Deterministic evolution – the role of cosmological parameters in the evolution of life

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Abstract:

Natural selection cannot logically explain the direction of evolution of life – emerging from non-living things and evolving from simple to complex – unless nature also evolves suitably. The ΛCDM model provides only an approximate co-relation between 'evolution of nature' (expansion of universe) and 'evolution of life'. Based on an alternate model, I propose 'deterministic evolution', expansion guiding the evolution in a predetermined way. This resolves the only serious drawback of theory of evolution, 'complexity emerging on its own '.

1. Introduction:

We humans are expert tool-makers. Why is it that our complex machines like computers work efficiently? The most simple answer is that these are allowed by nature (the Cosmos). Our machines are made up of atoms; Cosmos allows the pattern in which the atoms are packed, and once the pattern is correct, the structure shows the required emergent property. When we create machines, what we do is creating the required environment, and the atoms get packed on their own. We do not decide the positions of atoms; we only discover that atoms get arranged in a certain pattern under the given environment; the number of allowed patterns is very high that we have enough choice. In short, we provide a suitable environment, the atoms do the job themselves in a way allowed by the Cosmos, and our machines emerge.

The above approach can be used in explaining the existence of life. Why is it that life flourishes here? The simplest answer is that the Cosmos allows it. Like our machines, living things are also made up of atoms. Thus life is an emergent property of 'atoms packed in a certain pattern', and the Cosmos allows such a pattern. In the case of life, the environment is natural. The Cosmos provides the environment, the atoms do the job themselves, and life emerges.

Why is it that atoms can do the job themselves? The answer is that atoms are not inert, but are energetic; they possess energy and force. All emergent properties, including life, arise from energy and force. Energy is simply motion, and intuition suggests that force may be reaction to motion. This provides a new paradigm: motion at speed 'c' is a property of matter (vixra:1401.0135), and force is reaction to this motion. This leads to an alternate cosmological model.

2. Alternate cosmological model:

The ΛCDM model provides a very good picture of the cosmos. It agrees with observations: an expanding universe (accelerating), and the existence of Cosmic Background Radiation (CBR), large-scale structures (galaxies, stars, etc) and smaller structures (life forms, atoms, particles, etc). However, the model is incomplete and requires the existence of dark matter and dark energy, which are rather hypothetical.

Moreover, the model just describes the present state of the universe, but does not say anything conclusively about its initial state (past) or final state (future) or why it is in a state of expansion at present; that is, the model does not by itself predict any expansion.

The new paradigm, mentioned earlier, visualizes that bodies always remain in motion, and the natural energy of any body is $mc^2/2$. If just nine percent of this energy manifests as speed, then speed will be one-third of light; this implies that large-scale structures can move at very high speeds. Force (taken as reaction to motion) prevents these structures from moving infinitely away from each other; so these are confined to closed paths, and together these form a system. Such a system cannot remain static, but have to remain in motion, and the only mathematically viable model is a pulsating system (vixra:1602.0069). That is, the new paradigm predicts a pulsating universe.

The structures like Laniakea supercluster [1] are the basic units of the system we call the universe, and these remain moving at very high speeds in closed-helical paths. The geometry of their paths creates a pulsating system that exists for ever. Thus the future, past and the present remain rationally explained in the alternate model. Also, the model does not require any unknown or exotic entities (like dark matter and dark energy). The model visualizes that electromagnetic radiations also follow closed paths (vixra:1505.0042). By the time a radiation completes one revolution (the proposed period is 15.64 billion years), the expansion reaches halfway. The CBR is a system of such radiations, and it co-exists with the system of large-scale structures (vixra:1602.0069).

The pulsation of the universe is due to thermodynamic changes involving speed and internal-energy of superclusters. A static equilibrium is impossible between speed and internal-energy. So these remain in a dynamic equilibrium in which these oscillate between states of high internal-energy and high speed. So the system as a whole (the universe), oscillates between two potential states, one representing the state in which bodies (like stars and planets) have the maximum internal-energy and the other in which bodies have the minimum internal-energy. If the former is identified as a hot state, the latter has to be identified as a cold state, and the intermediate state as a neutral state having absolute zero temperature. The thermodynamic change from internal energy to speed causes expansion, and the reverse change causes contraction.

3. The structure of the universe:

The geometry of the universe is spherical. The center is empty, the inner clusters have shortage of energy, the middle clusters have near normal energy, and the outer clusters have excess energy. The innermost clusters contain mainly light elements, and due to shortage of energy, these do not reach temperatures required for fusion reactions. The outermost clusters contain mainly dense elements that can withstand high temperatures. So nuclear fusion/fission reactions do not happen in the outermost and innermost clusters. That is, most of the activities in the universe, like star formation, nuclear fusion/fission reactions, emergence of life etc. remain confined to the middle region. At the beginning of expansion, the middle clusters contain large amounts of light elements. As expansion proceeds, fusion reactions happen in them, and the reactions mainly end up with iron, the middle element. By the time the expansion reaches halfway, the middle clusters will have accumulated substantial amounts of iron. The average temperature of the middle region clusters always corresponds to the average temperature of the universe.

4. Nature of the expanding phase

Just before expansion, the universe is very hot (proposed average temperature 5225K), and bodies have high internal energy. Expansion cools the universe. Cooling is a process of 'internal energy changing into speed' in the case of bodies and large-scale structures, and a process of 'splitting' of quanta in the case of CBR; the rate of cooling is the same for both. As internal energy changes into speed, the superclusters move outwards from a common center along helical paths, causing expansion. Because of the high internal energy in the beginning, expansion starts with maximum acceleration. The acceleration reaches zero at halfway; thereafter, there is negative acceleration, and ultimately expansion comes to an end. By the time the expansion comes to an end, the universe becomes extremely cold.

Cooling starts from the centers of galaxies; the bodies at the galactic centers cool first, and the process gradually spreads to sub-levels. The large bodies of hydrogen (would-be stars) have high internal energies but are less dense, and so these remain at comparatively lower temperatures at the beginning of expansion. When internal energy changes into speed, these get compressed and heated, and fusion reactions are kindled; once the fusion reactions come to an end, these start cooling. The dense planets are initially very hot, but the rate of cooling is slower than the universe because the parent-star reacts sufficiently towards the expansion.

At halfway, the wavelength of the CBR will be 5.141×10^{-3} m, and this corresponds to absolute zero (vixra:1401.0135) temperature as per the alternate model; the temperature corresponding to higher wavelengths can be taken as negative. The present temperature of the CBR is approximately 2.8K, and so we are very close to halfway

The expanding universe favors a change from internal energy to speed, an environment that maintains stars and heat engines, an environment that favors an increase in the 'entropy of the universe'. In the contracting phase, speed changes into internal energy, creating an environment that favors a decrease in entropy; so neither stars nor heat engines can exist in that phase. The term entropy, however, requires to be redefined (vixra:1312.0002).

5. Emergent properties:

Mass, volume, energy and force are the only fundamental properties of matter. Energy (motion) tries to move matter particles away from each other, while force tries to bring them together. This action- reaction relation between motion and force keeps matter confined to closed paths (that is, matter cannot remain at rest or move at an infinite speed or move infinitely away from each other). Confinement leads to integration, and matter remains integrated as a complex system (universe), in which energy and force remain balanced. That is, matter cannot remain as a single lump or as a homogeneous soup of particles, but remains integrated into something in between these two extremes. With each step of integration, matter acquires some emergent properties, which are basically different from but explainable based on, the existing ones. The emergent structures are thus whole units, not just a mix-up of the constituents.

Out of the large number of composite particles that can be formed (from the fundamental particles), electron, proton and neutron are relatively more stable and so these 'three' are the selected ones in that step. The emergent properties of these cause the formation of atoms. Nearly 120 different atoms are possible, and these can integrate into millions of configurations, each having some distinct emergent properties. But when atoms and their combinations get packed into large bodies like Earth and Sun, the interaction between such bodies depend just on their masses (irrespective of the way in which the atoms in them are packed). That is, the number of possible combinations in that step gets drastically reduced; or new emergent properties are fewer. When a structure like the universe is formed, the only emergent property is pulsation, giving it two distinct phases. The expanding phase provides an environment of increasing entropy inside the system, while the contracting phase provides a reverse environment.

Thus the mid-level structures formed from atoms show a wide variety of emergent properties, which we can call 'exotic', like super-conductivity, super-fluidity, self-replication, data-storing, data-processing, life, intelligence, consciousness, etc.. The most feasible mid-level structures evolve naturally, while the less-feasible structures evolve out of artificial environment provided by us. The fundamental properties of matter are enough to create these emergent structures and emergent properties; or we can say that the Cosmos allows the existence of these.

6. Life – an emergent property:

Life is an emergent property acquired by structures (made up of atoms) that emerge naturally when the environment becomes suitable. The minimum requirement for a structure to acquire life is that it should be capable of absorbing, storing and using energy, and that provides it with a limited-independence. We can say that life, an emergent structure acts as a whole, and is somewhat independent, acting on its own; that is, it has freewill to some extent. Self-replication is the most distinct action shown by life. If a structure made up of atoms can replicate itself using the energy absorbed and stored in it, we can say that it acquired primitive life. However, if the energy required for replication is supplied by an external source, it is just a forced action, and the structure cannot be treated as having life. Though the distinction between independent action and forced-action is very thin, the difference is crucial.

Life works on the principle of heat-engine. A heat-engine requires a source and a sink, the source remaining at a higher temperature that the flow of energy from source to sink is spontaneous. The crucial condition for the engine to work is that the sink should be able to contain the heat energy that is released, without itself getting heated. In the case of life, Earth acts as the source and and the universe acts as the sink, and the temperature difference between Earth and the universe makes it possible for the heat-engine (life) to work. The expanding universe is cooling, and this makes it a suitable sink that can absorb the heat released.

As expansion is a process of internal energy changing into speed, release of internal energy is spontaneous in an expanding universe, and stored energy can be used to do work. The continuous emission of radiations by stars (which is also a consequence of expansion) forces energy into structures (made up of atoms) in planets like Earth. This energy gets stored in them and is used later to do work, and the structures thus acquire life. Thus, it is the expansion that maintains life.

The complex molecules that are required for the existence of life can exist only within certain temperature limits. Thus avoiding the extremes, we can expect life to emerge during the middle period of the expansion, when the universe is neither too hot nor too cold. As expansion approaches halfway, the environment becomes more and more favorable, and intelligent beings emerge. At the zenith of evolution, the intelligent beings attain consciousness, and understands what matter is; and thus matter attains self-realization. The expansion has now reached nearly halfway; the present wavelength of the CBR provides proof for that.

Again, as far as the energy possessed is considered, the most ideal environment will be in middle-region clusters, which possess near-natural energy (the inner clusters have shortage of energy and the outer clusters have excess energy). The presence of large amounts of iron in the core of Earth and the stopping of nuclear fusion reactions at iron in the stars in the observable part of the universe indicate that we belong to a middle region cluster. The agreement between experimental and theoretical (based on the proposed model) values of G provides proof (vixra:1510.0155) that Earth actually belongs to a middle-region cluster.

Thus, as per the model, life emerges in the middle-region clusters during the middle period of the expanding phase, the cosmos thus providing the environment required for the emergence and existence of life. Now it is the golden age of life: life exists in millions of isolated pockets in the observable part of the universe, and conscious intelligent beings may be present in thousands of them, the Earth being just one.

7. Time-frames of 'expansion' and 'evolution':

Based on the alternate model, the period of expansion is 31.28 billion years, and the middle period of nearly 10.5 billion years is the period during which life in any form may exist in the universe, and the middle period of (may be) 150 million years (during which, the average temperature of the universe changes from 20K to -20K), the only period when complex brain structures having consciousness can exist.

The dense core of a planet survives both expansion and contraction. The previous contraction heats up the central core, and by the time contraction ends, the temperature would have attained stability that its average temperature is equal to the average temperature of the region to which it belongs – the geometric mean of the surface and core temperatures can be taken as the average temperature. The average temperature of the middle region clusters at the beginning of expansion is 5225K, the then 'average temperature of the universe', that is, the then temperature of the CBR.

Unlike a star, the speed of a planet does not increase proportional to the expansion, and so the temperature of its core remains more or less the same until its parent star burns out, but its surface cools due to emission of radiations. The temperature of the core of Earth is 6230 ± 500 K and the surface temperature is 288K. At the beginning of expansion, the core temperature would be nearly the same. Though the crest formation is a subsequent event, the cooling of the surface will be more or less similar to that of universe, only that the cooling rate will be slightly less (because of the hot core). The table below shows the possible temperatures of 'universe' and 'surface of Earth' at various times during the past, assuming the rate of cooling to be linear.

Average temp. of the universe at the beginning of expansion	= 5225K
Present temperature	= 3K (nearly zero)
Rate of cooling of universe	= 5225/15.64
	= 334K / billion year
Temperature of the core of Earth (nearly constant till now)	= 6230K
Average temperature of Earth at the beginning of expansion	= 5225K
Surface temperature of Earth at the beginning of expansion	= $5225^2/6230$ =4382K
Present surface temperature of Earth	= 288K
Rate of cooling of surface of Earth	= (4382 – 288)/15.64
	= 261.76K / billion year

Time (in billion years ago)	Temperature (in Kelvin)	
	Universe	Earth's Surface
15.64	5225	4382
5.0	1670	1597
4.5	1503	1466
4.0	1336	1335
3.5	1169	1204
3.0	1002	1073
At present	3	288
At halfway	0	285

Table- 1: The temperatures of the universe and the surface of Earth at various times during expansion (rate of cooling assumed to be linear)

It can be seen from the table that at the beginning, the universe was hotter than the surface, 4 billion years ago both had the same temperature, and now the universe is colder than the surface. Though the rate of cooling is assumed to be linear, the result will be nearly the same for any time-temperature relation. As cooling depends on temperature, the cooling will be faster initially, the rate decreasing as expansion approaches halfway. So, 4 billion years ago, the temperature of the universe and that of the surface of Earth is expected to be around 450K (against 1336K shown in the table). So the present rate of cooling is expected to be around 1K / 8 million years.

Thus, based on the model, 4 billion years ago the surface temperature of Earth passed through a critical point. Before that, surface of Earth being colder than universe, emission of radiations was less than absorption. This favored endothermic reactions leading to the formation of organic molecules and oxygen. Exothermic oxidation reactions were absent that by the time the temperatures became equal, a large reserve of energy in the form of organic compounds came into being on the surface of Earth, and the amount of oxygen increased. After that crucial point, the universe became colder than the surface of Earth that exothermic reactions were more favored. When the temperature of the universe became sufficiently lower, the oxidation reactions became spontaneous that stored energy could be used by the amino-acid chains to form new structures, or the amino-acid chains started doing work on their own. That is primitive life started emerging. In 4 billion years, these primitive life evolved into complex life forms having intelligence and consciousness. The 4 billion-year period [2] is in near agreement with fossil records.

8. **Deterministic evolution:**

The Cosmos provides the overall environment required for the survival of life. The changes in the environment depends on expansion, and the environment becomes suitable for more and more complex structures, as expansion approaches halfway. That is, the environment offers newer and newer skills. For example, some three billion years ago, the environment was unsuitable for brain-structures to function. Suppose we were introduced at that time, the brain would be of no use, making us totally helpless. The overall environment became suitable for self-conscious intelligent beings like us only recently. That is why it took that much time for humans to emerge. Expansion thus decides the direction and speed of evolution.

As the environment has been becoming more and more conducive to life, a species that emerged at the beginning may survive even now without evolving. But the new species that emerge in the changed environment will have new skills that in the competition for survival, the older species may lose out completely. The net result is that most of the earlier species got extincted, a few remain more or less as such without much change, some retained the physical structure but acquired new skills, while the rest evolved into newer and newer species that differed both in physical structure and skill.

The evolution from inorganic molecules to complex structures having consciousness is not a case of mere survival. It is something more fundamental, a change in a certain direction, a race towards a deterministic end. There will be billions of habitable planets in the middle-region clusters, Earth being just one of that; and the race towards consciousness becoming successful is a rule rather than an exception. That is, the emergence of intelligent beings having consciousness is something that invariably happens in an expanding universe. Evolution is thus a deterministic process.

9. **Chance and complexity:**

The main drawback of the theory of evolution is that it views 'complexity can emerge from arbitrary events'. The argument of creationists that 'it requires some guidance for attaining complexity' is justifiable. That is, natural selection alone cannot explain the direction of evolution from simple to complex. The evolution of 'nature' (caused by expansion) together with natural selection decides the direction.

Initially, endothermic reactions were favored on Earth. So organic compounds including the amino-acids were formed, and these remained stable. The condition gradually changed to one that favors exothermic reactions. So during a certain period, both reactions had equal probability; this resulted in making and breaking of amino-acid chains, thus complex chains were formed, and these could remain stable. As the condition became suitable for exothermic reactions, stable primitive life emerged. Thus at every stage of evolution, the condition was apt for the stability of the structures formed then, and the complexity increased little by little.

Now exothermic reactions are spontaneous on Earth. Had this condition existed through out the history of Earth, the organic compounds formed initially, and the biological structures formed at each stage would be unstable that emergence and evolution of life would have been impossible. The expansion thus guided the evolution from simple to complex by gradually providing the suitable environment. The evolution is thus a reversible process in which the system always remains in equilibrium, and the direction of change depends on the guiding factor.

Deterministic evolution thus removes the only serious drawback of the theory of evolution. None of the factors required for the emergence of life are chance events. The existence of stars and planets, planets having dense cores and lighter crusts, cooling rate of universe, surface temperature of planets, the temperature difference between the planets and the universe, etc. are all deterministic to a very high degree. Here, chance has only a negative role, hindering the race towards complexity in some individual cases.

10. The evolution- devolution cycle:

Life emerges and exists during the middle period of expansion, and evolution reaches its zenith at mid-way of expansion, when the condition is most suitable. Complex brain structures, capable of storing and processing data efficiently, emerge close to midway. The viruses, which appear to be very simple structures but are extremely efficient in survival, also require the same ideal conditions to be efficient. But after midway, the condition becomes less and less suitable that there will be negative-evolution. The brain gradually loses its edge over other factors as a weapon that assists existence. Even the viruses lose their ability to create new proteins for survival. So, as in the past, muscle power becomes more useful. Gradually, brain becomes redundant, and life forms that have no central processing units replace those having brain structures – a gradual return to primitive life forms. Ultimately all life forms, and all organic compounds disappear, and the universe becomes as barren as in the beginning. In the next expanding phase, life emerges again, and the cycle continues infinitely.

11. Consciousness and self-realization:

In the race towards the ultimate goal (in evolution) of consciousness, we have sidelined the chimpanzees, baboons and all others having brain structures, and arrived at the destination. The rest of the animals are all following us in the race. That is, they are also becoming more and more intelligent as expansion approaches half-way. The present-day animals are more intelligent than their ancestors; their tool-using and communication skills may be recent developments. Some 23 million years are still left for the exact halfway. So the possibility is that some of these may cross the threshold of intelligence to become self-conscious (if Earth remains habitable till that time). The question is only how much information regarding this cosmos they can extract. We have succeeded to a significant extent in that area. Once we finish it, we can say matter (or Cosmos) attained self-realization through us.

12. Conclusion:

Why should there exist a Cosmos containing matter, space and time, and why these have some basic properties are questions that cannot be answered by physics. That is a limitation of physics; we can rather resort to metaphysical answers, if required. However, once their existence and their basic properties are acknowledged, it should be possible to arrive at a step by step integration picture; that is the role of physics, and that is what physicists try to achieve.

The alternate model refereed to in this paper gives a logical picture of such an integration. A pulsating universe is the ultimate structure formed by matter, and atoms are the structures at an intermediate level. A large number of permutations and combinations are possible with atoms, and each configuration has its own emergent properties. These emergent properties arise from 'a set of' actions' allowed by the Cosmos. Actions that lie outside that set are just impossible; we can neither accomplish such an action nor provide any logical explanation for the possibility of such an action.

Emergence of life is an allowed action that occurs naturally. The Cosmos provides the required environment in a deterministic time-frame: life emerges and exists in the middle period of expansion. Once it emerges, there is gradual evolution, the evolution reaching its zenith at halfway of expansion; thereafter, there is gradual devolution and at the end, life just vanishes. This cycle of events repeats infinitely as the universe passes through its infinite cycle of pulsations. The alternate model thus provides a better correlation (than the ΛCDM model) between the time-frames of 'expansion of the universe' and the 'existence of life'. Moreover, it removes the only serious drawback of the theory of evolution, complexity arising from mere natural selection.

Reference:

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