Order in the Universe and Biosphere degradation

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Abstract

This paper analysis the cosmic order in the Universe and also in the same time, the increase of entropy. Univers' entropy is increasing due to its expansion but also to a degradation of ordered energy into disordered energy as a result of fusion reactions occuring in the stars, such as the sun. At the level of the biosphere, the degradation of ordered energy is due to human activities.

The human species is the only biological species that pollutes far more than its biological function. Man did not inherit Earth from his parents, but borrowed it from his children and, therefore, has a duty to preserve and present it to the future generations. A man without a religious culture, and without a scientific culture, doesn't show respect for the environment where he lives.

Newton's dynamics, further developed by Lagrange, Hamilton, Jacobi and Laplace, has gained remarkable achievements in celestial mechanics. Because the motion of stars is conservative, it reinforces the image of a repeatable and reversible movement that replicates for eternity. All these characteristics have led to the picture of an infinite Universe in time and space, a static Universe, a Universe without beginning and without end, a Universe with no ambition and no purpose. Obviously, such a Universe did not need a Creator.

However, at the beginning of the twentieth century, Poincaré shows that for conservative systems, like our solar system, the planets' positions on trajectories evolving around the Sun depend on initial conditions. If the initial conditions were different, such as planet Earth's position on the

trajectory around the Sun was different, life would not have been possible [1].

There is no evidence showing that the great mathematician Poincaré was amazed by this overriding requirement regarding "the initial conditions" which led to the planets' positions on trajectories in our solar system and, by extension, all the planets' and stars' positions on trajectories in the Universe. Were these initial conditions set, and if so, by whom? Or is it chance that determines all in the Universe, including the conditions that led to the complementary evolution and the present evolution of the Universe in which we live[2]?

Because of the harmony that appears in the entire Universe, and the perfect consistency between the movements of billions of stars, we may think that the evolution of the Universe was "designed" from the initial conditions before creating the Universe. Roger Penrose, professor of mathematics at Oxford University, calculated that for the Universe to look like the one in which we live, the initial conditions must be chosen with an accuracy of $1/\ 10^{10^{123}}$ [3]. A stunning precision that is beyond any intuition or imagination!

Today there are two important theories that undoubtedly prove that the Universe had a beginning:

1. Expansion theory of the Universe, from which the Big Bang model was developed[2-5].

2. Increasing entropy theory of the Universe[2-6].

According to these theories, that are developed on the existence of irrefutable physical realities, if at present the Universe has a volume V_p and an entropy S_p, it means that at a certain finite time in the past, the Universe had a smaller volume V_t, and a smaller entropy S_t, and at time t = 0, when the Universe was created, the volume was V_o=0 and the entropy was S_o=0. Two times are defined: cosmological time and thermodynamic time. They both define the absolute physical time (Fig.1)[2-6]. *Physical time, physical space and physical energy were born simultaneously.*

"The conclusion that seems to force itself upon us is that the big bang was the ultimate beginning of all physical things: space, time, matter, and energy. It is evidently meaningless to ask (as many people do) what happened before the big bang,

or what caused the explosion to occur. There *was* no before."[5]. All the above evidences prove that the Universe has a beginning, and "So long as the universe had a beginning, we could suppose it had a Creator." [2].

A created Universe requires many initial conditions, and a lot of data is needed for a perfectly coherent evolution, just like our Universe really does. If there are an infinite number of Universes, then it wouldn't be a remarkable thing that one of them is our Universe. There would be no need for unique initial conditions, and thus a Creator. But if there is only one Universe, our Universe, then certainly its beauty and perfection lead us to believe that the Universe is the work of a Creator. Microwave background radiation which even now crosses through the Universe needs to be understood as a message from God about what has happened in the first 10^{-43} seconds of the Universe[7].

But for what purpose was the Universe created? The most disturbing response was given by John Wheeler: "the very existence of the Universe depended on human existence." Human creation was designed by God before the creation of the Universe, in the initial conditions, in such a way that after 10 to 15 billion years, from dead stars, bigger than our Sun, planet Earth would be formed and would become full of hospitality and everything needed to host Mankind. "You have made us for yourself," says St. Augustine at the very beginning of Confessions.

In the following lines, we'll only analyze the theory of increasing entropy of the Universe, which constitutes the core of the second law of thermodynamics in its cosmological form given by Clausius in 1865. The entropy of the Universe is increasing due to two fundamental, natural processes:

a) The expansion of the Universe and thus the increase of Universe's volume[2,5,6],

b) Degradation of the ordered energy into disordered energy (heat)[6,8,9].

a) The increase in the entropy of the Universe because of its volume growth is given by the equation:

$$\Delta S_{univ.} \approx R \ln(V_p / V_t) > 0 \qquad (1)$$

where V_p and V_t are the volumes at a present time, and at a past time, respectively.

b) All natural processes (physical, chemical, biological, etc..) irreversibly evolve with increasing the entropy of the system plus the environment:

$$\Delta S_{univ.} = \Delta S_{sist.} + \Delta S_{mediu} > 0. \quad (2)$$

The fundamental equation that describes this reality is[7]:

$$\Delta S_{univ.} = -\left(\Delta G_{sist.} / T\right) > 0 \quad (3)$$

In agreement with this last inequality, the evolution of any system is achieved by increasing the entropy of the Universe, $\Delta S_{univ.}$, on the account of the degradation of the ordered energy from the system, $\Delta G_{sist.}$, ie due to the decrease in the order of the Universe. Clausius' cosmological formulation generated very heated discussion since the increase of entropy implies, as showed, a degradation of ordered energy into disordered energy, ie heat. It is amazing to note that, although nineteenth century scientists, such as Helmholtz, Clausius and Boltzmann showed that the entropy of the Universe increases, no one imagined that the Universe could have a beginning when its entropy was exactly zero (Fig. 1).

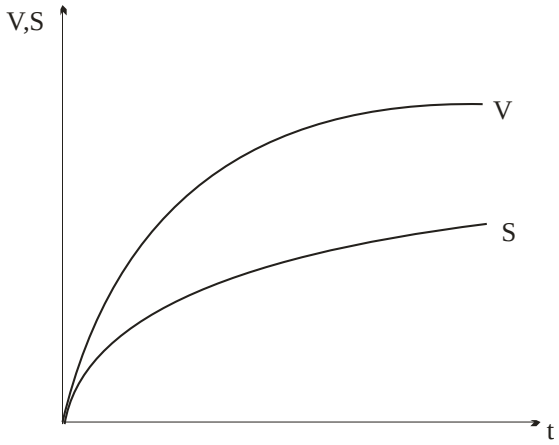

Fig.1

The increase of the entropy of the Universe due to the inexorable degradation of the ordered energy into thermal energy has led to a very pessimistic conclusion, namely the

thermal death of the Universe. This uncomfortably realistic finding, from a psychological perspective had a demoralizing effect on people, especially on scientists. Bernard Russell, one of the greatest thinkers of the twentieth century, totally overwhelmed by this sad statement, said "all the labour of the ages, all the devotion, all the inspiration, all the noonday brightness of human genius, are destined to extinction in the vast death of the solar system..."[5]. However, we'll prove that the death of our solar system should not concern us, but rather the death of our biosphere.

The degradation of the ordered energy in the solar system involves the release of energy as a result of fusion reactions in the Sun. Astrophysicists have determined precisely that in the Sun, in one second, a mass of 584 million tonnes of hydrogen isotopes are converted by fusion reactions into 580 million tonnes of helium[7]. The 4 million tonnes mass difference becomes radiant and thermal energy according to Einstein's equation:

$$\Delta E = \Delta mc^2 = 4 \cdot 10^9 \cdot (3.10^8)^2 = 3.61 \cdot 10^{26} \text{ Joules / second.}$$

So, every second, 4 million tonnes of hydrogen isotopes from our Sun are turned into radiant and thermal energy that crosses the entire Universe. Part of this radiant energy reaches the Earth and contributes to the process of photosynthesis and through all the biochemical chain processes it leads to formation of natural products that constitute the foods for all biological species, including humans. Moreover, in the process of photosynthesis, oxygen is formed, an element vital to life. Currently, the Sun still has a mass of 2 x 10^{27} tonnes of hydrogen isotopes. It is estimated that about 2-3 billion years will pass until the collapse of the Sun, an extremely large period on a biological time scale. So that, Mankind should not worry about the thermal death, at least in our solar system, as it was expressed in some concerns in the late nineteenth century and early twentieth century. It is very possible that the death of our biosphere will happen much faster. In the biosphere, the entropy is not increasing because of its volume, since $V_{biosphere}$= constant, or because of fusion reactions like

those from of the Sun. The entropy in the biosphere increases due to human activities, that lead to the degradation of the ordered energy stored in fossil fuels and nuclear fuels, into disordered energy, ie heat.

In recent decades, the automotive industry has developed into a disturbing rate, exaggerated, an indecent manner due to the phenomenon of market competition. Between 1960 -1990 the amount of CO_2 in the atmosphere has increased from 2.53 x 10^{12} to 2.81 x 10^{12} tonnes, that is, on average, 9.3 x 10^9 tons/annually or 2.6 x 10^7 daily [9]. At present, it is estimated that the daily emission of CO_2 into the atmosphere is about 3 x 10^7 tonnes. Of this amount 3/4 comes from burning fossil fuels (coal, oil) and the rest is from the fermentation of the equator and tropical vegetation. Approximately 7.8 x 10^6 tonnes per day, or 30% of the CO_2 dissolves in the water of seas and oceans, about the same amount is consumed in the process of photosynthesis, and the difference, 3 x 10^7 – 2 x (7.8 x 10^6) = 1.44 x 10^7 tonnes / day, remain in the atmosphere leading to greenhouse effect[10]. On the other hand, by dissolving CO_2 in the water of seas and oceans, their acidity increases. Moreover, by dissolving CO_2, O_2 gets dessorbed, because CO_2 molecules dissolve in water better than O_2 molecules. The acidity increase, coupled with the decreasing O_2 concentration seriously affects the flora and fauna from the seas and oceans.

In the last 50-60 years, Man has destroyed a heritage accumulated by Earth in over 4 billion years, if we also consider the minerals that were formed when planet Earth was created.

Since the human species is the most advanced from a structural and functional point of view, in order to maintain this state it must consume food of a high degree of organization (proteins, sugars, etc.) from the environment, thus leading to a decreased order in the biosphere. But now, Man has exceeded the strictly necessary and decent consumption, and also consumes order from the environment to achieve an outrageous comfort, without any reason or morality. Fuel and mineral reserves, which were offered to the Man for a judicious use, are now about to be exhausted. Moreover, these reserves are not renewable. Even with a constant population and a constant rate of natural reserves

exploitation, eventually they will be exhausted, and the existence of the human species will be jeopardized; if it will not end sooner because of other factors such as pollution, that represents the ultimate expression of degradation of order in the biosphere, an unprecedented manifestation of increasing entropy of the biosphere. The human species is the only biological species that pollutes far more than its biological function. *Man did not inherit Earth from his parents, but borrowed it from his children and, therefore, is obliged to preserve and present it to the future generations.* The Man without a religious culture, and also scientific culture, doesn't show respect for the environment where he lives. Notable is that it is not the scientists, who have contributed to the development of current technologies, are responsible for unprecedented global environmental crisis, but politicians, decision-makers that were involved in social and economic development of Mankind, which is mostly subjective. It is time for church involvement, religions, regardless of confession, to diminish the processes of exploitation of natural reserves. A dialogue between politicians, scientists and religious leaders is absolutely necessary, before reaching a critical threshold, and maybe this threshold has been reached already.

The beauty of the nature in which we live should be an invitation to save it, a sign of gratitude for the transcendental God who has "thought" the initial conditions in such a way that our planet is rich in all goods necessary for human existence: light, water, soil, fuels, minerals and an exceptional atmospheric composition, 21% oxygen and 78% nitrogen. Was all this the result of chance that happened about 15 billion years? "The laws of nature reflect God's reason," said Stephen Hawking[2].

"And the earth brought forth grass, and herb yielding seed after his kind, and the tree yielding fruit, whose seed was in itself, after his kind: and God saw that it was good."(Genesis, Chapter 1-12).

If we lose God's creation, we also lose God and "if God doesn't exist, then everything is dust and ashes. If there is no absolute to give meaning and value to our existence, then that means that existence has no meaning." said Mircea Eliade[11]

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