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Perspective

An environmental analysis of existence: The past, the present and the future

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Man, as a "being" with the unique capacity to think and reason, has always been curious about his end as well as the end of the known universe. Perhaps, that is the ultimate thing he can think about beyond which nothing exists. Not only in the religions, in science also, there are lots of queries and theories about the END, the total extinction beyond which it is the unimaginable "nothingness". It is not at all surprising that, there are almost similar mentions about the final extinction in various religions that were established and developed in different parts of the world. Wherever the humans lived, these thoughts persisted with them. He wondered, if he could know the beginning of life as well as the beginning of the known universe, he would know at least something about the end. For that matter, the end is the same as the beginning. What was there before the beginning and what will be there after the end? Philosophy says it is "nothingness". Science does not have a concrete answer to that as on today. Humans always looked at the stars and to the universe to get some clue about the beginning and the end.

Key words: Environmental Analysis, Space, Black Hole, Laws of Nature, Existence, Life and Death, Origin and Final Destiny of Universe.

THE BEGINNING

Perhaps, it is more rational and reliable to study about the past of the universe than about its future. Telescopes help us to look far and far. Actually light falling on the telescope today had left its source at some time in the past. Light from sun takes 8.3 minutes to reach the earth. So we are seeing the sun as it was 8.3 minutes back. While looking at greater distances we are actually looking back in time; that is the past. Theoretically how far one can look? That means, how much backward one can see? May be to the point of the beginning of the universe. Many high power telescopes are going to be installed in the near future to pear into the dark ages of the universe.

According to the present day wisdom, universe took birth about 13 to 15 billion years ago in a cataclysmic explosion named as Big Bang. That was the moment of creation of Space, Time and Matter. No one knows where that much energy came from and how that much energy got converged at that point of explosion. Though no one knows what happened in the first split second of creation, science has explained what happened afterwards. Immediately after the Big Bang, the immense radiation became a soup of sub atomic particles. This expanded at tremendous speed and combined to form atomic particles like proton, neutron, etc. They combined to form atoms. As the most abundant atomic particle was proton, it combined with electron to form Hydrogen. The early universe was full of hydrogen gas. As the expansion continued, nebulas were formed. Nebulas have the shape of a plate and rotate at tremendous speed. From the nebulas, galaxies were formed. Inside the nebulas, at different locations, hydrogen gas masses shrunk due to its own gravity to initiate the formation of stars. During the shrinking, the temperature and pressure inside the hydrogen mass increases. At very high temperature (more than about 15 million ° C) the nuclear fusion begins. Hydrogen combine to form Helium atoms emitting immense energy and a star is born. Formation of a star inside the nebula takes about 1.5 to 2.5 million years. Our sun took about 2.0 million years to take birth. In the stars, other elements are also formed slowly. Basic elements of the things around us, we ourselves for that matter, took shape from the remnants of the burnt off

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stars. It has been estimated that there are about 50 to 100 billion stars in each galaxy and there are more than 100 billion galaxies in the universe.

Time started ticking forward from the moment of big bang. Time always goes ahead in the direction of increasing disorder or entropy; it never goes back. Unlike the other basic dimensions (Mass and Length), time can be measured only once. It has been proved that time is not perfectly symmetrical. When particles go back in time, their behavior is somewhat different from what it was when they had gone forward. It has got a slippery nature. Many argue that there was an imbalance in the amounts of the matter and anti matter created during the birth of the universe. They annihilated each other quickly leaving only a slight excess of matter. That excess matter is our universe. It is believed that time had a key role to play in that imbalance in the amount of the matter and the anti matter created which finally became the cause of formation of this universe. Recently, the CERN and Fermilab particle accelerators showed that the time-reversal symmetry is violated, by measuring the decay process of neutral kaons and neutral anti kaons. Detectors measured the oscillations of kaons into anti kaons and vice versa as these fleeting particles sped away from their origin. The rate at which anti kaons turn to kaons was found to be higher than the time-reversed process in which kaons become anti kaons. If time were perfectly symmetric, both rates would have been equal. This asymmetry is considered to be responsible for the creation of excess matter during Big Bang. According to Einstein, time is not an absolute quantity. Time becomes slow when the speed increases. Also, when gravity increases, time becomes slow.

It has been found that all galaxies are going away and away and the direction of their trajectories can be traced back to a point. This single point is considered to be the origin of the universe. The whole mass was concentrated at that point. Matter was created from “nothing” at that point in the Big Bang explosion. How can matter form from nothing?

It was suggested that matter could be produced from “nothing” right in 1934. But this was not proved experimentally as none of the laboratories could pump in enough power into the colliding beam. In 1950, it was hypothesized that vacuum may break down creating real particles of matter and anti matter. But recently it has been experimentally demonstrated.

At the time of Big Bang, the temperature would have been very high and intense electromagnetic radiation would have been expelled out. As the universe has been expanding, the wavelength of this radiation would have increased and this radiation (of same intensity and very low temperature of about 3 K) should be there all over the universe. In 1964, the Bell laboratories discovered this microwave background radiation which literally proved the big bang theory.

Big Bang was the beginning. Just after the explosion it was featureless gas. Then slowly the stars, planets, solar systems and galaxies took shape. Star formation was at its peak when the universe was 1/3rd of its present age.

Scientists have explained the birth of a solar system. In the 0th year, a dense spinning cloud of gas and dust start collapsing forming a solar nebula. In 0 to 1 million years, the spin of the nebula increases and a star formation takes place. Dusts coalesce into proto-planets. In the 1-10 million years, the cloud flattens into a disc. In the outer regions, the cores of giant particles form. By 10 million years, any gas that has not been absorbed by the star or its giant planets dissipates. In 10 to 100 million years, proto-planets in the inner ring smash together to form rocky planets like earth. By 600 million years, the remaining proto-planets crash into the star or are ejected into outer space and the solar system has taken its final shape.

Some scientists believe that big bang was not strong enough to blowup the universe to its present size. They speculate another force (called cosmic repulsion) which acts over extremely large distances and keep the galaxies apart.

THE PRESENT

Now in the universe, there are galaxies, solar systems, stars and planets, mountains and oceans, humans, animals and trees, etc. Both animate and inanimate existences are there now. Now the universe looks much more than mere collection of gases and particles. Laws of physics permit the universe to create itself. From the initial inanimate existence, about 3.5 to 4 billion years ago the first life sprouted up. From that single life form every living entity, including the humans, evolved! To permit such evolution, the laws of physics should have been of a special form. Science reveals, if the fundamental forces of the nature had been different even slightly, life of any sort would have been impossible. For instance, gravity is the same for all the matter. Value of gravity (G) will not change wherever and when ever the measurement is made. Even a small change in the value of G will affect the structure of the universe. It is as if these laws are deliberately designed to bring forth conscious life. The intellectual ability of the humans to unlock the secrets of the nature hints a deep link between the human mental realm and the mathematical laws that govern the universe. The laws have brought forth complex beings with the mental ability to understand those laws. It is a fact the laws of the nature are ingeniously bio- friendly and seem to ensure that life and consciousness emerge some where, sometimes in the evolution of the universe. If it turns out that we share the cosmos with some other intelligent life forms, it would confirm that laws of nature have compelled the universe to engineer its own awareness. The phenomenon of mind would be revealed as a fundamental property of

nature rather than an evolutionary freak. Laws of physics can only move information about, they cannot create it. The problem is, where the biological information comes from remains unanswered.

Life

It is a fact that the living matter is somehow different from the non-living matter. What is that vital spark which imparts unique properties to the matter and characterizes life? It was thought that the secret lies at the molecular level. But even after understanding the molecular processes within the living cells, the essentials of life remains mysterious. Theories of evolution explain how new species evolved from the old, but they do not answer how life originated for the first time. Life cannot be explained in purely mechanical terms. There has to be a natural way for the non-living chemicals to turn themselves into a living organism. A chemical broth driven by an energy source gradually accumulated complex molecules until some primitive form of life finally emerged. According to the Biological determinism, a watery medium with simple organic compounds such as amino acids will incubate life after a few million years.

There is a belief that the life on earth came on the wings of comets. A spacecraft observed the particles of Carbon, Hydrogen, Nitrogen and oxygen in the Haley's comet almost in identical proportions to their presence in the human body. Life on our earth, which is carbon based, needs water. It is understood that every drop of water on the earth's surface came from outer space. Comets might not have brought the life from the outer space as such; but they might have brought the seeds of life. It was believed that earliest metabolic reactions might have began on the surface of minerals like pyrites (FeS_2); whose positively charged surface could attract simple inorganic molecules and catalyze them to form more complicated organic molecules. Until very recently, scientists thought that life had to depend on photosynthetic energy. But in 1977, stains of bacteria that exist solely on heat, water and compounds such as hydrogen sulfide were discovered in hydrothermal vents. Scientists now think that on the earth, perhaps the first life took shape in ocean near hydrothermal vents. The earliest microorganisms might have fed on CO and Sulfides from those vents. Afterwards, much life form emerged. Many comets hit the earth changing the course of life on earth. Life got a chance to diversify every time a huge asteroid or comet hit the earth. Many dominant species were eliminated and some other species emerged out surviving the catestrophy.

Life is full of cycles. It is an important pre-condition for life. Life and natural cycles are inseparably linked. Life can be found only where natural cycles exist. Key to the existence of life could also lie in the relationship between different cycles in the universe. Life is repetitive with its ends tied up to its beginning by a chain of events. We are all part of an organic cycle, which involves the decomposition of organic matter, followed by growth of vegetation and complex food chain and finally death. Water cycle, Carbon cycle, Oxygen cycle, food cycle, planetary motion and seasons, heartbeats, blood flow, menstruation, ocean tides, and music, are all examples of cycles. About 2/3rd of atmospheric oxygen moves back and forth in a closed loop through photosynthesis and respiration. This cycle is so stable that even if all the fossil fuels are burnt and oxygen required for their combustion is used up, oxygen concentration of the atmosphere will change only by about 1%.

Food-respiration cycle would not be possible without light. Light is radiated by stars with surface temperature more than 6000 K. The distance between the star and the planet must remain relatively a constant. Otherwise the planet may collapse into the star. So the planets revolve around the star. This relates the food-respiration cycle to the planet revolutionary cycles.

Time period makes every cycle unique. It is reported that cycles of this universe span a frequency range between 10-18 and 1018 seconds. The microwave oscillations occur 100 billion times in a second (10^{-6} Hertz). On the other hand, the largest recognizable time period is that of the solar system's revolution in the Milky Way. It is between 1015 to 1016 seconds. Normal heartbeat is once in 0.8 second. AC change directions 50 to 150 times a second. Time period for the circulation of blood through the heart is about 1 minute. Women's menstrual cycle is once in about 28 days. Seasons are annual cycles were as tides are daily cycles. In fact the sense and concept of time evolved due to the recognition of various natural and celestial cycles.

According to the single origin theory (out-of-Africa theory), man originated about 2 lakh years ago in Africa. From there, humans migrated to India about 60,000 years ago. Then, from India to China and other parts of the world about 10,000 years ago. The theory is based on DNA analysis. It has been proved that the mitochondrial DNA is passed exclusively from mother to the daughter (the maternal line) virtually unchanged. Strands of DNA were analyzed and the evolution lineage could be traced back to a single woman who lived about 2 lakh years ago in Africa. The migration patterns were studied by analyzing the genetic elements called ALU insertions. They are the small and useless pieces of DNA that have spread throughout the human genome. The genetic materials mutate so fast that the evolutionary changes remain recorded in its structure. ALU insertion studies showed that genetic variation of the ethnic groups in Africa was considerably higher than that of all other populations on the earth. The next highest was in India.

In India, the Lodha, Munda and Santal tribals are the oldest people. Humans were diligent copiers long before they became inventors. Just as bird flight evolved,

intelligence also evolved. But, it is difficult to learn from the fossil records. It is not possible to correlate the intelligence with the brain-to-body mass ratio. According to many researchers, talking intelligence is a truly evolutionary event. There is a characteristic asymmetrical expansion of that part of the brain devoted to speech. Evolution of speech will be a measure of the evolution of intelligence.

All living organisms have different life spans but have similar aging process. Aging is determined at the genetic level and has to pass through three phases such as development, reproduction and senescence. The difference is in the length of each phase. This is triggered through a gene switch in the DNA (the information molecule). DNA is capable of withstanding assaults on it by the highly reactive metabolic by-products. But with age, it becomes an inefficient repairer. The accumulated damages initiate a series of catastrophes until death. Comparing the lives of humans and rats, in rats this happens much faster than that in the humans. That way, one week of rat's life is equivalent to 6 months of human life. The long living species like tortoise, elephants, etc. have a higher capacity to repair their damaged DNA. Many think that they may be having multiple copies of genes in their cells so that, even if some genes are destroyed, the other genes will carry out the physiological functions for long.

THE END

There have been always threats to the lives on the earth. No one knows how many times the primitive life on earth was destroyed by unfavorable conditions and asteroid hits. It is difficult to predict what is in the store for the lives on earth now. It could be a supernova explosion or a gamma ( ) ray buster that can roast the earth. The red super giant star Betelgeuse (at the shoulder of the Orion constellation) is only 430 light years away from us and is ready to burst at any time. That explosion may be capable of showering earth with harmful radiation and destroy the ozone layer. γ ray busters are the spots in the sky which emit intense γ ray radiation for a few seconds/hours and then fade away without a trace. A nearby γ ray buster can roast the earth.

Death of a star

Stars are powered by the fusion of hydrogen atoms to helium. Stars that are considerably smaller than the sun, can not become full-fledged stars. They exist as Brown Dwarfs. When the hydrogen stock is exhausted, the star begins to die. It can not resist its own gravitational force and it starts shrinking. Stars with mass less than 1.4 times the mass of sun (Chandrasekhar limit) becomes Red Giants first and then shrink to become White Dwarfs. At that level, the electron degeneracy pressure will equalize gravitational force. White Dwarfs slowly loose its temperature and disappear over time. Stars within the mass in the range 1.4 to 3 times the mass of sun, will shrink further from the level of White Dwarfs. Due to the high pressure, all the atoms become neutrons and become Neutron Stars. At that level, the electron degeneracy pressure and the repulsion between the neutrons will equalize the gravitational force. Stars with mass more than 3-4 times the mass of the sun will continue to shrink beyond the neutron star level. They shrink to zero size and become black holes. Stars, which are very massive (more than 10 times the mass of sun), explode due to the violent burning and imbalance. These explosions are called Supernova explosions. In those explosions, a smaller star and planets may take birth and may form a solar system. It is believed that our own solar system was the product of a Supernova explosion.

Black Holes

Roger Penrose argued that if the theory of relativity is true, then, there have to be singularities. He was proved correct when the black holes (name given by John A. Wheeler) were discovered later on. According to him, there cannot be any open singularities. Singularity of a black hole will be always inside its horizon.

Black holes are like weeds in the cosmic garden. With the black holes, as the volume becomes zero, its density becomes infinite. It is a singularity where the laws of physics will not work. Because of the immense mass and powerful gravity, nothing (even light) escapes from its clutches. There is a horizon around the singularity, which acts as a boundary or limit of the black hole. Anything entering that horizon will not return. Distance from the singularity to the horizon is called Schwarzschild Radius. It is a measure of the strength of a black hole. It is about 3 million km for a 1 million-solar-mass black hole. Anything falling into the black hole experiences tremendous force of gravity. Every atom of the body separates out and disappears at the point of singularity. Black hole sucks in like a vacuum cleaner.

Mass of a black hole is about that of 3 to 5 billion sun. They swallow burning gas equivalent to 1 million suns every year. On their way into the black hole, the matter heats up through viscous dissipation and converts gravitation energy into radiation. This is the most efficient radiation source; even better than nuclear fusion. The resulting burp of radio waves show up as a quasar. They lie at the heart of some galaxies and rank among the brightest object in the universe. Quasars burn with the intensity of about 100 billion suns. Quasars have short life, perhaps just 100 million years.

Every black hole must be containing a singularity. If singularities can interact with the outside world, many things that are impossible now may be possible. For

instance, a spacecraft can be sent around a singularity on a trajectory that takes it into the past. Some scientists believe that black holes may be the tunnels in space-time to other universe. Mathematical description of a black hole in flat space portrays it as a kind of tunnel connecting two separate regions of flat space. These space-time tunnels may have some physical significance rather than a mere quirk of mathematics. Actually the snag with this speculation is the blue sheet problem. The singularity of a black hole can not interact with outside universe. Light entering into the horizon of a black hole does not escape its gravity. That is the light leaving the horizon is infinitely red shifted to zero energy. This means, the light falling on the to the horizon from outside must be infinitely blue shifted piling up to form a energetic blue sheet around the black holes. Many think that this blue sheet is an impenetrable barrier. But probability of crossing the barrier exists by quantum tunneling. Perhaps, when the quantum theory of gravity advances, material objects may be able to penetrate the black hole barrier entering into other regions of space-time.

An uncrossable horizon will form around any concentration of matter if it is squeezed into less than a critical volume, so that a hoop of the appropriate size could be passed around it in any direction. According to Thorne, a black hole forms when mass gets compacted into a region whose circumference in every direction is less than a critical value.

The black hole that rotates about its own axis is called Kher black hole. Their singularity is not a point, but a ring. Outside the horizon, Kher black hole has an ergosphere. Anything that enters into the ergosphere can not be stationary, but they rotate with the black hole.

Hawking postulated that the black holes would ultimately evaporate and vanish. Due to the vacuum fluctuations, there will be both particle and antiparticle near a black hole. Of these, one goes into the black hole and the other comes out of the black hole. The energy of the particle/antiparticle coming out was taken from the black hole only. This is called the Hawking radiation. Due to this energy loss, black holes are thought to evaporate and vanish.

Collision of Galaxies

It has been observed that galaxies collide triggering spectacular outbursts. It was never thought of before the Hubble Space Telescope (HST) recently photographed two Antennae Galaxies collide. Galaxies do not evolve in splendid isolation, instead they shape each other. Our Milky Way is now swallowing a dwarf galaxy Sagittarius. Its 10 million stars will be added to our 50 billion stars in about 200 million years time. In fact our Milky Way is closing in on the Andromeda galaxy at 0.3 million miles/hr speed. As Andromeda is far far away, the collision will be only after 5 billion years. Red shift or blue shift is used to measure the speed of galaxies and stars and the distances between them. Red shift is the amount by which the light is shifted to longer or reddish wavelengths. Things that are going away from us will exhibit a red shift; where as, things coming towards us will exhibit blue shift.

Fate of Universe

Universe was considered to be still (neither expanding nor contracting) until the recent past. When the theory of relativity was introduced, it was impossible for the universe to be still. So, Einstein included a λ term to make sure that universe was still. But in 1930s, Edwin Hubble proved that the universe is actually fast expanding. (Einstein, later on, removed his λ term calling it his biggest blunder). Universe is not expanding into any empty space. There is no space beyond the universe to expand. Universe expands by creating new space between the galaxies. To what extent it expands? What will happen at that stage? The cosmic fate is in the hands of the cosmic weight. Fredman-Robortson-Walker model suggests that, there are three possibilities based on the total mass of the universe. If the total mass is greater than a critical limit, after years, the expansion will decrease and finally the universe will start contracting (closed universe). On the other hand, if the total mass is lesser than the critical limit, the expansion rate will increase and increase forever (open universe) . If the total mass is equal to the critical mass, rate of expansion decreases but never stops (flat universe). No authoritative prediction has been made due to the difficulty in estimating the total mass of the universe. Many believe the probability is high for an open universe.

Total Annihilation

To describe the total annihilation, Adams and Louline choose a different scale of time. This time scale consists of segments (n). Each time-segment is 10 times the previous segment. The first year of the universe after big bang is the first time segment (n = 1). Second time-segment is 10 years and the third segment is 100 years. We are living in the 10th time segment. The first 4 time-segments are considered as radiation dominated era. Than the matter, radiation was more abundant and important in those eras. The second era, spanning from the 6th to the 14th time-segments, is the Stelliferous era. Stars are abundant in this era. Formation of the galaxies took place in the beginning of this era. We are living at the center of this era now. In the latter half of this era, most of the stars die becoming white dwarfs or neutron stars or black holes. Many will merge each other. Galaxies will be full of dead stars. Many galaxies will

merge each other. By the end of the 14th time-segment, there will be total darkness as all the hydrogen stock will be exhausted by that time and there would not be any stars left. Next comes the degeneration era (15th time-segment to 37th). In the initial phase of this era, many dead stars come closer and closer and finally merge into one another. There are chances that many brown dwarfs will merge and burn as stars. Similarly, white dwarfs may explode as supernovas. Many black holes shall be formed as the heavy cores of stars merge each other. The remaining matter will exist as clouds of gases. Then the proton decay begins.

It is estimated that the protons that were formed during the Big Bang have a life of 10^{30} years. On the time scale, this is 30 time-segments. Protons will break up into its subatomic particles such as positron, neutrino, etc. By the end the degeneration era, there will not be any matter left out in the universe other than sub atomic particles. Then comes the black hole era (38^{th} to 100^{th} time-segment). There will be plenty of massive ferocious black holes gulping in what ever comes their way. These black holes slowly evaporate through Hawking Radiation. By the end of this era, all black holes also will have disappeared. Then comes the Dark Era (extending from the 100th time-segment to infinity). Nothing other than the subatomic particles remain in the universe at that time. There will not be any activities. Universe moves on to a complete inaction and frigidity. Slowly all the subatomic particles also will disappear leaving behind nothing. Perhaps, the scenario at that time would be equivalent to the scenario before the big bang. The beginning meets the end there, completing one full cycle of creation.

At present, the age of the universe is about 1×10^{42} times the time taken by light to cross a distance equal to the size of a proton. It is believed that there may be a total annihilation leaving nothing behind. There are many theories about the total annihilation; but none has been validated by experiments or observation.But all of them incorporate the eventual decay of every proton in the universe. But so far no experiment has produced convincing evidence of the decay of a single proton. But the death of just one proton would herald the eventual end of everything. It is estimated that, if at all protons decay, it takes more than 2.5 times 10 to 32^{nd} power years. This is about 10 quintillion times the present age of the universe. Present age of the universe is about 15 billion years.

Conclusion

As an entity with the faculty to think and reason, humans will be always having the thirst for knowing about their past and future – the beginning and the end. However, they should also think about making their present more meaningful. We are destroying our environment, which finally cause diseases and accelerates aging. It has been proved that men's reckless activities have finally started bringing forth the aftermath. There are plenty of chemicals (POPs - the persistent organic pollutants), which mimic the female sex hormone estrogen causing breast cancer in females and reproductive disorders in men. Heavy emission of CO_2 and CH_4 gases brings forth global warming. It has been proved that the thermosphere of our earth has shrunk by about 5 miles in the last 4 decades indicating that it is cooling. This shows that the global warming is really taking place. We have emitted enough CFCs to the atmosphere to cause ozone layer depletion in the stratosphere. We have amassed enough nuclear weapons to destroy every life on the present earth many times and to make sure that life will not sprout up once again on this earth for many millions of years. We have mined acres of land that kill innocent people all over the world. We have enough biological and chemical weapons to create havoc to the environment. We have exploited the major part of the energy resources like coal, fuel oil, methane gas, etc. in a record time of a couple of centuries. Mother earth has been pooling up these things over millions of years. It is high time that we, as human race, stand united for a better life and a better environment. For that, we should have a global perspective and a new religion – **science.**

We know how the four basic forces (namely gravity, electrostatic force, the strong force and the weak force) act; but we do not know why they do so. Of the four forces, gravity is the weakest. The force between two electrons is about 1×10^{42} times stronger than the gravitational force between them. But the structure of the universe is defined and decided by the gravitational force as almost all matter of the universe are chargeless. Einstein considered gravity as a curvature of space-time rather than a force. Where gravity is more, time moves slowly. A photon moving against gravity looses some of its energy and the wavelength increases. But no one could dissect gravity and time into their component quantum packets, if such things exist. Many feel that, actually it is the time that is the real culprit during the quantification of gravity. Now, the scientists are trying to generate theories that will explain all the four basic forces together. This effort started a century ago. It was Faraday who began that by converting electric current to magnetic force and back. But even today, it remains unsuccessful.

Even though we do not know much about our own life, we exist! What is life? We know that the uniqueness of a living organism is not its complex chemical content as such, but it is the information content. Life is an information processing and copying system. But how that system brings forth humans with consciousness?

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