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Beyond the anthropic principle: man and the Universe

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According to the anthropic principle, the physical world is structured to host a life that can observe it, so the values of the physical constants are such that the universe has favorable conditions. Both the weak anthropic principle and the strong one – despite their differences – emphasize that the basic role of the Universe is the development of life and especially of intelligent life. But without ignoring the importance of life in the Universe, a philosophical framework is proposed under which man is not placed in the center of the Universe, but physiology, on the contrary, forms an integral part of the Universe.

Keywords: Anthropic principle, fine tuning, Universe, determinism

1 Introduction

The philosophical research from antiquity to the present has as its main purpose – among other things – the determination of man's position within the Universe. Even theories such as the geocentric system, where Earth is considered to be the center of the world, actually reflect the desire of man to perceive the creation of the world as a reference point to himself. This perception has changed over the years, but even today, an important part of cosmological research occupies the issue of the humanitarian authority. In the present study, the issue of the human principle and fine tuning will be initially presented, a vision according to which the natural world is configured to host life. Then there are the versions of the anthropic principle (strong and weak), and finally a philosophical vision that does not place man at the center of the Universe, but instead emphasizes that he is an important part.

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2 Anthropic principle and fine tuning

The term "anthropic principle" was originally introduced in the scientific literature in 1974 by astrophysicist Brandon Carter. In the discussion of the "great number" of coincidences that were evident in physics and cosmology, Carter used the term to refer to the fact that making any scientific observation necessarily depends on our existence (Carter, 1974). However, in order to have any measurement and observation, the Universe itself should have favorable conditions for the existence of observers. If any of the various fundamental constants were little different, the universe would be unlikely to be conducive to the development of galactic structures, stars, and by extension, planetary systems and life. Carter himself (1974), in order to amplify his claim, argued that the universe is by definition built to have observers. It should be pointed out that the existence of observers is necessary in order to define dimensions such as time, which in fact is a spiritual process of measuring the movement of celestial bodies (Kalachanis et al., 2013). The case of the necessary existence of observers in the Universe means that the physical constants are "regulated" in such a way as to host life. This approach, also known as fine tuning, states that, through a large number of probabilities, physical constants have specific values, the universe is "set up" to be, as we know it, hospitable to life. So, one of the possible conclusions could be that the appearance of life was not a random event but a plan. This was why John Barrow and Frank Tipler published their work entitled "The Anthropic Cosmological Principle" Alternative approaches, however, referring to the regulation of life itself in the demands of the Universe (Landsman, 2015). In this case, there is practically no question of an anthropic principle, since the existence of man is adapted to that of the Universe. In addition, the question arises about the purpose of creating the Universe, which should serve a purpose. In this regard, the teleology referred to by Aristotle, in which everything in the Universe has a purpose (Aristoteles, *De coelo*, 271 a, 33).

With this rationale, the question of the power of the anthropic principle essentially offers two opposing contradictory interpretations of the universe, one of which is deterministic and the other based on randomness. According to determinism, as expressed by Laplace as early as the 19^{th} century, the future state of the Universe can be predicted on the basis of the conditions that now prevail in conjunction with our knowledge of natural laws. This idea of the French mathematician is known as the "Laplace's Daughters," referring to the possible existence of a strong intelligence that would know all the possible positions of individuals in the Universe, where, based on Newtonian mechanics, a mathematician a type that describes them. Laplace even relied on engineering laws, according to which each equation describing motion has a unique solution (Van Strien, 2014). On the other hand, however, the evolution of quantum physics disputes determinism, as theories such as Heisenberg's indeterminacy show that not all processes of the natural world are predictable.

One parameter which, according to the supporters of the anthropic principle, excludes the randomness from the creation of the Universe, is the cosmological constant (λ), which is defined as the value of the energy density of the vacuum space. Originally introduced by Albert Einstein in 1917 as an addition to the theory of General Relativity in order to "balance gravity" and achieve a static universe. If the cosmological constant had a different value, then the universe would have collapsed long

before quasars, galaxies, stars, and planetary systems were created. In fact, in 1922, A. Friedmann introduced the three scenarios for the evolution of the Universe (open, closed, flat), depending on the factor of "critical density" (Ω). Therefore, the cosmological constant is conditioned to preserve life (Weinberg, 1987). With this in mind, the value of the cosmological constant should be able to sustain life, which happens when the high energy density of the universe is overcome in its early moments. But there are arguments that the cosmological constant should not be confused with the existence of human life but with the evolution of galaxies (Smolin, 1994). Perhaps such a view could be extended to all natural laws, which apparently have not been regulated for the preservation of life, but they just happened to have these values.

It should be added here, however, that in Inflation Cosmology there is the possibility of the existence of conditions similar to those in our own solar system and in other parts of the Universe where life is possible depending on the amount of dark matter and the effect of dark energy (Kallosh & Linde, 2003). In addition, it is argued that other Universes (worlds) could evolve according to our own (perhaps through a Big Bang) and reach a point of even life (Carr & Ellis, 2008). Such assumptions, however, are only theoretical at this time without any evidence of observation.

In addition, there are some cases that have been characterized as fine-tuned, but with a second glance things look different. Hogan (2000) analyzes the anthropological conditions in the Yukawa couplings. It concludes that 3 conditions must be satisfied for the masses of electron m_e, up quark m_u and down quark m_d. Initially (1) $m_d - m_u > 1.2$ MeV to exclude the transformation of all particles to neutrons in the first moments, (2) $m_d - m_u + m_e > 3.4$ MeV such that the proton–proton reaction is exothermic and finally (3) $m_e > 0$ Mev. This limits the two parameters $m_d - m_u$ and m_e in a very narrow range (Hogan 2000). The proton–proton reaction is the basic nuclear reaction into stellar cores for the fusion of hydrogen in helium, especially for the first stars (population stars III, ie, zero metal content). Weinberg notes, however, that the proton–proton reaction is not a one-way route, since the alternative but less likely proton–electron–proton reaction would work equally so that the stars burn hydrogen in their core for a long time. So if one takes this into account, there is no longer a very narrow range of these parameter values (Weinberg 2005).

A very typical case is also the power of strong nuclear force. According to Barrow, if the strong nuclear force was even a little stronger then the dineutron and the diproton, would be stable and so hydrogen would be consumed rapidly in the early Universe resulting in the absence of star creation (Barrow 1987). McDonald and Mullan (2009), however, estimate that since the power increase does not exceed 50% of the current value then a sufficient amount of hydrogen remains to build stars. And in this case it would be a bit too much to say that a margin of 50% is "narrow".

A corresponding case is also the interaction of neutrinos and baryonics through the weak interaction. Referring to the star nuclei, Davies (1982) observes that if the strength of the weak interaction was greater then neutrinos could not escape from the nucleus, and if they were less they would not exert enough pressure on the outer layers of the star to cause a burst of supernova (Davies 1982). In any case, we do not have a supernova explosion, so we do not have enrichment of the interstellar medium with heavier elements that is the basis for creating planets like ours. Different answers are given by Harnik et al. (2006) who consider a simulation of the Universe exactly the same as our own but in the absence of the weak interaction. Their results are that

this particular universe contains all the necessary phenomena for creating life such as nucleosynthesis, the creation of large structures, the star formation, long periods of stellar burning, supernovae explosions, and dispersal of heavy elements into the interstellar medium.

Therefore, the concept of fine tuning is at present a hypothesis, which although it even has a metaphysical interpretation (because of the possible indirect reference to God), it can not be substantiated experimentally. Nevertheless, each scientist or philosopher interprets natural phenomena based on his beliefs.

3 Versions of anthropic principle

3.1 Weak anthropic principle (WAP)

Established by Brandon Carter and Robert Dicke, who emphasized not only the values of physical constants but also the fact that human presence coincides with ideal conditions prevailing on Earth where, at other times, human life maybe was impossible. Even factors such as the Sun (located in the Main Sequence) have contributed to this (Penrose, 1989). Therefore, according to the weak anthropic principle, what we observe for the universe is constrained by the requirement of our being as observers. In this case, the development of intelligent life should be possible in some areas of the Universe like ours, so mankind is in fact in a privileged position, as an observer of the Universe. It is worth noting that Barrow & Tipler did not speak about observers as carbon-based life, which meant that they emphasized the development of life and not particularly whether it was intelligent (Barrow & Tipler, 1986).

3.2 Strong anthropic principle (SAP)

John Barrow and Frank Tipler (1986) supported the view that the Universe is built to accommodate intelligent life. An interpretation that strengthens this version is the range of probabilities that the world can be modeled in this way, as physical constants could have any value. However, they have the values and scope to support life (Earman, 1987). In this case, God's role in secularism is indirectly included, if one assumes the necessity to have a design. Even this argument can be discarded, as all the worlds that may exist should be understood as true (Lewis, 1986 rather than Earman, 1987).

But Hawking wonders if there are other Universes with laws different from ours, where development of life may not have been possible. The question of why the universe is as we see it, is answered by saying that if it were different we would not be here. The answer is very simple: "if it were different, we will not be here" (Hawking, 1998). Therefore, on the basis of this critique, it just "happened" to our own Universe – unlike others – to have all those conditions that favor the development of life, but the question is whether it really happened, or whether the universe was regulated, a possibility that directly refers to fine tuning.

A different version, the ultimate anthropic principle, in which the intelligence, and intelligence of the universe, must be intelligent and intelligently processed, is related to the strong anthropic principle and eventually its transformation. The roots of

this version are found in the formulation of Paul Dirac (known from the Dirac sea phenomenon in quantum physics) that human intelligence will evolve continuously (Kragh, 2011). It is interesting that Bailey (2019) compares the fine-tuning of the universe with providence, but this providence does not explain why the world has been modeled in this way, in the manner that theology does.

4 Beyond the anthropic principle

There is not yet an anticipation following from anthropic principle which is subsequently confirmed by observational data. This is because it is essentially a *post hoc* theory (Carr & Rees 1979). And on the same basis, the anthropic principle proposes an overturned causal relationship as a whole. Thus, since Darwin, and then we, know that life adapts and evolves on the basis of environmental conditions, here we have the assumption that conditions have been adapted so that they can accommodate life (Gratton 1993).

It is evident from the above that the question about the anthropic principle is mainly philosophical-theological (Susskind, 2005) and relates to how mankind sees its place in the Universe, whereas in reality it cannot be scientifically documented since it is neither verifiable but neither a discarded theory. Depending on the angle of view chosen by the individual, the evaluation of scientific data and his philosophical beliefs, he leads to the adoption of an attitude. Other issues like God's, and especially whether he intervenes in secular events, are difficult to explain because of the finite human intellect.

God is beyond our limit of perceptions and obviously because of our finite nature we do not understand it. So, based on our own philosophical beliefs (and possibly faith) depends what we will accept.

Moving beyond the anthropic principle, it would be possible in principle to delimit the position of man within the Universe. Already in Greek antiquity there have been perceptions that make man not as a center, but as an important part of the Universe, because of its structural elements being compared with those of the world. According to this philosophical view which has been supported by Hippocrates and was famous even at the time of the doctors and philosophers of Byzantium such as Nemesius (4th century); the four humors compiling the human body correspond to the four basic elements of the Universe as follows (Nemesius *De natura hominis* IV, 8–12): see Figure 1.

Also the doctor Rufus of Ephesus (1st century) was aware that human body is an imitation (antimimos – $\alpha\nu\tau\acute{\iota}\mu\iota\mu\omega\varsigma$) of celestial order, a fact which is apparent in his views (*De partibus corporis humani*, 1.3), while the Neoplatonic scholar Hermias (5^{th} cen.) mentions that the shape of human brain is similar to the celestial. Moreover, Hermias claims that human is a small cosmos as a part of the great cosmos (*In Platonis Phaedrum* $\Phi\alpha\acute{\iota}\delta\rho\omega\nu$, 90, 11 and 194, 8). So it could be possible to compare the anthropic principle with a modern "Geocentric" system that tries to bring man back to the causative center of the Universe. In this way a reverse Copernican revolution is formed.

The fact that our biological existence is fully interwoven with the world is fully documented today, because of the knowledge of the stellar evolution it does not make

Humor	Element
Yellow bile	Fire
Black bile	Earth
Phlegm	Water
Blood	Air

Figure 1

us the center of the Universe but it signifies our full dependence on the processes taking place in the Universe. If we take into account that in the Universe matter constantly changes its form, functioning in fact as a substrate of the natural changes, a function that was perceived by Aristotle who considered matter as the substrate of the natural processes (*Physica* 192a, 31), we will realize that even our material might have another form. Indeed, its origin is in the stars, where the death of a star through a cataclysmic eruption (Figure 2) enriches the interstellar space with a plurality of chemical elements (H, Fe, O, C etc.) which then form new stars, planetary systems, but also have role in the evolution of life.

So, our solar system was created by the chemical elements dispersed due to the death of old stars. Nevertheless, it is remarkable that the anthropic view makes the

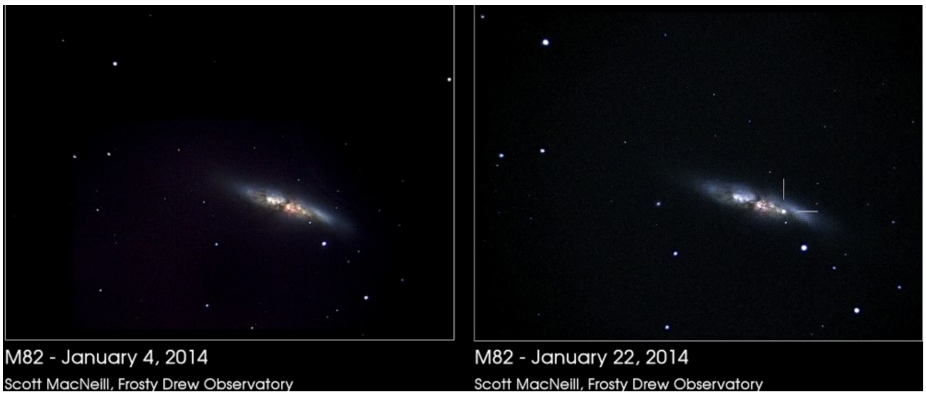


Figure 2 The galaxy M82 on 4/1/2014 and 22/1/2014, with an exploding supernova. This violent process plays a vital role in the evolution of life in the universe. Source: Hubblesite.org.

arbitrary assumption that the only form of life that can exist is the organic form as we know it today. This does not take into account the possibility of the development of a life of different biochemical composition, e.g. a silicon-based organism, and we are now talking about an "organic chauvinism" (Sagan 1973). In the event that an exotic form of life can exist and develop, many of the fine tuning conditions are either weakened or no longer necessary.

Conclusions

From the above analysis, it appears that the anthropic principle in all its aspects revolves around the role of man in the Universe and especially whether the world has been created, either to host life or to be the subject of observation. Moreover, it is not possible to answer the question of the value of physical constants, and in particular whether they are "regulated" to develop intelligent life. Instead of the human principle, however, a new philosophical vision of mankind is proposed, which, because it is derived from dead-element chemical elements, is actually integrated into the cosmic system. So man is not the center of the Universe, but an important part of it.

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