

Magna Cosmogony

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Received: _20 May 2021_/ Accepted: _04 Aug 2021_/ Published: _31 Oct 2021_.

To Saraswathi Natarajan Balasubrahmanyam, in memoriam...

Abstract: This article aims to show that science and faith have always walked closer than is usually thought, and that they can even coexist harmoniously in the same individual. It also seeks to show the sterility of the debate that puts both in direct confrontation, evidencing the often prejudiced and disdainful position of current science towards faith as a characteristic of the human condition, whether or not it is associated with a religion. In a broader approach, it discusses currently existing beliefs about the existence of intelligent life outside the Earth in contrast to the possibilities that science offers in our actual state of technological development. In addition, the work intends to convey the perception that it would be much more constructive to accept faith as a natural manifestation of consciousness that recognizes the limits of knowledge, rather than rejecting it through scientific arguments that, being faith, is manifestly inapplicable.

Key-words: science, faith, cosmogony, cosmology.

Resumo: Este artigo tem como objetivo mostrar que ciência e fé sempre estiveram mais próximas do que normalmente se pensa, e que podem até coexistir harmoniosamente no mesmo indivíduo. Também busca mostrar a esterilidade do debate que as coloca em confronto direto, evidenciando a posição muitas vezes preconceituosa e desdenhosa da ciência atual em relação à fé como característica da condição humana, associada ou não a uma religião. Em uma abordagem mais ampla, discute-se as crenças atualmente existentes sobre a existência de vida inteligente fora da Terra em contraste com as possibilidades que a ciência oferece em nosso atual estado de desenvolvimento tecnológico. Além disso, o trabalho pretende transmitir a percepção de que seria muito mais construtivo aceitar a fé como manifestação natural da consciência que reconhece os limites do conhecimento, do que rejeitá-la por meio de argumentos científicos que, para ela, sendo fé, não se aplicam.

Palavras-chave: ciência, fé, cosmogonia, cosmologia.



From Left to Right: R.B. Cathcart, N. Serpa and S.N. Balasubrahmanyam, 2021.



CALIBRE – Revista Brasiliense de Engenharia e Física Aplicada, ISSN 2526-4192. Livre direito de cópia de acordo com os princípios estabelecidos pela *Creative Commons*.



Prolog

A few months ago, I received the sad news of the passing of my dear colleague, Professor Saraswathi Natarajan Balasubrahmanyam (1932–2021), an eminent physical organic chemist. His kind and generous style, together with the quality of his scientific production, made him the model of the true man of science. It took me some time to think about how to honor him within the modest limits of my role as a theoretical physicist and cosmologist. Finally, bearing in mind that organic chemistry is a fundamental discipline for its implications on exobiology, and the fact that his also late wife, Chanchal Uberoi, was a distinguished mathematician and astrophysicist, I decided to write this brief cosmogony, inviting my dear friend Richard Cathcart to participate.

As we know, apart from the mythical sense and by adopting an erudite view, cosmogony is a literary genre that reigns between belief and science. Indeed, not so long ago, cosmology was closer to belief than to science¹. It was the dizzying advance of observational technology that definitely elevated it to the status of a discipline of falsifiable propositional content. However, when cosmology touches on the study of life as a phenomenon conditioned to universal constraints of physical nature, we return to the sphere of speculation and to the region of beliefs. Again, it is hoped that at least some of these beliefs can be tested in the future as long as we have enough technology to do so. However, we have no way of knowing how far our technology shall go, nor how to foresee all the limitations imposed by nature itself.

Discussing some thoughts on science and faith, the final purpose of this article is to moot ideas regarding our current beliefs on the subject of intelligent life outside Earth (if we really have cosmically wise intelligent life here!), as this theme has gained renewed attention with the discovery of numerous planets outside our solar system. I hope this work lives up to the legacy of that man, affectionately called "Bala", whose intellectual gap left shall be difficult to fill.

Anyone who honestly devotes himself to the study of cosmology never abandons the daily exercise of contemplating existence.

Nilo Serpa

Scientific Editor

¹ In the award-winning movie *A Theory of Everything*, the young genius Hawking introduces himself to his wife-to-be Jane as a cosmologist, explaining to her, by a quip, that cosmology "is a kind of religion for intelligent atheists". In fact, that statement cleverly summed up sarcasm and reality, for in the 1960s, it has to be admitted, cosmology came much closer to faith than science.



1 Introduction

"The problem of the totality of things and that of the provenance of this whole arise from the most naive intention: to see what would have preceded the light." (Valéry, 1945).

Looking back at the so-called "new physics" in its evolution since the beginning of the 20th century, we see that astronomy — and cosmology, in particular — was the last sub-area to develop significantly among the most important specializations of natural philosophy. The construction of orbital telescopes and the sending of probes to the most distant regions of the solar system reaffirmed indisputably what Nigel Hembest and Michael Marten had early called "The New Astronomy" in 1983, long before the advent of Hubble. This new astronomy has advanced a lot and consecrated Peter van de Kamp's legacy with the discovery of so many extrasolar planets. Cosmology has also achieved a high level of precision and power of elucidation with detailed studies on galaxy clusters, type I-A supernovae and gravitational lenses. In addition, the interstellar space proved to be much more active and "alive" than was imagined until recently, full of clouds of gases — that "sing" through magnetohydrodynamic waves —, hyper-fast stars and wandering binary worlds.

From the first years of the 21st century, the discovery of exoplanets has become commonplace, bringing new challenges for astronomy, such as the identification of extravagantly and oddly configured solar systems and exotic worlds. Our instruments are very precise and keep advancing is precision, so that the list of planets, already in thousands, tends to grow even more. The study of the composition of these planets is at the top of the list of commitments in space science, since, from such a study, we shall be able to estimate the possibilities for the existence of life outside Earth, a crucial question for humanity, as yet unanswered. More than that, other correlated studies will show us the prospects of finding complex life in our mysterious galaxy enveloped by an incalculable cosmos poorly defined by anyone, composed of epic dimensions and energies.

Even so, despite all this newness brought into public exhibition over the last few years, particularly since the inauguration of humankind's self-dubbed Space Age, little has changed in our expectations about intelligent extraterrestrial life. Aside from some eccentric speculations, based on questionable arguments, and the rumored ET-military co-op reverse-engineering fanciful programs, no concrete evidence was presented to us amidst the spurious ufological-conspiracyist content that today has social networks always at disposal with fake news (they cause more harm-than-good and probably explain why so many people believe in the presence of aliens among us; fiddle-faddle!). On the contrary, the scenario that is becoming more and more clearly outlined is that we are most likely alone as sentient beings, at least up to the current limits of our technological capacity for observation. So, discovering intelligent life off Earth at a relatively close distance, say within a radius of ~250 light years at most,



would be a surprising and disturbing fact, as nothing registered so far suggests that this is possible. As painful as it may be, there seems to be nothing but cold spatial emptiness, hot objects and gases as well as a disappointing silence or, at least, so far undetectable emissions that is not classed as noise, blips or "WOW' readouts.

Of course, it is possible that we are looking for signs of alien intelligent life by overly restrictive means based on the logic of human communication. On the other hand, it is very difficult to admit that an advanced civilization, or even at the level of ours, would despise such an obvious and simple form of communication as the emission of coded signals by means of radio waves. As much as we wish to find sentient beings similar to ourselves in intellectual capacities, this seems impossible in our galaxy. It may well be that, by some cosmic evolutionary mechanism of constraint, only one civilization can flourish in a galaxy, so that there would be no possibility of inter-species warfare or undesirable contacts that could cause biological risk to the species; the survival of the species would depend on itself, since the distance between galaxies is, to say the least, "unimaginable". In particular, with regard to survival, it is interesting to take into account the discussion made by Serpa (2019) about the so-called "Restraint Orders", and the work of Ćirković (2018).

In fact, this uniqueness proposition lies right halfway between belief and science, since very high-precision deep space scans are feasible and could bring us closer to an answer in the relatively near future. However, an alternative to the conjecture of a one-to-one relationship between civilization and galaxy could be that almost no civilization would live long enough to evolve to the point of acting in deep space in a meaningful and detectable way. So it's possible that we'll never be sure if we're really unique². It shall be more or less a matter of personal

² There is an even more cosmogenic alternative. An ongoing study carried out by Serpa proposes that the emergence of complex life is only viable at a very narrow range of rates of space-time expansion. The fundamental thought is that, if the expansion rate is out of this narrow range, the primordial building blocks of life — namely the long-chain molecules required for the chemistry of life — may not have been formed, resulting in sterile galaxies. This idea stems from the fact that everything is made up of expanding space-time, including biological beings (it would be very superficial a model that ignores the role of something so intrinsic to the structure of the universe as the space-time expansion!). Rates beyond a certain threshold would not allow higher levels of matter organization, just as rates below this threshold. Assuming that the expansion rate is not isotropic, as suggested in recent works (MIGKAS et al, 2020; MIGKAS et al, 2021), and that, furthermore, they must change over time (whilst after long periods of stability), intelligent life would indeed be a rarity. To avoid controversies about imprecise expressions such as "complex life", "simple life", "intelligent life" and others, in present context a being endowed with complex life can be succinctly defined as a thermodynamically open system capable to 1) self-regulate internal electrochemical energy levels; 2) physically reacting to the environment; 3) process and interpret information through a neurocognitive kernel; 4) reproduce by dissemination of encoded biological material and evolve in the elementary Darwinian sense. To reach the subsequent stage in the evolution of complex life, *viz* "intelligent life", the being must be able to 5) evolve through adaptive artifacts (culture).

Serpa's conjecture derives from his own theory on the structure of the space-time, with the premise of an inhomogeneous universe, now reinforced by the apparent anisotropic expansion rate pointed out by Migkas and colleagues (2020-2021). Migkas and his team were very meticulous. They were exhaustive concerning all possible biases involved. Combining data from the galaxy cluster surveys available, they mapped the expansion rate, indicating it in terms of the Hubble constant, as shown in Figure 1 bellow (purple hues denoting slower rate; orange/yellow hues denoting faster rate). Although they have tested a large number of potential X-ray and cluster-related reasons and



preference to believe in either alternative. In any case, perhaps the concept of intelligence based on what we know about humanity needs to be carefully revised.

The evolution towards complex life is a theme closely linked to the necessary distinction between "origin of the universe" and "beginning of the universe", two expressions that address different issues. This is a very broad discussion, so that we have no intention of exhausting it in our approach. The implicit purpose of the present cosmogony is to expose the fragility of the human intellective condition when placed in check in face of crucial issues such as the origin of the universe and our apparent loneliness as sentient beings, and to discuss how faith, born from a tenacious philosophical introspection about existence from the cosmological point of view, can converge with the objectives of science, even becoming present in some of its choices.

systematics that might cause the observed anisotropies, they emphasized that more studies are needed to definitively rule out the possibility of an overestimation of the anisotropies due to the combination of systematics.



Fig. 1 - H₀ anisotropy map as derived from the combined data analysis (courtesy of K. Migkas, Astronomy & Astrophysics, 2021).

Certainly there are many constraints to the emergence of complex life, and we are in process of testing them from increasingly precise observations. For instance, in addition to the well-known features relating to the habitability of a planet, such as the existence of a protective magnetic field, positioning within the "Goldilocks zone", existence of liquid water, etc., regarding the proximity between galaxies a denser universe could expose worlds potentially favorable to biological evolution to lethal gamma-ray bursts.

CALIBRE Vol.6 nº 3 - Outubro 2021



2 Science and faith: ignorance and disdain in the civilizing process

Are we really an intelligent species? Scientists who still waste time rejecting the erudite faith — that is, faith from the perspective of deep theology — in the light of the rationality that originated the most significant theories for accumulated certain human knowledge do not seem, to us, to show much intelligence with this attitude of curtailment. For faith can only be dealt with in the encompassing realm of theology; it is a human manifestation and, initiated as an educated guess, it is the first step in asserting a promising intuition. There is no point in confronting it with a practitioner-limited non-envelopment science. William Stoeger, a Jesuit priest who was a staff scientist for the Vatican Observatory Research Group in Tucson (Arizona, USA), specialized in theoretical cosmology, high-energy astrophysics, and interdisciplinary studies relating to science, philosophy and theology, in his brilliant approach to the subject, pointed that

"[...] it is crucial to recognize the competencies and limitations of each [science and theology] [...]. Obviously, theology is not equipped to, nor even interested in, describing and modeling the laws of nature more accurately at their various levels of operation. This is the realm of the sciences. Nor are the sciences capable of dealing with questions of God and of ultimate value and meaning. These are the objects of theology and philosophy. Furthermore, the languages used by the natural sciences and by theology are very different not only in what their terms signify, but also in the context within which they are to be understood." (STOEGER, 2007).

Faced with such a crystalline truth, we must admit that it surprises us to hear some scientists repeating the obvious as if they had attained superior knowledge: "Science doesn't need God to describe the universe"; it is true, of course! Now, descriptions of nature are representations created by consciousness, by the "knowing self" endowed with the ability to inquire about its place in the universe, which is quite different from asking why the laws of nature are as they manifest in our universe; the latter is indeed a matter of faith's interest, giving rise to the plausibility of God as a transcendent and hidden creative agent, outside the scope of science. As Monseigneur Georges Lemaître said,

"I think that everyone who believes in a supreme being supporting every being and every acting, believes also that God is essentially hidden and may be glad to see how present physics provides a veil hiding the creation." (LEMAÎTRE, 1931).

The immensity of the universe, in size and variety, is rivaled only by our own ignorance. Even crucial assumptions at the foundations of observational science, such as the isotropy of the universe, are being challenged. As Migkas (2021) said, "[...] assuming it [the universe] to be isotropic is almost a *leap of faith* for now." (italics ours). We are constantly led to believe in preposterous ideas at the heart of science, making us question whether the ancient rigor of science remains today, and whether we are putting science on a much higher pedestal than it should, unnecessarily complicating our models of reality. Since science, among many guesses, has considered explaining our universe by the existence of other inaccessible universes, which is absolutely unsatisfactory and purely



fictional³, let us not waste another second with the so-called expressions of the obvious and with empty disputes; let us have faith that the simplest answers shall bring us closer to understanding the whole⁴. Much of science has become, especially since the 1960s, a doctrine which resembles formations of early religions; so, it is our view that much of science as currently practiced seems to be trending toward a copycat version of very limited faith, which means that such science may well be a delaying social movement rather than a progressing social movement for our species.

2.1. Faith and finalism

The conjecture of a civilization per galaxy can lead one to think of a mysterious design. We don't think this naive impression survives reason. Nature is full of self-regulating mechanisms, such as the dynamic predator-prey relationship. Hawking, for instance, didn't like the idea of time travel at all, and seemed to think there's something he called "chronology protection", a kind of natural "prohibition" that would prevent disastrous paradoxes. In fact, our conjecture is based on facts that indicate, whilst partially, the extreme rarity of complex life. If one looks for weaknesses in science, we recommend, for example, theories built on inaccessible dimensions⁵. In the field of astrobiology, technology is in our favor. We are dealing here with an increasingly observable universe, however, bearing in mind that technology fits the limitations imposed by cosmic nature. This is an important warning for those who think that everything is only a matter of technological advancement. Many of our well-designed creations in imaginative planning may never come to fruition.

Indeed, the idea of a one-to-one relationship between civilization and galaxy as a form of species preservation brings out the old doctrine of finalism, but as Valéry observes: "[...] the notions of cause and adaptation almost inevitably lead to it" (VALÉRY, 1945). This is not to say that we must rescue finalism in a renewed teleological

³ The idea of the "multiverse" is an ingenious curiosity from a cosmological point of view, but it is vastly speculative. As Ellis noted, "that multiverse proposals are good empirically-based philosophical proposals for the nature of what exists, but are not strictly within the domain of science because they are not testable." (ELLIS, 2004). In this field of speculations, it is often hard to distinguish a fictional boast from something that has any basis in reality. Of course this is not the way science is properly done. Some have offered even more radical offshoots of the basic notion of multiverse, and the story along these lines morphs with time. Surely, in this whole manner of thinking nothing out-of-the-ordinary happened last decades.

⁴ Post-modern physicists are piling conjecture on top of conjecture. For instance, there are many theories on how gravity works, with most being conveniently untestable. As a curious and fun activity we believe to be valid, but is it science?

 $^{^{5}}$ We are aware of the current submillimeter tests for extra dimensions since the early 2000s. But, it is essential to take into account that to say there is a physics in 10 dimensions would imply that we know there are 10 dimensions. But, unfortunately, we do not. There is no physical evidence for this, and not all mathematics is realized as a description of a objective physical phenomenon.



vision. However, it must be understood that finalism is simply the projection of the human spirit on how things simply are in fact, more or less like the tendency we manifest to see human faces in natural accidents (cloud formations, landscape similarities to life-forms, star patterns); there are no faces, just as there is no finalism (which does not exclude the consideration of "a supreme being supporting every being and every acting")⁶.

2.2. The witchhunt

It can be said that there is an "aesthetics of belief" when one recalls Einstein's Spinoza-like belief:

"This deep intuitive conviction of the existence of a higher power of thought which manifests itself in the unscrutable universe represents the content of my definition of God." (WHITROW, 1967).

Therefore, we need to distinguish faith from superstition. The latter is a bizarre construction of the psyche, apparently separate from the action of the intellect, free from reasonableness and causal nexus, being fueled by ignorance or by primitive impulses and passed on through generations. Certainly, in relation to faith, we are referring to belief governed by a long-term contemplative reflection on existence, not popular belief in fantastical things; a belief that even favors keen insights into complex matters. Most critics of the faith do not make this distinction and dive all in the same well of lost souls. They wander off on many tangents and are frequently and demonstrably wrong (they are wrong in the sense that they don't appreciate the human essence). In some more extreme cases, outside the governmental funding insiders "club" of undisputed authorities, everybody else is

⁶ Biologists have a serious problem with the idea of a superior creative force; they think that to sustain it it's necessary to deny evolutionism and natural selection. In many cases, the innate exercise of thinking about the meaning of existence was blocked due to the bad habit of dismissing anything their theories cannot envelope. This way of trowing stems from the almost complete absence of philosophical refinement. So, our intention here is to alert to the common bias of wanting to discuss faith with the logic of scientific rationality. We know that several natural factors may conspire favorably for the course of evolution; for instance, a small portion of the cosmic rays that cross the atmosphere can cause changes in the genetic material, characterizing mutations that may have survival value for a given species. So, the focal point is not evolution, but the driving force behind natural selection. Indeed, natural selection works by preserving the characteristics that prove useful for survival. The interesting question then is: why does nature operate in this way, selecting mutations favorable to survival? In fact, this question is a particularization of the major question about the laws of nature being as they manifest themselves and not otherwise.

So it's not about denying evolution; on the contrary, it is the very necessary realization of the creative force. Thompson's gazelles have developed extraordinary escape adaptations, but not enough to be fully unreachable by cheetahs; cheetahs, on the other hand, have developed equally extraordinary abilities for hunting gazelles, but there are not enough of them to threaten the gazelle population. The predator-prey model describes this dynamic very well, but why is it so? The alternating black and white stripes of zebras act to perfectly regulate their temperatures under the strong African sunstroke, while other animals lack this feature; why? These are the themes of faith, far beyond institutionalized religions, themes that awaken in some individuals the supreme desire for communion by contemplating the universe, that is, by the "breath-of-the-soul" which leads to the essence of all things. According to our way of seeing, there is no contradiction between contemplating existence through faith and representing our simple hopes for knowledge through art, physics and mathematics.



branded a "crackpot" or worse (also, there are reports of acidic-abrasive "bedside manner" of debating). Not long ago, Pierre Teilhard de Chardin was the target of a kind of modern inquisition, combining clerics and academics. His original and innovative thinking was widely attacked by radical minds who simply refused to even try to understand his philosophy.

Teilhard de Chardin tells us about an "attractor" of the evolution of consciousness, the "Omega Point", the apex of his noogenesis, that is, the integration of all human thought into a single conscious network (CHARDIN, 1955). According to his belief, God and the universe (the universe as a material expression of God) have a creative and dynamic relationship of progressive evolution. Although this idea appears to conflict with the Second Law of Thermodynamics, there is no way to deny the visionary nature of the concept of the noosphere, the abstract layer created by the conscious network covering the physical layers that make up the Earth. Interestingly, however, the prevalence of the Second Law is not necessarily an obstacle to the Chardinian conception, since, as analyzed by Serpa and Fernandes (2020), the Second Law encompasses an intrinsic creative process based on the interaction between regions of different states of decelerated entropy. We understand that the search for a convergence of science and faith is nothing more than an investigation that seeks to show that both can coexist harmoniously in the same individual. It's not about meddling with each other; it is, rather, the coexistence of these two forms of knowledge acquisition. After all, there is nothing paradoxical about creatures made from matter produced in the stars to seek some kind of communion with the cosmos, since we shall return to dust! Whether this communion is sought and expressed through equations, allegories, poems, paintings or music it is a matter of personal temper that cannot be discussed in a destructive way, just as it is not the role of science to discriminate the ideas of faith as meaningless (indeed, a contemplative quest for eternity, with a bit of symbolism, arises: could a Chardin's "Riemannian" *noosphere* to be extended in some way to the whole cosmos as the final purpose of God?).

At this point, it is worth remembering Bohm's thinking in terms of enlivening consciousness regarding the fact that our ways of thinking not only fragment reality, but, in a way, induce the thought habit of considering reality as we exactly describe it⁷. Admitting that the ultimate substantiality underlying matter and thought is nothing more than a process, that is, the "becoming", the flux beyond simple transformation, then the fragmentation of the world is simply the result of a confusing fad that is rooted in the mechanical and fragmented way in which pre-intelligence

⁷ The attitudes of clear persecution that humanity's history is full of show how much the exercise of science is contaminated by ideologies and political trends, tearing the nobility's cloak with which scientific circles have always been covered. David Bohm has also been one of the targets of a general vociferous criticism (an evident product of controversy which was permeated by social influences) on the theory of hidden variables in quantum mechanics, in the 1950s and early 1960s, a fact that in 1973 deserved a striking counterpoint by Jauch:

[&]quot;... the discussions which surround the quest for hidden variables in quantum mechanics have, on both sides of the camp, often been conducted in a spirit of aggressiveness which resembles more the defence of orthodoxy of one ideology than a spirit of scientific objectivity." (JAUCH, 1973).



thinking organizes memories. In fact, what we create are visions of reality. Bohm emphasizes that it is not, therefore, about imposing a unity or integration, which in itself would already be a form of fragmentation, but about embracing at a single stroke all the different visions of reality within their respective domains (BOHM, 1980). We think science and faith fit perfectly into this understanding of the world. However, these ideas were systematically misinterpreted and viciously taken up by acid critics as very close to oriental monism for which "all is one", as in Buddhism and Lao-Tzu's philosophical Taoism (remembering that these wisdoms are not really religions, but ways of life). In fact, in the last third of his life, Bohm approached Eastern thought, however, not with mystical intentions as claimed by those who fly the flag of science as a symbol of a comprehension above the common people, but with the unassuming and friendly intention of showing to everyone that the human mind will always create representations of reality that in the end resemble each other in the search for a unified understanding behind the fragmentation that is presented to us, regardless of current cultural influences⁸.

Thus, once all is flux with no real fragmentation, this idea is consistent with the notion of the space-time expansion continuum within a finite element — a simple vision of reality — abstracted from the continuum itself (although human understanding continues to weaken in face of the persistent image of an atomized world, the truth is that the concept of particle does not resist an underlying reality that imposes itself as a flux or process). This being the assumed understanding, it seems quite natural and understandable that several beliefs imagine some kind of union with the cosmos, since we are part of the continuum.

3 A better world to come: belief or fact?

We recall with gratitude the persons who have influences our lives because in many ways we have emulated their inspiring best qualities, and we have been fortunate, or blessed perhaps, to share what we have learned over the years with others close to us in our lifetimes. Inspired by oneiric thoughts and their example, we are motivated to act — as in penning this article — through the power of God within ourselves. Our dear friend "Bala", now absent in our everyday lives as an active corporeal form, was imbued with practical creativity, substantial thought-product, wisdom and understanding of life's many facets. Habitually, he treated others with kindness and greeted people with an ennobling smile. "Bala" exhibited affirmative thinking in his relentless pursuit of service, teaching, and useful learning. Surely, there are many "Bala" persons striving to energize and focus humankind's vision of the past, the present-day and the future, even the magna-cosmological?

We think the abstraction of a better world — a world where true faith, as belief in the field of high theology, can play its role with science according to the knowing subject's freedom of choice — in present moment is the basis for a belief to which we cling inspired by individuals like Bala, a belief which in a sense keeps us convinced that

⁸ Another interesting example of the quest for understanding a flowing reality is the Sufi conception of a universe in constant creation.



our presence is something worthwhile. A truly better world, as by the true faith we can hope to come, requires so many changes with respect to what actually happens today that it seems unlikely we shall survive long enough for such changes to take place. A good start, however, would be to re-discuss the civilizing process, something that has not been done for a long time. For this, we can dispense those who engage in debates as if they were dancing around a bonfire of vanities (full of themselves, with lack of humility!).

4 How faith and science can collaborate in revelation

Recently, Westby and Conselice (2020) proposed improvements to the old Drake equation in light of the knowledge acquired and accumulated since the 1960s until now. Yet equations of this type initially work much more like expressions of belief, which science translates eloquently as "likelihood."⁹ Indeed, such equations cannot be intended to include all the variables involved, but in the near future some factors as the number of rocky planets that have developed a protective magnetic shell against ionizing radiation will need to be explicitly considered based on the ongoing technological improvements. As the truth is revealed through empirical confirmations, the original intuition gradually gives way to adjustments in calculation models athwart reiterated attempts to better approximate reality; it's how human intelligence works.

In view of everything we've said, it is undeniable that the power of intuition in science can lead to a true act of faith when it is directed towards the construction of a conjecture whose hopes for testing and empirical corroboration are beyond practicability. It is a human feature to fight or simply live for what is believed, whether in the field of science or theology. In science, however, intuition comes to revelation through the intervention of artifacts for observation (telescopes, etc.) and devices for phenomenal provocation (particle accelerators, etc.). In theology, revelation takes place through inspiration, through an unexpected and overwhelming cognition incited by the pervasiveness of the cosmos in everything around us, creating in the spirit a full conviction, devoid of parts, therefore, unknowable by the analytical mind. Both revelations seek the truth through distinct and complementary ways. It is really a pity that few realize this, preferring the dissatisfaction of a unilateral choice that only tends to distance us from understanding the whole.

Probably, the difficulty in realizing this complementarity lies partially in the fact that we are "in" the "great complexity"; perhaps, as has been said, intelligence is the way the universe found to know itself.

⁹ In the context of science, and, in particular, in cosmology, belief often appears hidden in statistical formulations from which one seeks to extract a "likelihood". It's a kind of "honorable solution" to knowledge at a *cul-de-sac*!





5 Final comments

The option for a highly consumerist market model has proven to be a way of breakdown rather than of human growth. In the trail of uncritical consumption, science as institution and social practice is gradually being replaced by the technology of immediacy, incapacitating the individual for critical thinking. In this downfall, faith turns into superstition exploited by persons who despise and even hate the most basic ethical principles. This global effect is evidenced by the visibly decreasing quality of the intellectual production of the younger generations. Logically, a world centered on trifling and vileness favoring the creation of untold fortunes in the hands of a billionaire minority is not the right place for an evolution with progress. If all the hypothetical intelligent life that might inhabit our universe is based on such limited parameters, it's no wonder we haven't picked up the slightest hint of other civilizations so far.

Howsoever, with an estimated 100 billion galaxies (maybe much more!), imagining a civilization for each doesn't seem outlandish, even if many are presumably sterile. Putting this conjecture alongside speculations about parallel universes and inaccessible extra dimensions, welcome back to beliefs! Intellectualized indeed, but beliefs nonetheless. As Stoeger said,

"The processes of evolution rely on the harnessing of chance within a larger framework of order and regularity. In fact, what has happened in our universe is that each of the hundreds of billions of hundreds of billions of star systems in our observable universe has become a separate evolutionary experiment. How many of them — or even whether or not any of them besides our own — have yielded life and self-conscious social life, we shall probably never know." (STOEGER, 2007).



Acknowledgements

The authors are grateful to Professor Balasubrahmanyam's daughter, Vibhavaree Gargeya, for kindly authorizing the use of the information contained in her father's obituary along with the photo of our dear colleague. The authors also thank Professor Konstantinos Migkas for his kindness in allowing the use of the nice graphical representations that illustrate his latest work.



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