Life forms, "hybrid" causality, gravity and hierarchical parallel universes

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Abstract

This paper proposes a new definition of life forms in relation to a new type of "hybrid" causality, gravity and the possible existence of hierarchical parallel universes.

Keywords: life forms, gravity, hierarchical parallel universes;

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Observation no. 1 (Obs1) (life forms as dissipative systems). Being complex dissipative systems, life forms (**LFs**) periodically (and progressively) change/refresh significant fractions of their molecules, atoms and subatomic quantum particles (**QPs**) [1, 2], by interchanging significant percents of the total number of these physical particles (**PPs**) (found inside those LFs) with their outer environment (**outENV**), to preserve (at least their vital) energy and (at least their vital) structural and functional biological information (**BI**) and to replicate. It is clear that LFs use each (internalized) PP not only for the energetic content of that PP (the "caloric value" of that PP), but also (very frequently and essentially for survival!) for the (bio-structural and bio-functional biophysical and biochemical) bio-informational (carried) content of that PP (including, for example, the photons that hit the retina and are used for creating perceptual images), including the capacity of that PP to (chemically) "donate" or "accept" any other QP or PP, so that all PPs may be considered "energo-informational packs" when analyzed in the "frame of reference" of any LF, especially in the context that energy and information are intricate (and indissolubly related) concepts in both physics and biology.

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Definition no. 1 (Def1) (the inner environment of a life form). The inner ENV (**innENV**) of an LF is also defined as the 3D space (plus all the PPs it contains) "trapped" within the approximate spatial borders of any LF phenotype, at any instance of its lifetime.

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Observation no. 2 (Obs2) (the physical particles defined as "vital" for any life form in part). Given the total dependence of an LF on some demonstrated "vital" PPs (**vPPs**) from its outENV and its innENV (which vPPs are defined as sine-qua-non for the existence of that LF phenotype and genotype), it is very clear that all LFs are indissolubly related to their outENV.

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Conjecture no. 1 (Conj1) (the ternary structure of any life form). Based on Obs.1, Def1 and Obs2, LFs are conjectured to be essentially composed from **three main parts**:

(**1**) a biological "LF code" (**LFcode**), defined as a set of laws and rules which allow the existence, survival and replication of LFs:

(**i**) the known laws of physics which allow the existence of LFs (no matter the complexity of LFs) are all considered the main/primary parts/modules of the LFcode;

(**ii**) Every structural and functional information of every (transitory) PP contained by innENV is also considered a secondary part/module of the LFcode (for example, the DNA/RNA code and generally the set of all physical [including energetic, geometrical etc.] and chemical properties of all substances from any innENV useful for the survival and replication of any LF)

(**iii**) any other rule used by any LF (at any of its structural and functional innENV levels) for survival and replication is considered a tertiary part of the LFcode;

(**2**) an "LF body" (**LFbody**), which is defined as the innENV, no matter the rate of "refresh" of each PP from that innENV;

(**3**) an "extended LFbody" (**extLFbody**), which is defined as the sum of all 3D space plus vPPs from the outENV (of any LF) which may be potentially used by any LF for its survival and replication at any instance of its own lifetime (as an individual) or its whole lifetime (as an LF species);

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Definition no. 2 (Def2) (the concept of horizontal causality). Given an arbitrary frame of reference and an arbitrary movement of a chosen PP from position A to a (measurable) distinct position B, the horizontal causality (**hCaus**) is defined **as the set of all local and non-local physical interactions needed by that PP (interactions of all its possible subcomponents plus local and non-local interactions between that PP and its surrounding ENV) to change position from A to B**.

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Definition no. 3 (Def3) (the concept of vertical causality). Given an arbitrary frame of reference, an A-to-B movement of a chosen PP and the hCaus definition, vertical causality (**vCaus**) is defined as the set of all physical laws which govern (and allow)

the PP existence and its A-to-B movement (with all the implied/needed interactions for that A-to-B movement to occur at the first time and then to finalize in a predefined spacetime reference frame), which laws may partially (but not totally) oppose to the PP existence and to its A-to-B movement. **In other words**, vCaus is defined as that set of "all vertical causes" that allow the existence of a chosen PP and its (chosen) A-to-B movement. **As it can be observed**, vCaus is double-layered in two main subsets: (**1**) the primary subset of physical laws that allow the existence of that chosen PP at the first time; (**2**) the secondary subset of (physical) laws that allow the chosen A-to-B movement (with all its implied/needed intermediary interactions) of that (chosen) PP (in a predefined frame of reference).

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Observation no. 3 (Obs3) (the concepts of hybrid causality and 2D time). Based on the previously introduced Def2 and Def3, it is clear that <u>all possible movements of any possible PP (from our physical universe) are simultaneously governed by both hCaus and vCaus</u> which is named <u>hybrid causality</u> (**hybCaus**) in this paper. Based on hybCaus, time can be modeled as a <u>two dimensional mesh/grid</u> (**2D-time**, abbrev. as **"2DT"**) with:

(**1**) one "horizontal" physical (and informational) dimension (identified with hCaus) and

(**2**) an additional 2nd "vertical" abstract (pure informational) dimension (identified with vCaus).

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Observation no. 4 (Obs4) (and some of its related speculations on gravity, entropy and the large ratio between the electromagnetic field strength and the gravitational field strength). Gravity is indissolubly related with <u>physical distinctiveness of PPs</u>: if gravity would much stronger than it is in the present epoch of our observable physical universe (**OPU**), the most PPs of our OPU would exist in much compact micro- and macro-configurations and would allow a much lower number of possible relative positions so that our OPU would be in a much lower entropic(/informational) phase, characterized by a much lower OPU volume, and much larger compactness of its PP-based matter and energy. **In opposition**, a variant of gravitational force/field (**GF**) much weaker than the electromagnetic force/field (**EMF**) (like in the present epoch of our OPU) offers much larger number of possible microstates/micro-configurations of any conceivable PP-based system from our OPU (as EMF and GF together simultaneously act at both large global scales and small local scales), resulting in a much higher total entropy (total quantity of overall information) of our OPU: **in consequence**, the <u>EMF-to-GF strength ratio</u> (**EGsr**) EGsr "controls" the rate of global and local matter (including radiation) "agglutination" in our OPU, so that EGsr can be considered <u>an indirect measure of the maximum achievable/allowed global entropy (**S**)/information</u>

(S_{max}) <u>of our OPU</u>, which S_{max} can be defined as (natural or binary) logarithmic measure of the (possible finite) maximum number of configurations/states of all PPs from our OPU (N_{max}), such as:

$$S_{max(1)} = \ln(N_{max}) \qquad \textbf{(1a)}$$

$$S_{max(2)} = \log_2(N_{max}) \qquad \textbf{(1b)}$$

It is also important to emphasize that, if EGsr will be proved to vary in time, then $S_{max(1,2)}$ and N_{max} may also vary in time.

Notations used further in this paper. Most of the notations used in this work are standard: $\hbar = h/(2\pi)$ for the reduced Planck constant; G for the Newtonian constant; $m_N \cong 10^{-27} kg$ for the rest mass of a nucleon (proton or neutron) $(m_p \, or \, m_n)$; m_e for the rest mass of the electron; c for the speed of light in vacuum; k_e for the Coulomb's electrostatic constant; q_e for the elementary charge of the electron; $\boxed{\alpha = k_e q_e^2 / (\hbar c) \cong 137^{-1}}$ for the fine structure constant (**FSC**) at rest (which FSC is also the coupling constant of EMF at rest) and its inverse (and its inverse $a = \alpha^{-1} \cong 137$); $\boxed{\alpha_G = G m_e^2 / (\hbar c) \cong 10^{-45}}$ for the gravitational coupling constant (**GCC**) (and its inverse $a_G = \alpha_G^{-1} \cong 10^{45}$) with its variants $\boxed{\alpha_{Gv} = G m_N^2 / (\hbar c) \cong 10^{-38}}$ (and its inverse $a_{Gv} = \alpha_{Gv}^{-1} \cong 10^{38}$) and $\boxed{\alpha_{Gvv} = G m_p m_e / (\hbar c) \cong 10^{-42}}$ (and its inverse $a_{Gvv} = \alpha_{Gvv}^{-1} \cong 10^{41}$).

EGsr at low non-relativistic energies (corresponding to large length scales) can be measured by the ratio $(\phi_{E/G})$ between the electromagnetic repulsion force between any two electrons (each from a distinct atom of our OPU) $F_e = k_e q_e^2 / r^2$ and the gravitational attraction force between those same two electrons $F_g = G m_e^2 / r^2$ (with r being the distance between those chosen electrons), such as:

$$\phi_{E/G} = F_e / F_g = (k_e / G)(q_e / m_e)^2 =$$
$$= a_G / a \cong 4 \cdot 10^{42} \qquad \text{(1c)}$$

EGsr (as measured by $\phi_{E/G}$) is the main factor which decides the rate of matter "agglutination" in our OPU together with (possibly) indirectly measuring $S_{\max}$ (with EGsr and $\phi_{E/G}$ both having a plausible global thermodynamic meaning/interpretation in our OPU).

It is also very plausible that, if $N_{\max}$ exists as a finite integer number (of configurations of all PPs of our OPU), $N_{\max}$ to be directly proportional with EGsr (and $\phi_{E/G}$) or an exponential of them, so that:

$$N_{\max} = k_1 \phi_{E/G}^{\ k_2} \qquad \text{(1d)}$$

$$S_{\max(1)} = \ln\left(k_1 \phi_{E/G}^{\ k_2}\right) = \ln(k_1) + k_2 \boxed{\ln\left(\phi_{E/G}\right)} \quad \text{(1e)}$$

$$S_{\max(2)} = \log_2\left(k_1 \phi_{E/G}^{\ k_2}\right) =$$
$$= \log_2(k_1) + k_2 \boxed{\log_2\left(\phi_{E/G}\right)} \qquad \text{(1f)}$$

Checkpoint conclusion on Obs4 and its equations. Given the last equation, both logarithms $\ln\left(\phi_{E/G}\right)$ and $\log_2\left(\phi_{E/G}\right)$ may have a specific valid physical thermodynamic meaning /significance/interpretation and may be used as a "unit of measure" for $S_{\max(1)}$ and $S_{\max(2)}$ respectively.

The well-known physicist Edward Teller appears to be the first who considered (in 1948) the natural logarithm $\ln\left(a_{Gv}\right) \cong 88$ (also an indirect measure of EGsr) AND speculated on the relative closeness between the magnitude of $\ln\left(a_{Gv}\right) \cong 88$ and the inverse of FSC $a\left(= \alpha^{-1} \cong 137\right)$ [3]. In fact, $\boxed{a_G = a\phi_{E/G}}$ so that both $\phi_{E/G}(\cong 10^{42})$ and $a_G(\cong 10^{45})$ can be considered (alternative) measures of EGsr.

In 1980, the theoretical physicist Saul-Paul Sirag alternatively considered the binary logarithm $\log_2\left(a_{Gv}\right) \cong 137.84$ and also speculated on the striking numerical closeness [4]:

$$\boxed{\log_2\left(a_{Gvv}\right) \cong a} \qquad \text{(1g)}$$

Speculation no. 1 (Spec1) (based on Obs4). If EGsr (no matter if fixed or variable in time) remains finite on the entire OPU evolution (no matter if OPU lifetime is finite or infinite), there may be a significant probability for $S_{\max}$ to remain finite on the entire OPU lifetime, which may indicate a Big Bounce universe (Spec1).

Speculation no. 2 (Spec2) (based on Obs4 an related to Spec1). The present EGsr is surely compatible to the existence of LFs in the present epoch of our OPU. Besides, LFs obviously need a "minimal" morpho-functional complexity (**Cmin**) (which is sine-qua-non for their existence and which Cmin may be also measured in entropy units), which Cmin implies a minimal (3D/volumic) space and a minimal (4D/hypervolumic) spacetime for the movement (in both innENV and outENV) and survival of any LF: this minimal space/spacetime (needed by any LF) also implies a "not-too-compact" innENV and outENV (with our present low-strength gravity allowing sufficient average spacing between any two PPs of our OPU), thus EGsr (implying Smax?) and Cmin may have a common origin in a kind of "entropic secret" of our "LF-friendly" OPU.

Speculation no. 3 (Spec3) (based on Obs4 and Spec2). The very large EGsr (which implies a very-low-strength gravity, in comparison to EMF strength) is probably an essential vCaus factor which allows the existence of LFs and their huge diversity, covering a very large spectrum of sizes (of about 7 orders), from bacteria (~10^{-6} m) to humans (~10^{0} m).

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Observation no. 5 (Obs5) (on biological hybrid causality and biological 2D time). When an (arbitrarily chosen) LF acts on an (arbitrarily chosen) PP and moves it from position A to position B with any specific biological purpose (a purpose "encoded" in the LFcode of that chosen LF) two additional biological vCaus (**bvCaus**) and a biological hCaus (**bhCaus**) simultaneously come into action, thus a biological hybCaus (**bhybCaus**) and its corresponding biological 2D time (**b2DT**) are to be analyzed.

Definition no. 4 (Def4) (the concept of biological horizontal causality). Given an arbitrary frame of reference and an arbitrary A-to-B movement of an (arbitrarily) chosen PP produced by an (arbitrarily chosen) LF, the biological horizontal causality (**bhCaus**) is defined **as the set of all local and non-local physical interactions needed by that PP (interactions of all its possible subcomponents plus (local and non-local) interactions between that PP and its surrounding outENV and innENV (ENVs defined in respect to that LF) to change position from A to B.**

Definition no. 5 (Def5) (the concept of biological vertical causality). Given an arbitrary frame of reference and an arbitrary A-to-B movement of an (arbitrarily) chosen PP produced by an

(arbitrarily chosen) LF and the bhCaus definition, the biological vertical causality (**bvCaus**) is defined as the set of all physical and biological laws which govern (and allow) the LF existence, the PP existence and the A-to-B movement (of that PP) produced by that LF (with a specific biological purpose encoded in the LFcode of that LF; with all the implied/needed interactions for that A-to-B movement to occur at the first time and then to finalize in a predefined spacetime reference frame), which laws may partially (but not totally) oppose to the LF existence, to the PP existence and to the A-to-B movement of that PP. **In other words**, bvCaus is defined as that set of "all vertical biological and physical causes" that allow the existence of a chosen LF, a chosen PP and its (chosen) A-to-B movement. **As it can be observed**, bvCaus is also double-layered in two main subsets: (**1**) the primary subset of physical and biological laws that allow the existence of those chosen PP and (the PP-based) LF at the first time; (**2**) the secondary subset of (physical and biological) laws that allow the chosen A-to-B movement of that PP by that LF (with all its implied/needed intermediary interactions) of that (chosen) PP (in a predefined frame of reference which includes both innENV and outENV of that chosen LF).

Observation no. 6 (Obs6) (based on Obs5, Def4 and Def5: on the biological hybrid causality regarded as an additional layer added to physical hybrid causality). bvCaus adds a very large number of additional biological laws/rules to the set of physical laws of our OPU (contained in any vCaus), so that bvCaus may be considered a metaphysical "parallel" (patch-like) layer added to vCaus. bhCaus also adds a very large number of additional biological entities (molecules with a huge number of structures, designs and functions) to the simple PPs (and to their possible interactions) that dominate our OPU (contained in any hCaus), so that bhCaus may be considered a metaphysical "parallel" (patch-like) layer added to hCaus. In a checkpoint conclusion, bhybCaus (which contains both bvCaus and bhCaus) can be regarded as being an important software-like "patch"/"update" to hybCaus.

Speculation no. 4 (Spec4) (based on Obs6). If parallel universes (**PUs**) will be proved to exist in the future, PUs may be discovered to have an hierarchical organization, so that each "superior" PU acts as a "code"/"mind" for its "inferior" PU and this "inferior" PU acts as the "body" of its superior PU. In this speculative context, LFs can be regarded (and redefined) as regions of intersection between our OPU (a "body"-like PU governed by hybCaus) and another superior parallel universe (which expresses/acts, in our OPU, as an informational software-like entity, a biological "code" or "mind" governed by bhybCaus).

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Observations set no. 7 (Obs7).

Preliminaries(1) of Obs7. The estimated age (**A**) of our OPU is $A_U \cong 13.8 \times 10^9 \ years$ measured from the hypothetical Big Bang (within the ΛCDM concordance model) [**5**]; it is estimated that the first stars (**fS**) appeared at $\Delta t_{fS} \cong 0.18 \cdot 10^9 \ years$ after the hypothetical Big Bang [**6**]; the estimated age of our Sun is $A_S \cong 4.6 \times 10^9 \ years$ [**7**]; the expected total lifetime of our Sun (which lifetime is mainly determined by its mass $M_{Sun} \cong 10^{30} kg$ [**8**]) is $t_S \cong 10^{10} \ years$ (see the next table, adapted from [**9**]);

Table 1. Representative lifetimes of stars as a function of their masses.

Star mass $(\times M_{Sun})$	Estimated lifetime of the star $(years)$	Spectral type of the star
60	3×10^6	O3
30	11×10^6	O7
10	32×10^6	B4
3	370×10^6	A5
1.5	3×10^9	F5
1	10^{10}	G2 (our Sun)
0.1	10^{12}	M7

The estimated age of the Earth is $A_E \cong 4.54 \times 10^9 \ years$ [**10**] and the estimated age of the oldest LFs demonstrated on Earth is $A_L \cong 3.7 \times 10^9 \ years$ old [**11**].

Preliminaries(2) of Obs7. Additionally, for LFs to appear at the first place, LFs need not only need hydrogen (with atomic number Z=1) and other "vital" chemical elements with small atomic numbers like carbon (Z=6), nitrogen (Z=7) and oxygen (Z=8) (produced by CNO nucleosynthesis in stars with masses comparable to M_{Sun} and larger), BUT also some "vital" chemical elements (specific stable isotopes called micronutrients, which are defined as sine-qua-non for any LF to form at the first time and to survive) with larger atomic numbers (listed in the ascending order of their atomic numbers Z): manganese (Z=25), iron (Z=26), cobalt (Z=27), copper (Z=29), zinc (Z=30), selenium (Z=34), molybdenum (Z=42), iodine (Z=53) etc. These "vital" micronutrients (with relatively large atomic numbers) can only be

produced in massive stars (**mS**) $M_{mS} \in \left[12M_{Sun}, 35M_{Sun} \right]$ (supergiants) (with average lifetimes $t_{mS} \in \left[11 \times 10^6, 32 \times 10^6 \right] years$) which are the most prolific source of new isotopes from carbon (Z = 6) to nickel (Z = 28), by supernova nucleosynthesis followed by massive (supernova) explosions and spreading those micronutrients on large volumes in OPU, so that they may reach potential LFs-compatible planets (planets which also need at least one star with optimal distance and mass for sustaining LF on those planets).

Preliminaries(3) of Obs7. Hydrogen (**H**) has a double "cosmic" role for any LF: (**1**) H is used as a "fuel" for stars (and converted to helium by atomic fusion with very large energy release) to energetically sustain life on any conceivable planet; (**2**) H is a chemical element essential in the (chemical, physical and biological) structure and functions of any conceivable LF (with a minimal needed complexity Cmin for it to exist from the first time) in our OPU. Additionally, the "LFs-fueling" star needs to be sufficiently stable so that LFs to have "sufficient" time to at least appear at the first place (even if not given sufficient time to survive on long periods or to evolve). Only (relatively) "light" stars (**lS**) $M_{lS} \in \left[0.1M_{Sun}, 1.5M_{Sun} \right]$ are sufficiently stable, with lifetimes $t_{lS} \in \left[3 \times 10^9, 10^3 \times 10^9 \right] years$:

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Observation 7a (Obs7a). Interestingly, the first LFs on Earth appeared after passing of just $\left(A_E - A_L \right) / A_E \cong 18.5\%$ of our Earth's present age (in more plastic words, the first LFs appeared in Earth's "childhood"), which is quite striking, because the Earth is expected to exist (excluding any catastrophic events that could destroy Earth much earlier!) for a total of $t_E = A_E + \left(t_S - A_S \right) = 9.94 \times 10^9 \, years$ (measured from Earth's birth until the moment in which our Sun is expected to exhaust all its hydrogen, thus to gravitationally collapse and engulf Earth [after planets Mercury and then Venus] in the red-giant-branch phase of our Sun's evolution, a phase with a predicted duration of $10^9 \, years$ and in which our Sun will lose ~1/3 of its mass), which means that the first LFs may have actually appeared immediately after the first

$$\boxed{\Delta t_{L(E)}(\%) = \left(A_E - A_L \right) / t_E \cong 8.5\%}$$ of Earth's total

lifetime (in more plastic words, the first LFs actually appeared in Earth's "infancy") which is even more interesting and quite striking by the fact that LFs have the potential to superpose with $1 - \Delta t_{L(E)}(\%) \cong 91.5\%$ of Earth's total evolution (defined as

Earth's history plus Earth's future) and with $1 - \left(A_S - A_L \right) / t_S \cong 91\%$ of our Sun's total evolution, as if LFs were somehow "predesigned"/"predestined" for Earth and Sun (as LFs have the potential to "assist" more than 90% of Earth's and Sun's evolution and even have the potential to decide Earth's faith, as humanity has now the technological potential to destroy Earth long before our Sun's "death").

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Observation 7b (Obs7b). For the first LFs to ever appear on any planet (or any satellite of a planet) of our OPU, LFs plausibly need at least two stars (with great "indulgence"!): (**1**) one massive star $\begin{pmatrix} with \ M_{mS} \in \left[12M_{Sun}, 35M_{Sun} \right] \ and \\ t_{mS} \in \left[11 \times 10^6, 32 \times 10^6 \right] years \end{pmatrix}$ to "be born", to produce supernova nucleosynthesis (of both light [called "macronutrients"] and heavy chemical elements [called "micronutrients"], vital for all LFs) and to "die" by supernova explosion and spread those vital macro- and micronutrients far away in their surrounding space; (**2**) one "light" star like our Sun (with $M_{lS} \in \left[0.1M_{Sun}, 1.5M_{Sun} \right]$ and $t_{lS} \in \left[3 \times 10^9, 10^3 \times 10^9 \right] years$) to be "born" and live at least $A_S - A_L = 0.9 \times 10^9 \, years$ (analogous to LFs of our Sun-Earth system which appeared after $\Delta t_{L(Sun)} = A_S - A_L$). Thus, for our OPU to become a "LF-friendly" universe, at least (with great "indulgence"!) an interval of

$$\boxed{\Delta t_{L(OPU)} = \Delta t_{fS} + \min \left(t_{mS} \right) + \Delta t_{L(Sun)} \cong 1.1 \times 10^9 \, years}$$

(also based on the minimal interval needed for the first stars to initially appear in our OPU) is needed as a "prelude" (as measured from the Big Bang, with great "indulgence" however!) before the appearance of the first LFs in our OPU. The first LFs on Earth appeared after passing $\left(A_U - A_L \right) / \left(A_U - \Delta t_{L(OPU)} \right) \cong 79.5\%$ of the present age of our OPU (measured from the moment of reaching its "LFs-friendly" phase). However, if we consider a hypothetical (**hyp**) (physical) universe with a total lifetime $t_{hypU} \left(\cong 10^{12} \, years \right)$ at least equal to the lifetime $t_{lS} \cong 10^{12} \, years$ of a (very) "light" star with mass $M_{lS} \cong 0.1M_{Sun}$, then the first LFs on Earth seem to have actually appeared immediately after the first

$$\Delta t_{L(hypU)}\left(\%\right) = 1 - \frac{t_{hypU} - A_L}{t_{hypU} - \Delta t_{L(OPU)}} \cong 0.26\%$$ of the

total lifetime of this hypothetical universe: this fact is quite striking, as if LFs were somehow "predesigned"/"predestined" for our OPU (because, at least theoretically, LFs have the potential to "assist" more than $100\% - \Delta t_{L(hypU)}\left(\%\right) = 99\%$ of the evolution of this hypothetical universe).

Checkpoint conclusion on Obs7a and Obs7b. It is very plausible that those (relatively) small percentages $\Delta t_{L(E)}(\%)\left(\cong 8.5\%\right)$ and $\Delta t_{L(hypU)}\left(\%\right)\left(\cong 0.26\%\right)$ may not be not just simple coincidences, as there is a strong contrast between the (relative) smallness of these percentages and the astonishing complexity of LFs and LFs societies (the complexity of the Earth biosphere as a whole, with a lifespan of about $A_L / A_U \cong 27\%$, which is a significant fraction of A_U, which implies a quite significant overlap between the history of our biosphere and the history of our OPU). Based on this double-argument, we also consider very plausible that <u>life may be essentially a predesigned phenomenon probably "engraved" in the laws of nature (including the still unknown laws of our universe), and just secondarily shaped by different so-called "natural accidents"</u>.

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Observation 7c (Obs7c). There are also some strong arguments that <u>creationism and evolutionism can be unified in a more profound monad</u>. It is generally considered that the non-zero probability of any LF existence strongly depends on: boson-fermion dichotomy (**BFD**) (associated with Pauli's exclusion principle [**PEP**] which apply to all fermions), some narrow intervals of allowed variations of FSC $\left(\alpha\right)$ (at rest) and for the beta constants values (at rest) $\beta_p\left(= m_p / m_e\right)$ and $\beta_n\left(= m_n / m_e\right)$ (which both influence the formation and life cycles of all the stars from OPU, which are the main sources of energy for LFs and the only source of atoms heavier that the iron chemical element, which are vital micronutrients for LFs); it is also generally admitted (and partially proved by some experiments and observations) that α, β_p β_n values (at rest) have probably been "decided" (by so-called natural (pre)selection) relatively close to the first moments after the (hypothetical but very probable) Big Bang: **for example**, β_p is estimated to have the same value (as in the present and as predicted by the Standard Model) for at least half the age of our OPU [**12**]. It was also demonstrated that the stability of all

chemical structures that compose any LF mainly depend on: BFD-PEP association, α, β_p and β_n values (at rest): **for example**, if FSC was with 4% lower (than its present value), stellar fusion would not produce carbon, so that carbon-based LFs couldn't have existed from the first place (and it is very hard to believe that any LF may achieve its minimum complexity "threshold" [as a sine-qua-non for any LF existence] without carbon); if FSC was larger than 1/10, stellar fusion would be impossible so that no star could provide the minimum energy flow probably needed for any LF to appear and survive from the first place [**13**]. In order for the first LFs to appear by the 3rd step of (Darwinist) "biological natural selection", proper chemical structures (atoms and molecules) must have been produced long before these first LFs by a 2nd step of "chemical natural (pre)selection": but this 2nd step of "chemical natural (pre)selection" strongly depends on α, β_p and β_n values (at rest) that were also "naturally (pre)selected" a relatively close to the (hypothetical) Big Bang moment and this "primary/basic selection" may be consider the 1st step of the "natural selection" process, that can be named the "<u>alpha-beta natural (pre)selection</u>". In this way, we propose a "natural selection" in three "A-B-C" steps:

(**A**) the selection of the main physical principles and adimensional constants compatible with life (relatively close to the Big Bang moment);

(**B**) the selection of the atoms and molecules compatible with life;

(**C**) the appearance of the first LFs that evolved by a so-called "natural selection" process

With this arguments, we propose <u>the unification of both Darwinist evolutionism and scientific creationism in a monad</u> that can be plastically described as a "seed"-like pre-Big Bang singularity which unpacks ("germinates") and generates a ("tree"-like) physical universe that produces ("fruit"-like) LFs in a specific "maturity"-moment of our universe. This monad "pushes" the three-steps "natural selection" close to the zero moment of the Big Bang, when α, β_p β_n values (at rest) were probably "naturally" (but not necessarily randomly!) selected [**14,15**].

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Observation 7d (Obs7d) (an important remark on the importance of FSC value at rest in the structure and functions of any LF). A change in the energy level of a specific electron in a specific atom and/or molecule of any LF may produce a change in configuration of that atom and/or molecule, a change that may also generate and transmit (further in a functional biological chain) a potentially vital information for that LF. FSC can be interpreted as the probability of a real electron to emit a real

photon (Feynman's interpretation): in biology, FSC can be "translated" as the main probabilistic measure of the relative stability of any atomic or molecular electronic cloud configuration, a cloud on which any LF can rely on as a generator and transmitter of vital/non-vital biological information.

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