."

Lemaître's work was published in French and was therefore not widely used. Thus the relationship of proportionality between distance and speed of galaxies was discovered experimentally only in 1939, when Edwin Hubble analyzed light received from many galaxies. Hubble noted that all galaxies are moving away from the Milky Way, with speeds that increase proportionally with their distance, which became known as Hubble´s Law.

The discovery of Hubble's law definitively confirmed that the Universe was not static but was actually expanding. When finding out about Hubble’s work, Einstein himself acknowledged that the inclusion of a cosmological constant to maintain a static Universe was his biggest mistake.

The Big Bang Theory

In 1946, Hubble's work served as the basis for the physicist George Gamow to establish his theoretical model now known as the Big Bang theory. In this model Gamow considered that the matter of the galaxies that today are in expansion were initially all concentrated at a single point. Furthermore, Gamow considered that the current observed quantities of hydrogen and helium would have arisen from an initial Universe that was very hot and dense. Gamow also proposed the existence of a background residual radiation (today referred to as cosmic background microwave radiation) that would arise as a function of the initial conditions of the Universe and made a theoretical estimation of its intensity.

In this model, Gamow predicted that the early Universe was very hot and contained a type of hot plasma, composed of photons, protons, electrons and neutrons. In this initial state the photons could not travel freely, and thus the Universe was invisible. As the Universe expanded, the plasma cooled to a temperature of "only" 3000 degrees Fahrenheit once it was possible for electrons to combine with protons and neutrons to form atoms of hydrogen and helium, and so the photons began traveling freely through space that had become transparent. The space expansion had increased the wavelengths of these initial photons into the range of microwave radiation. Today this microwave radiation is perceived as a cosmic background radiation that permeates all of observable space.

Astronomers did not give much importance to the cosmic radiation proposed by Gamow, until it was experimentally confirmed only two decades after he predicted its existence.
In 1965, Arno Penzias and Robert Woodrow Wilson, who studied problems of noise in communication systems, accidentally discovered an electromagnetic radiation in the range of microwaves, which emanated from all directions of space and fills the entire Universe. This radiation was associated with the cosmic radiation that had been predicted by Gamow and this fueled one of the most important pieces of evidence to support the Big Bang theory since Hubble's initial discovery of the expansion of the Universe.

It is interesting to note that the term “Big Bang” is credited to Fred Hoyle, who in 1948 developed the Steady State theory as an alternative to the Big Bang theory. The Steady State theory is a model widely discredited in cosmology which describes a Universe that also expands, but in which new matter is created continuously in increasing intervals between galaxies. It is popularly reported that Hoyle coined the term "Big Bang" in 1949 during a radio broadcast in which he referred to the Gamow model pejoratively in order to defend his Steady State theory.

Cosmic Inflation

The Big Bang model was enhanced in 1981 when Alan Guth proposed the Cosmic Inflation theory which posits that the Universe in its initial stage went through a phase of exponential growth with some regions moving farther away from others at speeds greater than the speed of light, which does not contradict the theory of relativity of Einstein.

The Cosmic Inflation theory solved several problems of the Big Bang theory, one of which being the fact that cosmic radiation is very uniform throughout the Universe.

Considering the Cosmic Inflation theory, some regions of the Universe would have been able to have kept contact with each other before the cosmic background radiation had decoupled from matter (about 380,000 years after the Big Bang) and the homogeneous behavior observed today in this radiation had been generated.

Currently, in the Cosmic Inflation theory, space expansion is attributed to a hypothetical force field called inflation, which would be responsible for the exponential expansion of the Universe in its early stages.

Figure 1 shows an estimated value of cosmic inflation for our Universe. The first moment of the universe can be defined by the Planck time (10^{-42}s) which is the smallest possible fraction of time defined by Max Planck in the context of quantum mechanics.

In this initial time, the Universe would have had a size equal to the Planck length. The Planck length is the smallest possible size of the Universe according to quantum mechanics and is equal to 10^{-35}m.

As can be seen in Figure 1, the Universe grew to a size of 10^{-25} meters, at a time of 10^{-35} seconds once the cosmic inflation process began.

The initial cosmic inflation occurred in a very short time period, and some models have estimated that it ended at 10^{-32} seconds. Nevertheless, during the cosmic inflation, space expanded exponentially until it was 10^{50} times larger than its initial size.

At the end of cosmic inflation the Universe still continues to grow, but at a much slower rate.

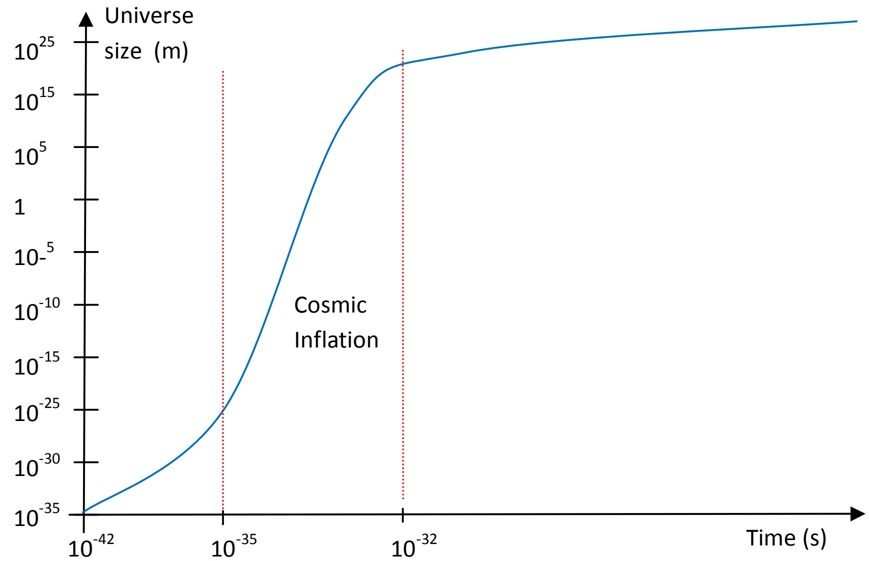

Figure 1 - Estimated values for the Cosmic Inflation.

Problems with the Big Bang Theory

Despite the Big Bang theory today being the cosmological model accepted by virtually the entire scientific community, the Big Bang model also still has several open issues and unanswered questions.

First, the Big Bang theory postulates an initial instance of space behaving at a singularity point whose size tends to zero but with an energy density and temperature tending to infinity. This infinite value generated by the Big Bang theory creates mathematical problems and inconsistencies that cannot be resolved in the context of the two main theories that we have today to treat the Universe on very large scales (Einstein's General Relativity Theory) and at very small scales (Quantum Mechanics.)

Also, the appearance of matter is not well explained in the context of the Big Bang theory. While according to special relativity, energy can be converted into matter via Einstein's famous formula (E = Mc^2), according to quantum mechanics for each particle of matter that is created there will also exist an associated particle of antimatter. For example, two photons can under certain circumstances annihilate each other and in this process generate an electron and a positron pair, or even a proton and an antiproton pair.

However, astronomical data points to the fact that our Universe is composed predominantly of matter and so we are unable to explain where the antimatter is that should have been created with the matter, creating an enigma called "the loss of antimatter problem."

The answer to this problem that is predominantly currently accepted was proposed in early 1966 by the Russian physicist Andrei Sakharov in a model that considers a small asymmetry or imbalance in the process of matter and antimatter creation.
According to Sakharov, an excess of a particle of matter for every billion pairs of particles that were formed in the Big Bang would solve the loss of antimatter problem.
For how antimatter is generated and combines with matter generating energy again, even a small imbalance would generate all the particles of matter in the known Universe.

But until now there has been no experimental proof of this asymmetry between matter and antimatter that was proposed by Sakharov. And so, the problem of the loss of antimatter remains today one of the great mysteries of physics.

Besides containing problems with the initial singularity and the loss of antimatter, the Big Bang theory does not explain exactly the formation of galaxy structures that we observe in the Universe. For example, in all galaxies that have been observed to date, astronomers have identified that in the center of each galaxy there exists a supermassive black hole that is typically equivalent in weight to millions of solar masses. The astronomers also have observed that there is a proportionality (of about 1/1000th) between the mass of a supermassive black hole and the mass of the galaxy that contains it. This proportionality seems to indicate a relationship between the process of galaxy formation and supermassive black hole formation. However, the model of galaxy formation derived from the Big Bang theory is unable to explain this relationship or explain the supermassive black hole formation, which continues to remain a mystery amongst the physics community.

Small Bang Model

The authors believe that the Big Bang Theory presents some open points for why it is sustained by a false premise, that all energy in the Universe observed today was generated at the initial time once the Universe emerged.

This “cosmic egg” assumption has been adopted for many reasons:

a) The law of matter and energy conservation states that the matter and energy observed today in the Universe have always existed, since its initial moment.
b) Observing the Hubble´s Law we can easily infer that in the past galaxies were closer to the limit of a very small space, in which all matter (and energy) were confined forming a “cosmic egg,” a region with extremely high temperatures and energy densities.
c) As the force of gravity acting on matter particles tends to attract them to each other, a counter force is required to keep the Universe expanding. Thus a "big explosion" solves this problem because from the initial “Big Bang point” particles of matter and energy are scattered throughout space as it expands.

Observing each one of these factors leads to a kind of "common sense" understanding that may be wrong. For example, the Universe expansion mentioned in (c) today is considered more linked to a period of cosmic inflation than the existence of an initial "cosmic egg" with temperatures tending towards infinity.

Thus, the authors believe that at the beginning of space and time that space-time contained no matter nor energy, and have developed a model called the "Small Bang" in which everything in the Universe arises due to cosmic inflation.

Figure 2 illustrates the basic difference between the Small Bang theory, proposed by the authors and the Big Bang theory. In this figure are shown two graphs indicating the amount of energy (including the energy contained in matter) over time. We can see in these graphs that in the Big Bang model the entire energy of the Universe already exists initially, while in the Small Bang model, the initial energy is zero, growing during cosmic inflation. In the Small Bang model part of the energy that exists in the inflation field is converted directly into photons and particles of matter and antimatter particles, and so when the Universe inflates it also fills with energy.

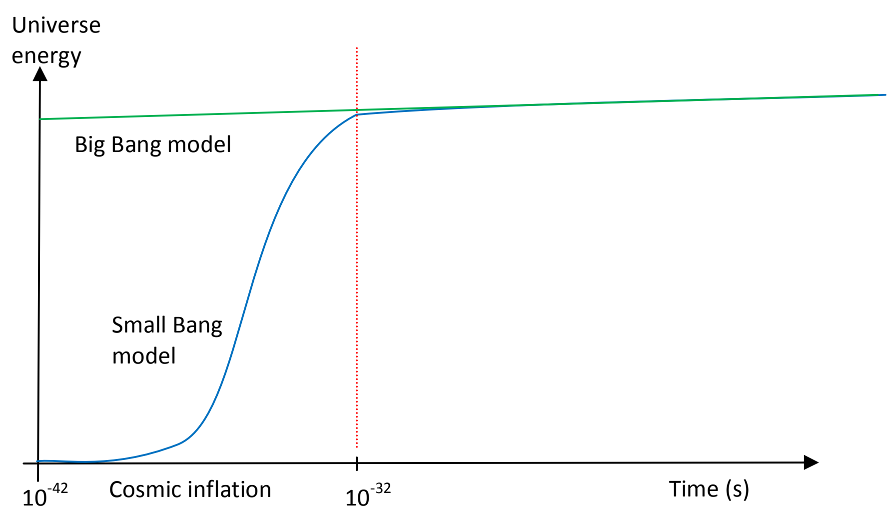

Figure 2 - A comparison of energy values over time for the Small Bang and Big Bang models.

Figure 3 shows two curves of energy density in the Universe over time that can also be related to the space temperature. In the Small Bang model the initial energy density and the space temperature is null growing during the cosmic inflation process and decreasing after that. In the case of Big Bang theory the energy density and temperature tend to infinity at the initial time, generating a series of problems including the inability to show these initial values in the graph of Figure 3.

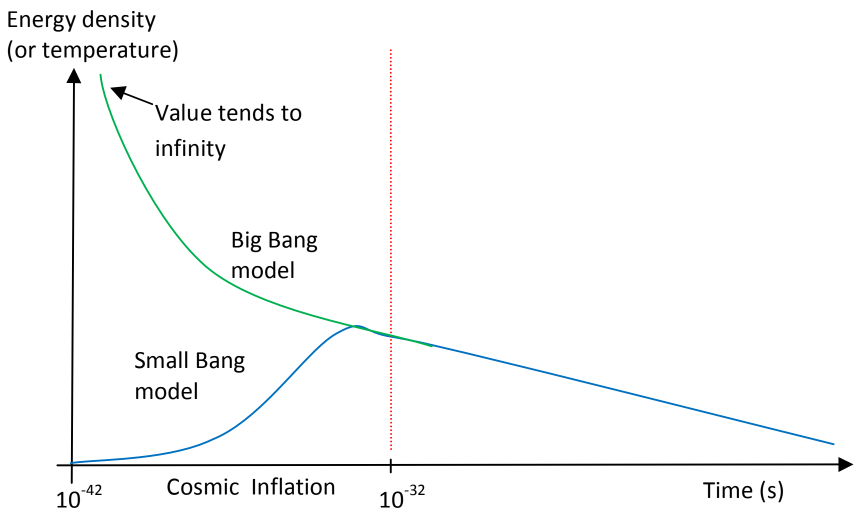

Figure 3 - Comparison of the energy (or temperature) density over time for both models.

It is important to note that in the graphs shown in Figures 2 and 3, the final conditions (after the cosmic inflation) have the same values. In this way some measurements performed after cosmic inflation cannot differentiate one model from the other.

Creation of space-time in the Small Bang theory

The Small Bang model considers that the Universe emerged from an empty bubble of space-time with a Planck length diameter.

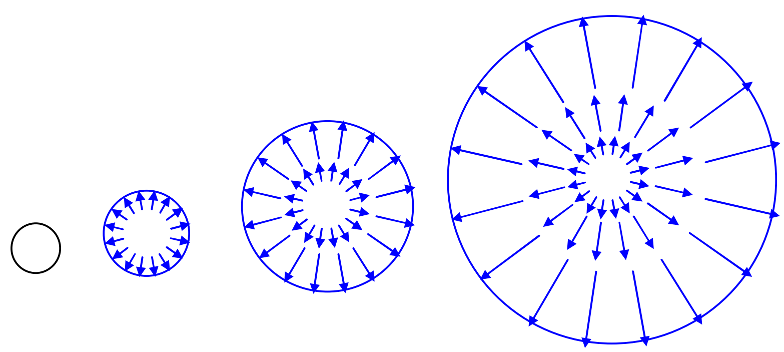

Figure 4 - Universe being initially an empty bubble expanding exponentially by a force field (inflation).

This bubble immediately underwent a process of expansion, which is connected to cosmic inflation, in which a force field called the inflation field acted on the space, increasing its size exponentially, as shown in Figure 4.

During the cosmic inflation process, the space size increased at high speeds, at speeds faster than the speed of light. While this bubble expanded the space-time behaved like a quantum vacuum, wherein as soon as quantum mechanical particles came into existence these virtual particles arose spontaneously and then annihilated themselves, keeping the total energy equal to zero.

Creating energy

Figure 5 shows an example, where two virtual photons (whose total energy is zero) arise along one individual trajectory (the dotted lines) and then annihilate themselves.

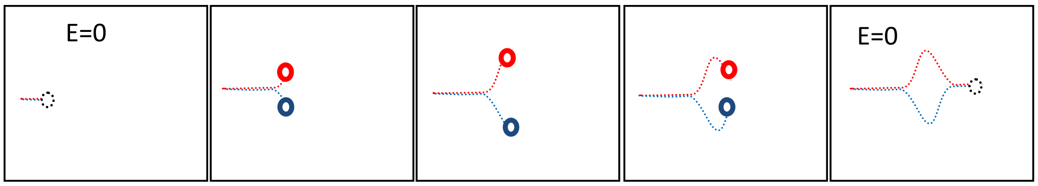

Figure 5 - virtual photons being generated and annihilated in quantum vacuum fluctuations.

As the cosmic inflation expands space at speeds faster than the speed of light, some virtual photons can be removed as shown in Figure 6. In this figure two space regions are illustrated by circles, generating a condition in which the photons are no longer annihilated. In this case cosmic inflation turns virtual photons into real photons, filling the space with energy.

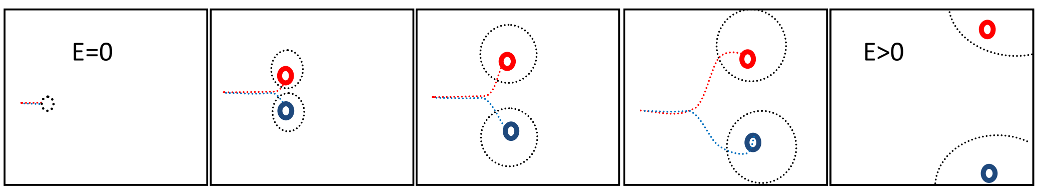

Figure 6 - virtual photons being separated due to cosmic inflation.

In Figure 6, it can be seen that the initial energy is equal to zero but the final energy is given by the photons created by the space inflation, that breaks the connection between the original virtual photons. At first, this break can cause a slight reduction in the expansion rate in a small region. Thus the Small Bang model predicts that part of the inflation field energy is converted into the energy of photons.

Creating Mass

According to quantum mechanics, two photons can interact generating pairs of particles of matter and antimatter, as shown in Figure 7, where an electron and a positron (positively charged electron made of antimatter) are generated.

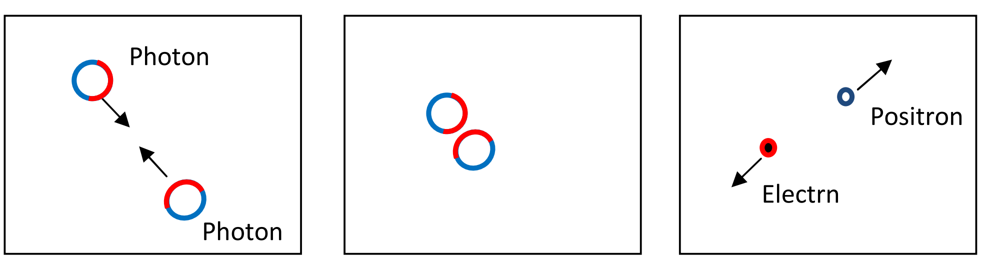

Figure 7 - photons generating an electron and a positron.

For high energy photons, the mass of the particles created will be greater and may generate a proton and an antiproton (the antiproton negatively charged and composed of antimatter), as shown in Figure 8.

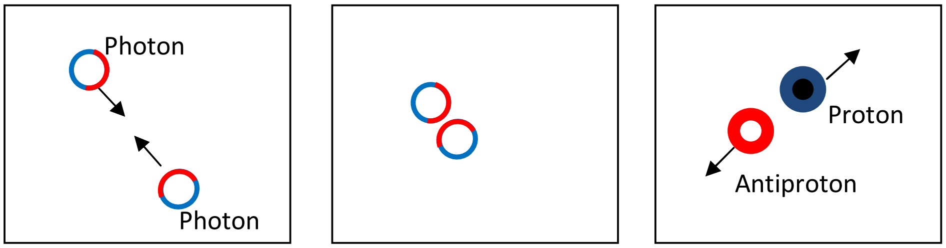

Figure 8 - High energy photons generating a proton and an antiproton.

In the Small Bang model, the photons generated at the beginning of cosmic inflation can have tremendously high energies in the order of the Planck energy (1.956×10^9 Joules). In this case, two photons can generate a pair of particles with a mass equal to the Planck mass (2.176×10^8 kg). This mass is sufficiently large to create two micro black holes, one composed of matter and the other composed of antimatter, as shown in Figure 9. These are the smallest black holes that may exist, because the radius (or event horizon) of each is equal to the Planck length (1.6×10^{-35} m).

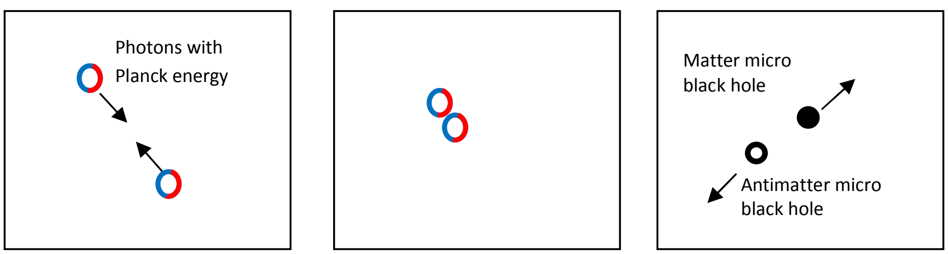

Figure 9 - Photons of high energy generating two micro black holes.

Interaction of matter and antimatter

In 2011, the Italian physicist Mario Villata proposed a new model where matter can exert a repulsive force on antimatter, creating a framework similar to that which occurs with electric charges, but with the matter repelling antimatter, as shown in Figure 10.

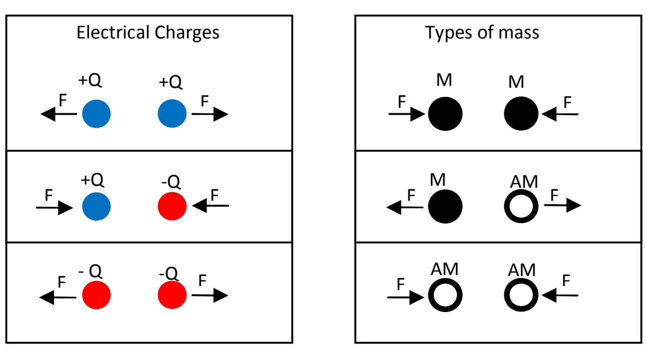

Figure 10 - Forces that act on electric charges, matter(M) and antimatter (AM).

Note that even if the Villata model is not true, we should still consider the general relativity theory in which the matter (and the antimatter) distort space-time, generating geodesic lines that represent the shortest distances between two points.

So for example a star made of matter orbiting an antimatter black hole, will have the same orbit as is if it were orbiting a matter black hole. In both cases the star moves along elliptical orbital paths as shown in Figure 11.

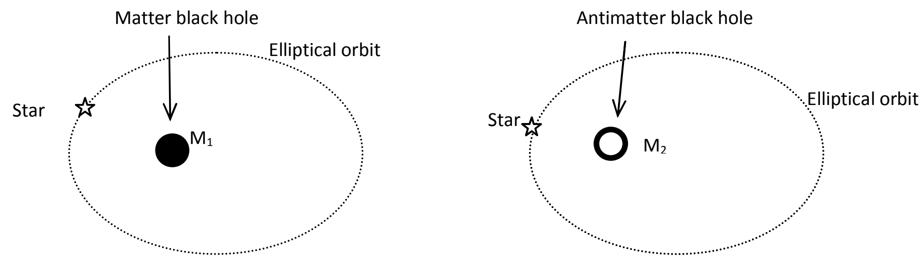

Figure 11 - Two examples in which a mass star orbits two different types of black holes

In Figure 11, whereas the same star has the same orbit, the mass of an antimatter black hole (M_2) must be greater than the mass of the matter black hole (M_1). This occurs because in the case of the antimatter black hole, repulsive forces lead the star to orbits further away and thus to maintain the same orbit the antimatter black hole mass should be greater than the equivalent matter black hole.

It is important to note in Figure 11, that based only on the motion of the star it is not possible to identify whether the black hole is composed of matter or antimatter. Also if the black hole is assumed to be composed of matter but is in fact composed of antimatter than the mass calculation for that black hole will be incorrect.

Mass creation in the Small Bang Theory

According to quantum mechanics, the vacuum fluctuations in addition to virtual photons can also generate pairs of virtual particles of matter and antimatter as, for example, the four virtual particles (proton, electron, positron and antiproton) shown in Figure 12.

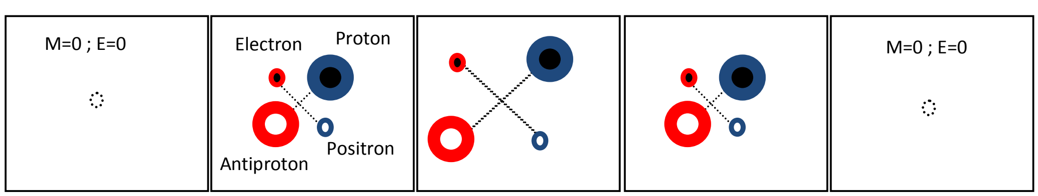

Figure 12 - Virtual particles of matter and antimatter hovering during vacuum fluctuations.

Figure 13 shows the iteration of matter micro black holes, with virtual particles generated close to its event horizon, considering the forces shown in Figure 10, where the black hole's matter repels the antimatter particles.

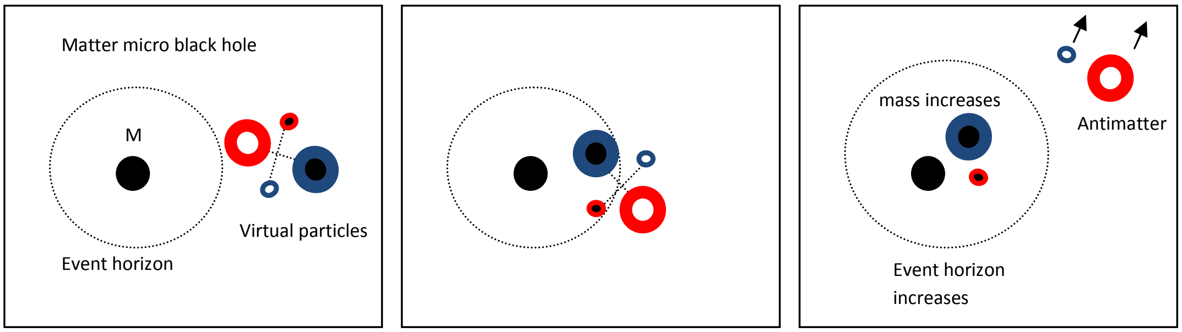

Figure 13 - Matter micro black hole breaking apart virtual particles near its event horizon.

Figure 14 shows a similar interaction, but considering an antimatter black hole, that attracts antimatter virtual particles and repels the matter ones.

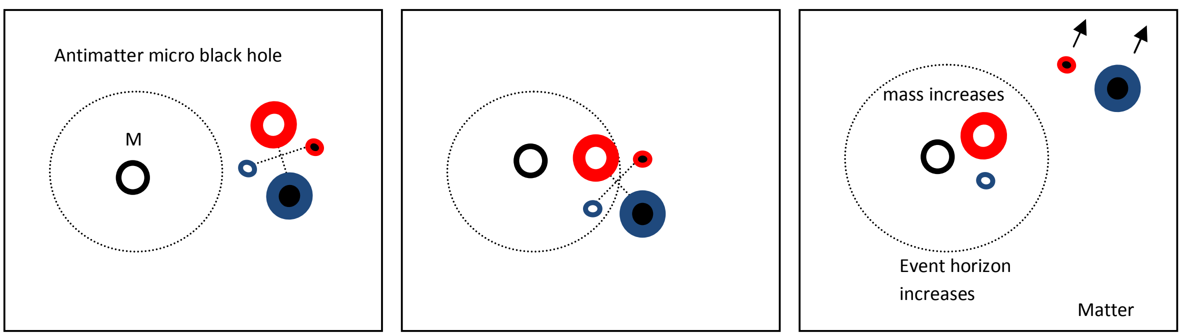

Figure 14 - Antimatter micro black hole breaking apart virtual particles near its event horizon.

It can be seen in Figures 13 and 14, in which the micro black hole's masses will increase, that the antimatter black hole expels matter particles and vice versa.

So the event horizon of these two black holes, formed at the beginning of cosmic inflation (which was presented in Figure 9) tends to increase continuously during the cosmic inflation.

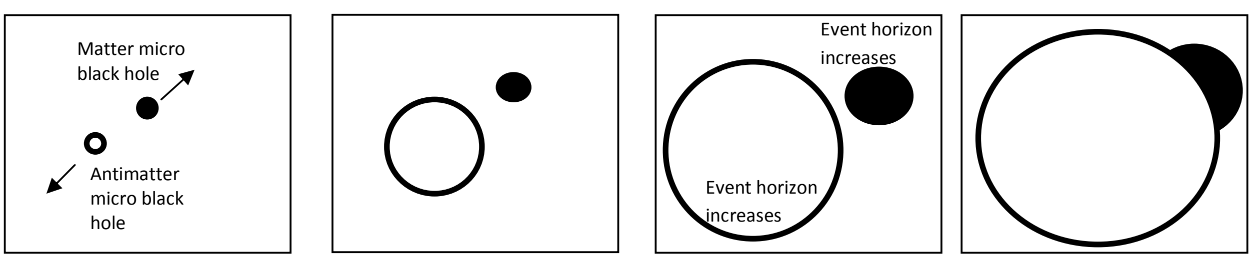

Figure 15 - Micro black holes growing at different rates.

As the process of virtual particles breaking apart is random, these micro holes blacks will grow at different rates, and soon one of them will be much larger than the other.
In this case, the bigger black hole mass will generate a distortion in space-time that will cause the lower black hole mass orbiting it to become absorbed, leaving at the culmination of this process just one black hole as shown in Figure 15.

In our observed Universe some factor seems to favor the growth of antimatter micro black holes, and thus the matter black hole is always absorbed by the antimatter black hole.

A Rotating black hole

In the Small Bang model, another important point of matter creation is that the black hole angular momentum increases over time which is shown in Figure 16. In this figure we see that the matter expelled by the black hole follows a geodesic orbit that is generated by the distortion of space-time due to the mass of the antimatter black hole. Antimatter that falls into the black hole generates an angular momentum that rotates the black hole in the opposite direction of the rotating matter. In this way angular momentum is conserved and the total angular momentum tends to zero.

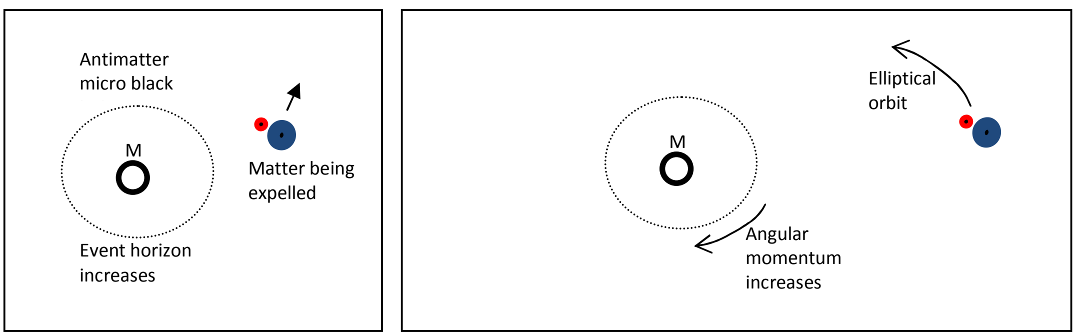

Figure 16 – Black hole increases in angular momentum over time.

In general relativity theory the rotating black hole is modeled by the equations defined by Kerr in 1963 that today is known as the Kerr model and is an exact solution to the Einstein vacuum field equations. The Kerr equations define a metric for a rotating black hole in which it “drags” the space-time that surrounds the event horizon, generating a new surface entitled the ergosphere presented in Figure 17.

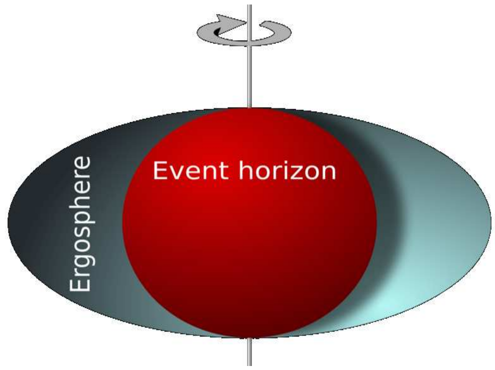

Figure 17 - Kerr model for a rotating black hole.

On the ergosphere surface the space is dragged at the speed of light, which makes the process of matter generation (shown in Figure 11) occur more easily along the ergosphere equatorial plane (the rotation plane.) In this way, the matter particles tend to be pitched towards the same direction as the first particle that was created (i.e. in the opposite direction of the rotation of the black hole.)

Thus during cosmic inflation an antimatter micro black hole, will increase its angular momentum and tend to expel a cloud of matter particles (electrons and protons) in the rotation plane forming a matter spiral disk as shown in Figure 18.

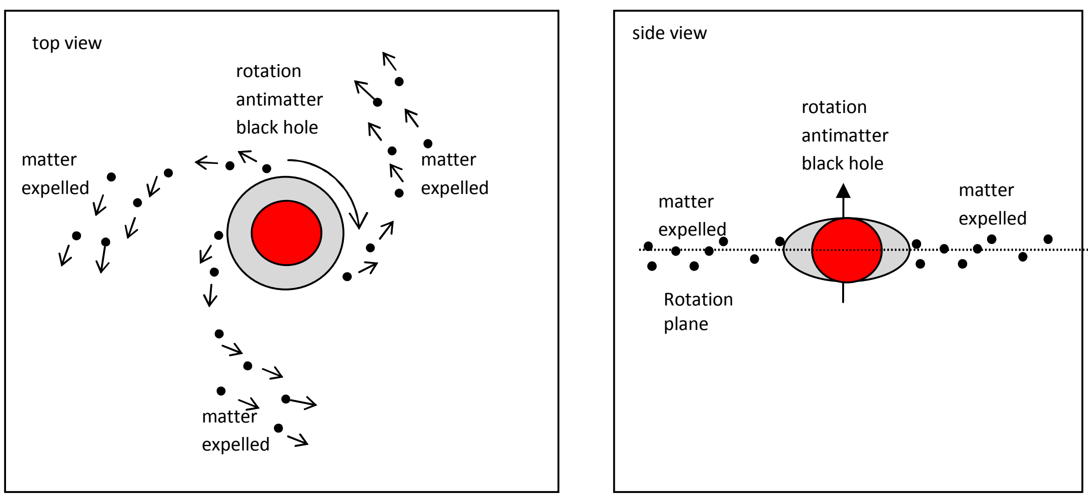

Figure 18 - Emission of matter particles by a rotating antimatter micro black hole.

Insofar as the antimatter black hole expels matter particles it absorbs the associated antimatter particles and increases its mass and its angular momentum, undergoing an exponential growth.

In the Small Bang model, the presence of the rotating black hole hinders the local process of expansion caused by cosmic inflation. In this sense we consider that the black hole "steals" inflation field energy transforming it into matter and antimatter. This process can be compared with a simple waterwheel placed in a river that takes the energy of the flowing water and converts it into mechanical energy or electricity.

Galaxy Formation

During the process of cosmic inflation, the exponential growth of an antimatter micro black hole eventually turns it into a supermassive black hole, surrounded by a cloud of matter composed primarily of protons and electrons that will make hydrogen and helium atoms.

This matter cloud is distributed on a rotating disk forming a protogalaxy with a supermassive antimatter black hole at its center.

Considering the cosmic inflation curve shown in Figure 1, the growth rate during inflation is so high that if, for example, the cloud of material shown in Figure 18 has a diameter of 10^{-34}m (or roughly ten times the Planck length) the protogalaxy generated at the end of cosmic inflation will have a one light year diameter.

Figure 19 shows the evolution of the Universe according to the Small Bang theory. In figure 19-a one small region of space is observed at the moment when cosmic inflation begins. In this region high-energy photons start to be generated creating antimatter micro black holes which are shown as white dots in this figure.

In Figure 19-b the cosmic inflation process ends and the original region is now a few light years in size. Each antimatter micro black hole has grown exponentially becoming a supermassive antimatter black hole and is orbited by a spiral cloud of matter particles, forming a protogalaxy.

In Figure 19-c (present time) the original region occupies an observed space of millions of light years, and each protogalaxy has grown and become a new galaxy, where the hydrogen clouds have been fragmented by the gravitational forces in billions of clusters that form all of the stars in the galaxy.

In the center of each galaxy will be a supermassive black hole that spins in the opposite direction of the galaxy and contains all the antimatter associated with the process of creation of matter in the galaxy.

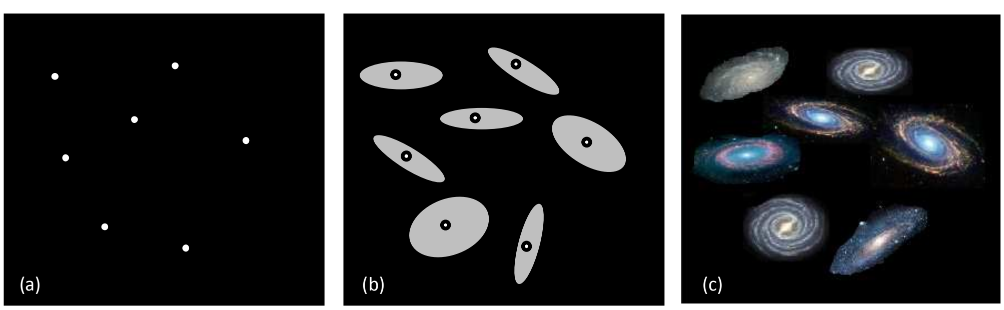

Figure 19 - Evolution of the Universe according to the Small Bang Theory.

Problems to be solved in the Small Bang Theory

The Small Bang model best explains the process of galaxy formation, but it would be expected that the antimatter supermassive black hole at the center of a galaxy has the same mass of the galaxy or at least of the same order of magnitude. Astronomical data confirms that the mass of the central black hole is about 1/1000th of the mass at the galaxy center.

This is an aspect of the Small Bang model to be studied, but the authors believe that one explanation for the reduced mass of the black hole can be explained within the context of a new string theory called the UST (Ulianov String Theory) model.

In the UST model all particles of matter and energy are composed of one-dimensional strings that wrap themselves in order to compose closed circles (due to photons) which are membranes with a two-dimensional shape of spherical shells (associated with electrons) and solid spheres (associated with protons).

The UST model explains why the proton mass is greater than the electron mass because the proton is being curled like the layers of an onion. Within the UST model once an electron falls into a black hole it tends to keep basically the same configuration as the mass of the black hole but forms a two-dimensional surface (a spherical shell given by the event horizon) and the mass of the electron also is represented by a two-dimensional surface.

A proton will be rolled out when it falls into the black hole event horizon and therefore its mass will no longer occupy a three-dimensional volume, tending to form the same configuration as the electron mass. In this way, the supermassive black hole of antimatter that exists in the center of each galaxy would be composed by a total number of antiprotons and positrons equal to the number of protons and electrons in the galaxy. However, the total mass of antiprotons inside the black hole will equal the total mass of the electrons. Thus the mass of the black hole is equal to two times the mass of the electrons existing in the galaxy, while the mass of the galaxy would be equal to the mass of the protons coupled with the mass of electrons.

Knowing the mass of a proton divided by an electron is equal to 1836, we can calculate that the mass of the black hole is equal to the galaxy mass divided by 918, which is a value very close to the ratio observed by astronomers.

Dark Matter

In the Small Bang model the galaxy angular momentum is generated when matter is separated from antimatter. Thus the total angular momentum (considering the galaxy and the supermassive black hole) tends to be zero, which indicates that the black hole should have the same angular momentum of the galaxy, rotating in the opposite direction. However, as the central black hole mass is about 1/1000th of the galaxy mass, its angular momentum should be at least 1/1000th of the galaxy angular momentum.

In this way, the Small Bang theory suggests that one supermassive black hole (that exists at the center of one galaxy) generates a large distortion in the space around it, dragging the space in the opposite direction of the galaxy rotation. The authors believe that the large angular momentum of the supermassive black hole generates an effect over the galaxy rotation, that is currently attributed to some kind of "dark matter" that in fact does not exist as detailed below.

Perfect liquids and atoms of space-time

Although the theory of relativity has abolished the concept of ether, the general relativity field equations can be modeled as if the space were filled by a perfect fluid. This fluid is a liquid without viscosity, which lets a body pass through it without friction, but also has a pressure. In this way, if a boat is placed on a perfect fluid it would float, but after being driven forward once, it would keep a uniform speed.

Currently some physicists like Martin Bojowald (who developed a theory of quantum loops), consider the possibility that there exist atoms in space-time that have very small size (on the order of the Planck length) and behave like a perfect liquid.

In this context we consider the analogy of Figure 20 where a toy boat moves in a circular pool containing an ideal liquid.

As the liquid does not generate friction forces on the boat, if it is pushed it will keep the same speed (v) indefinitely. In this example the boat is connected to a pin in the center of the pool by a spring. In this way the boat will move in a circular trajectory. The spring will then be stretched, generating a coil force (F_m) on the boat which compensates for the centrifugal force (F_c) generated by the mass of the boat, which tends to maintain a rectilinear movement. Whereas an electronic meter inside the boat is capable of indicating the speed of the boat in relation to the liquid, an observer can obtain this value by calculating the centrifugal force, thereby estimating the force in the spring.

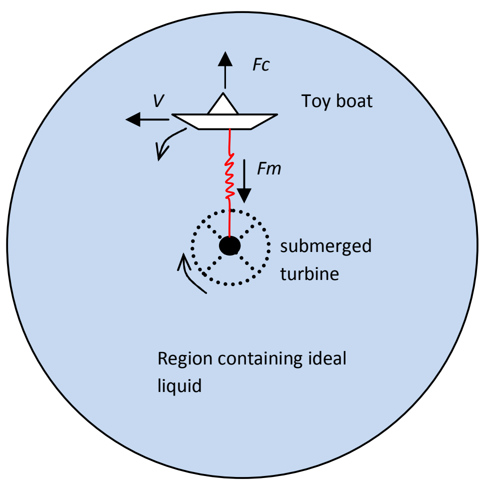

Figure 20 - Analogy of a toy boat sailing in a circular pool.

As can be seen in Figure 20, in the center is positioned an underwater turbine which rotates, causing the liquid pool movement in the direction opposite to the boat movement. Like the liquid movement it does not generate friction on the boat and the turbine in fact does not affect the boat's behavior, but the measurement speed (between the boat and the liquid) becomes larger.

Assuming that the spring force can be observed on a graduated scale, with the turbine stopped we observe a centrifugal force (F_{c1}) due to boat speed (v_1). In this case the calculated value F_{c1} will be quite close to the force value (F_{m1}) observed in the spring.

However, by connecting the turbine, the boat speed increases to a value v_2, which can for example be equal to twice v_1, but in this case the spring force is equal. An observer then recalculates the centrifugal force and obtains a value (F_{c2}) that is four times greater than F_{c1}

(since the centrifugal force is proportional to velocity squared) and this calculated value is no longer "close" to the observed spring force.

The observer can then hypothesize that besides the observed spring that there exist other invisible springs submerged underwater that are absorbing the additional forces. In this example, the visible spring responds only to ¼th of the centrifugal force acting on the boat while the "dark invisible springs" are responsible for ¾th of the centrifugal force.

Passing this analogy to the case of a galaxy, the boat is related to the movement of a star and the spring is related to the mass of the central galaxy that attracts this star while the submerged turbine is analogous to the supermassive black hole at the galactic center and the springs are connected with the invisible dark matter.

The authors believe that dark matter does not really exist and that all effects attributed to dark matter are due to the supermassive black hole at the center of the galaxy that rotates in the opposite direction of the galaxy.

Thus for example in the case of the sun, whereas only normal matter has been observed the orbital velocity of the sun around the Milky Way center should be equal to 160km/s but actually the measured speed of the sun is 220km/s. Thus 60km/s has been attributed to the additional influence of dark matter. However, if the high angular momentum for the supermassive black hole at the center of the Milky Way is considered (of the order of 1/4500th the momentum of the galaxy rotating in the opposite direction) based on the metrics Kerr defined in the context of general relativity, we will see an increase in speed of around 60km/s exactly the amount currently attributed to dark matter.

Swing speed in a perfect liquid

Considering further the analogy presented in Figure 20, we can observe the effect of rotation of the turbine on the perfect liquid filling the pool. Figure 21 shows a chart which defines the behavior of the velocity of the liquid as a function of distance from the turbine. We can observe from this figure that the turbine speed rises linearly with distance, which features a rotating solid body. In the next interval the speed remains constant and then falls at an inverse value of the distance, reaching a null along the edge of the pool.

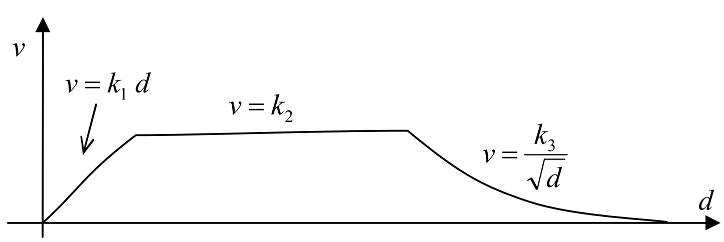

Figure 21 - Net speed as a function of distance to the center of the pool.

The liquid does not exhibit frictional movement due to pressure variations caused by the rotation of the turbine. Thus the curve shown in Figure 21 depends not only on the angular velocity of the rotating turbine, but also on the size of the pool. Obviously a smaller pool at a constant velocity will occupy a smaller area on the curve and vice versa.

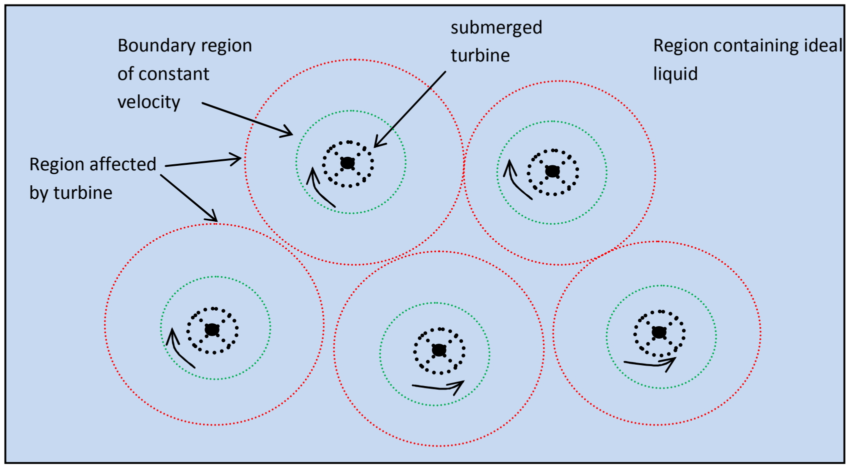

Figure 22 - Several turbines placed in a larger pool.

Taking the example of Figure 22, whereas in a larger pool several turbines were placed, we can see that the liquid region affected by each turbine (red circle) extends up to half the distance of the nearest turbine. Additionally there will be a region where the speed limit of the liquid tends to be constant (in the white circle) which has approximately half the overall diameter of the region affected.

Figure 23 shows a side cut in the pool, where it is observed that each turbine also tends to affect the liquid which is located outside the plane of rotation, since the liquid above and below the turbine is also set in motion due to pressure variations caused by turning the turbine. In this way the affected region of liquid by a turbine tends to assume a spherical shape, regardless of the plane of rotation of the turbine.

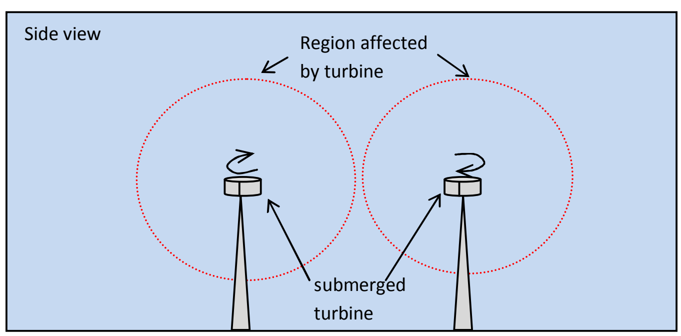

Figure 23 - Side view of the pool.

Dark Matter in the Galaxy

Astronomers estimate that the dark matter in a galaxy is concentrated in a spherical halo surrounding each galaxy, as shown in Figure 24, and within this halo the velocity observed (for interstellar gas clouds) is approximately constant.

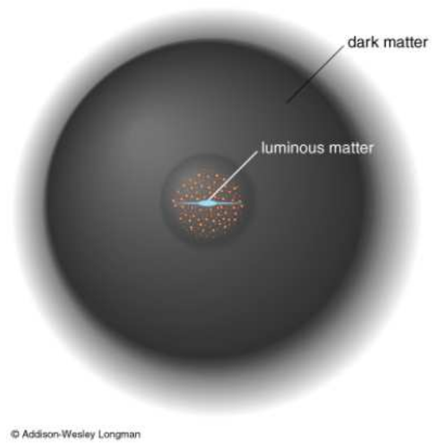

Figure 24 - Disposition of dark matter surrounding a galaxy.

In the case of the Milky Way halo this would be about five times the diameter of the galaxy, extending for 500 thousand light years.

If we consider that the supermassive black hole at the center of the Milky Way behaves similarly to the turbines shown in Figure 22, the region of dark matter presented in Figure 24 for the case of the Milky Way would be equal to the region of constant velocity shown in green in Figure 22. So knowing that the nearest galaxy to the Milky Way (Andromeda) is at a distance of 2 million light years away, we can consider that the region affected by the rotation of the black hole at the center of the Milky Way stretches to reach zero at the distance of 1 million light years (half the distance to the Andromeda galaxy.) Thus the region of constant velocity is estimated at 500 million light years, which is the same distance estimated for the effects of dark matter in the Milky Way.

That this same calculation is in fact a bit more rudimentary is an indication that dark matter does not really exist, and that the effects attributed to it arise due to the high angular momentum of the supermassive antimatter black hole that lies at the center of each galaxy.

Conclusion

The Small Bang model has received this name because it considers that all the energy and matter in the Universe arose due to the process of cosmic inflation and thus at the initial time of creation space is essentially an empty bubble.

It is important to note that after the process of cosmic inflation the energy density in the Universe would be basically the same as proposed by the Big Bang theory and thus the two models differ only with respect to the behavior of the Universe and its galaxies before the end of cosmic inflation.

Besides eliminating the problem of infinite energy densities and temperatures, the Small Bang model also solves the problem of the loss of antimatter, proposing that focusing on the supermassive antimatter black hole that lies at the center of each galaxy allows for a better understanding of the formation process of galaxies.

The Small Bang model also suggests that the effects attributed to dark matter today are in fact due to the high angular momentum of supermassive antimatter black holes and the effect of drag on the space-time that extends beyond the limits of the galaxy and creates a region of constant rotation that is currently attributed to some type of "dark matter."

The most basic principal of the Big Bang model is that of a "primeval atom" or "cosmic egg" that concentrates all the matter and energy in the Universe and was first proposed in 1927 by Georges Lemaître The Small Bang model eliminates the notion of the "cosmic egg" and represents an innovation to an idea that is almost a century old.

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