Climate Change in the Universe and Birth of the Earth

Introduction:

In terms of the age, the Universe is ancient and the Earth is modern. Earth was born about 4.6 billion years ago while the Universe was born about 13.7 billion years ago. Compared to the vastness of the Universe, our Earth is very tiny. How vast is the Universe? According to Isha Upanishad: '***Pūrnam adah, pūrnam idom, pūrnat pūrnom udacyate pūrnasya pūrnam ādāya pūrnam evāvasisyate'.*** (This is full; this is full. The full comes out of the full. Taking the full from the full; the full itself remains). This means we are not capable of contemplating the vastness of the Universe. But we are indebted to this Universe. From it, our mother Earth was born. For the birth of anything, it takes time. The Earth was formed about 9 billion years after creation of the Universe. It was born in stages. These stages have been described in this volume of ***Anuranan***. The ancient Universe was a well ordered whole; the modern world is chaotic. In the modern Earth, impact of climate change due to global warming has thus drawn attention of all concerned. Birth of Earth, one may say, is an outcome of climate change in the early Universe. Question of sustainable development did not, however, arise at that time. At present, sustainable development is the main issue for economic and human development. In this issue, we have given in brief and lucid way how climate change took place in the early Universe before birth of the Earth. In our coming issue in May, 2017, we would describe how climate change had been responsible for the formation, structure and nature of our Mother Earth in different eras.

Galaxies, Stars, Black Holes, Supernova and Sun:

Since the beginning of the Universe, there have been many climate changes. Temperature which was 10^{11} degree centigrade (one billion times the boiling point of water) started cooling down. Composition of cosmic soup went on changing. Electron and positron dominated the early Universe. Neutrinos, photons and relatively heavier particles, like protons and neutrons joined with them later. With continuing expansion of cosmic soup and temperature falling down, rate of production of electrons and positrons became less than the rate of their annihilation. At this stage, with further reduction of temperature at one billion degree centigrade, protons and neutrons formed nucleus of heavy hydrogen (deuterium). Finally, after a few million years, when temperature further dropped down, electrons and nuclei of deuterium did not have enough energy to overcome the electromagnetic attraction between them, they formed the atoms of hydrogen and helium. In the course of time, heavier elements, like lithium and beryllium were formed. Upto this stage, there were no galaxies, no stars, no planet. There was darkness everywhere. Hydrogen atoms were in the void. Gas was getting accumulated at a slow pace. Denser accumulation of gas started getting condensed. Hydrogen raindrops were formed. Expansion of those regions of the Universe which were denser, slowed down by the extra gravitational attraction. This caused those regions to collapse. Gravitational pull outside those regions started them rotating. When these regions became smaller, they started spinning fast to balance the gravitational attraction. In this way, ***galaxies were born*** – some disk-like, some oval – shaped. With passage of time, hydrogen and helium gas broke up into smaller clouds. They collapsed under their own gravity. Atoms within them collided with one another. They became so hot that caused nuclear fusion. At this high temperature, more hydrogen was converted into helium. More heat and pressure generated from this exothermic reaction stopped further contraction of clouds. They became stable and helped burning hydrogen into helium and radiating the resulting energy as heat and light.

Galaxy

Star

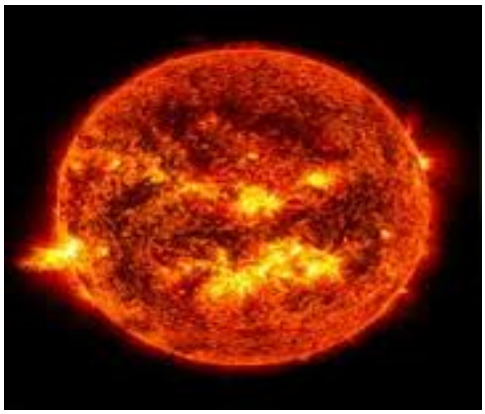
The formulation of stars like our SUN began. It is not the end of climate change in the Universe. Massive stars needed to consume more hydrogen for nuclear fusion reaction to continue rapidly to keep them hotter to balance their strong gravitational force. This made them contract slightly causing them to heat up further and convert helium into heavier elements like carbon, oxygen, silicon and sulfur. With these reactions, central region of the stars collapsed to a very dense state known as **BLACK HOLES**.

In the outer region, massive explosion took place forming **SUPERNOVA.** The massive stars started dying in this way. *However, nothing is lost in the Universe.* While forming Supernova, heavy elements blown off from the star came back and got mixed up with the gas in the galaxy.

Black hole

Supernova

They became the raw materials for producing the next generation stars. Our **SUN** in its galaxy is said to be the second or third generation of stars formed about 5 billion years ago out of cloud of rotating gas containing the debris of a supernova.



SUN

Earth:

Eruption of star thrown other elements, namely, silicon, iron and oxygen also. Some portion of

this cloud of rotating gas left over after forming the **SUN** mixed with heavier elements like hydrogen, helium, carbon and oxygen and joined together to form other bodies. These bodies were too little to ignite the nuclear fire within them with available hydrogen. They started orbiting the **SUN** as its planets without light within them. ***The early Earth was one of them***.

Early Earth

Unstable elements such as uranium and thorium which were created at the time of the stars' explosions, became embedded in the body of the Earth. They exploded again and shot fragments of their nuclei at high velocity into the surrounding rock. The initial heat created at the time of Earth's creation and the radioactive explosion from the uranium and other heavy elements kept Earth's inner body very hot. Heat generated from the churning process underneath the surface made the thin crust on top roll forward creating uneven surface of the Earth. Pressure created from churning made a section of thin and soft crust crumpling into each other producing ripples. In other places, the churning heat pulled open gaps. The surface of the Earth started cooling gradually making the upper crust hard. Hydrogen and oxygen present in the outer surface of the Earth combined and formed large water basins with waves. Iron which remained inside the planet created magnetic lines due to spinning of the Earth around its axis.

Beginning Of Life:

The early Earth was very hot and without an atmosphere. In the course of time, it cooled and released methane, ammonia, water and hydrogen gases that were trapped within, forming the primitive atmosphere and the first ocean. Light from

Gradual Formation of Earth

the **SUN** made the early Earth warm. Violent storms generated lightning and thunder. Volcanoes overflowed with lava. These processes disrupted molecules of the primitive atmosphere. The fragments generated from eruption of volcanoes fell back together in a more complex form, which subsequently got dissolved in the early ocean. After a time, the seas and oceans achieved the consistency of a warm dilute soup. Molecules were organized, and complex chemical reactions took place on the surface of the Earth. After a few thousand years, a molecule which arose by accident, was able to make crude copies of itself out of the other molecules in the broth. With passage of time, more accurate self-replicating molecules arose. Those that copied better produced more copies. As a result, the primitive oceanic broth gradually grew thin as it was consumed by and transformed into complex condensations of self-replicating organic molecules. In this way, life had begun on the Earth. And then, a few million years thereafter, the first humans emerged.*

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