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The ethics of astrobiology: Humanity's place in the cosmos and the extinction problem

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Western philosophy has always stressed the importance of understanding the very nature of the universe and the relationship between humanity and the cosmos. Nowadays, astrobiology is used to shed light on that issue through a set of empirical data. Also, the Fermi paradox and the Rare Earth hypothesis could offer a suitable ground to properly interpret the proofs emerging from space exploration and direct and indirect observations from astronomers, that is, "we are likely the only intelligent species within the universe." From this, we can say that maybe we are confronted with a cosmic bet. We should better wager on our cosmic importance as a species, otherwise the loss could be immense: the disappearance of the only species through which the universe enabled itself to understand its own secrets and cosmic treasures.

KEYWORDS

cosmos, ethics of astrobiology, Fermi paradox, Rare Earth hypothesis, cosmic bet

1 Introduction

Since the beginning of its history in Greece, philosophical investigation devoted its efforts to understanding the relationship between human beings and the cosmos (Couprie, 2011). Thales of Miletus is quite unanimously considered the pioneer thinker within the Western philosophical tradition. He thought that the primary element of reality is water. After Thales, Anaximander moved a step forward in the comprehension of the structure of the universe by saying that everything derives from àpeiron, and everything is doomed to return to it (Guthrie, 1979). Within his most quoted fragment, he said, "whence things have their origin, they must also pass away according to necessity; for they must pay penalty and be judged for their injustice, according to the ordinance of time" (B1 fragment). This wording well introduces a moral facet within the physical speculation.However, the Presocratic tradition presents just a bunch of unrelated sentences, so that it is implausible to affirm that, for instance, Thales or Anaximander were concerned with moral issues dealing with the cosmos or humanity's position within it. It was Democritus of Abdera who first accounted for a more coherent and systematic speculation on the relationship between the building blocks of matter, the atoms, and human behavior (Lachenhaud, 2022).He also speculated about the human soul and formulated, from a materialistic view, the principle of cosmic equivalence of matter, according to which human beings and the universe share the same elements, the atoms. Socrates and his opponents, the Sophists, inaugurated another phase of Western thought

known as the anthropological turn (Klenk, 2019). They mainly focused on politics and morality, but they speculated on the afterlife and the position of humanity in the cosmos as well. Plato, Socrates' disciple, tried to give a solution to what he considered flaws and shortcomings of Socrates' thought. His doctrine of ideas or eternal forms of reality was conceived with this very intention. In Timaeus, one of Plato's latest works, the Greek philosopher, who had previously apparently rejected the idea of investigating the physical world, much more imperfect than the ideal world of eternal forms, proposed a method of inquiry, involving mathematics, which is supposed to be one of the bases for modern physical science (Koyré, 1968).

Also, he speculated about the position of man in the cosmos. Similarly, his disciple, Aristotle, both in metaphysics and in physics, confronted these issues. Christian philosophy abandoned these topics and preferred to shift the focus on the relationship between man and God. Nevertheless, the position of humanity in the cosmos continued to engage some philosophers. In the Renaissance, with the full revival of scientific inquiry, Marsilio Ficino, just to name one, wondered how macro-cosmos and micro-cosmos interacted and what could be man's role within this entanglement. The Scientific revolution, which started with the Copernican Revolution, undermined the position of man in the cosmos. The mechanistic view of reality became widespread within a couple of centuries, and humanity's role in the universe was declassed (Principe, 2013). However, some authors speculated about man's vulnerability and greatness at once. It was Blaise Pascal who wrote about the very features of a person, awareness, and self-awareness, which are able to confer them privileges against the rest of reality (Pascal, 2013). Although some attempts were made to contrast the depressive outcomes of the Scientific Revolution, the advances in astrophysics and the formulation of the theory of general relativity by Albert Einstein fueled the scientific understanding of the cosmos. Together with this general framework, astronomers began to accelerate the scientific exploration of our solar system, and the step-by-step scientific exploration of the space outside our solar system. In 1960, the Nobel Prize winner J. Lederberg published a study titled "Exobiology: approaches to life beyond the Earth" (Lederberg, 1960). Here, Lederberg discussed central issues for the upcoming discipline of astrobiology: what molecules and elements are indispensable for life? What are the environmental constraints whose role is crucial for the development of life and its maintenance? Ultimately, what is life, and can life exist beyond the Earth?

These questions were not new for Western thought. For instance, Giordano Bruno, a Dominican monk, asked himself similar questions. However, the context of questioning was new. During the 60s, the enthusiasm for the new challenging discoveries favored the raise of speculations about the position of man in the cosmos and the possible existence of other intelligent beings within the universe.

The Zeitgeist may be well grasped by the motto "we are not alone in the universe." Drake's equation mirrored this Zeitgeist in a mathematical manner, as it was intended to show the likelihood of the hypothesis that the universe is life-abundant and maybe also disseminated with intelligent living beings.

2 Ethics of astrobiology

However, Drake's equation aside, space explorations revealed a dark universe, one within which the presence of life was even harder to imagine. To the extent that a growing number of celestial objects were discovered, the possibility of human–alien encounter diminished. The constraints to life appearance were revealing more and more demanding: the Goldilocks standard, the dimension of a planet and presence of an atmosphere and liquid water on the surface, the dimension of the star within the planetary system as well as the dimension of other planets around, and the presence of oxygen, carbon, certain metals, and other biosignatures (Covone and Giovannelli, 2022). So, the more the astrobiology-acquired data on exoplanets, the less likely the life appearance seemed to be. We could spell out this matter of fact with the motto "we are likely alone in the universe."

Insofar, as astrophysics advanced and the transdisciplinary field of astrobiology was being structured, a set of challenging questions raised up, not only within the domain of scientific research but also in the realm of social sciences and humanities (broadly speaking). Since the 2000s, some authors started to speak about astrobioethics or ethics of astrobiology as a new field of scientific research halfway between astrobiological research and applied ethics (Schwartz, 2018). The key issues of astrobioethics are as follows: the policy of planetary protection, the responsibility of scientists toward the society at large, the principles to be adopted in scientific exploration, the status of human beings who will be born outside planet Earth, the moral status of microorganism within non-Terran biospheres, and so on (Chon-Torres, 2018).

Also, "another of the central aspects that should be addressed in astrobioethics is the one concerning the consideration of human beings as guardians of life in the universe." Octavio Torres tackles these issues within the question of human non-Terran obligations.

Now, this article believes like there is another important issue to be addressed, one that deals properly with the position of man in the cosmos. As we have mentioned previously, this is one of the oldest and biggest questions in philosophy. Nowadays, we have tons of data at our disposal so that we can confront this issue in a non-speculative manner. As a result, (spoiler alert!) we can phrase all this with the motto "maybe we would never know whether or not we are alone in the universe but so far we are likely alone." In the following paragraphs, the article shows the reason why this motto may be the best way to unfold an ethical framework from astrobiology.

3 The Fermi paradox and the Rare Earth hypothesis

The building blocks of our ethical framework are the Fermi paradox and the Rare Earth Hypothesis. That is, once we assumed that these hypotheses give an adequate picture of the state of the art of fundamental facets of the astrobiological research "the principle of the survival at any cost" which could be chosen as the allegedly best guiding principle for our actions.

What are the Fermi paradox and the Rare Earth hypothesis?

The Fermi paradox derives its label from the Italian scientist Enrico Fermi. During a lunchtime in 1950 with some colleagues, Fermi pronounced his famous question "where are all they?" He was referring to aliens and the very fact that, despite the alleged flying saucer's reports, whose reliability was very low, nobody was capable to detect alien signals from the space (Webb, 2002). Maybe, the best explanation to the cosmic silence, in a very likely interpretation of Fermi's question, is that, we are alone in the universe, or that given the interstellar distances we would never know whether there are other intelligent beings all around the universe.

Milan Ćirković proposed three different formulations of the paradox, namely, 1) ProtoFP; 2) WeakFP; and 3) StrongFP, which must be viewed well beyond the intentions of Fermi (Ćirković, 2018).

(There is also a fourth formulation, the KardashevFP. However, this one is not larger than the StrongFP).

ProtoFP says that "the absence of extraterrestrial on Earth is incompatible with the multiplicity of extraterrestrial civilizations and our conventional assumptions about their capacities."

This interpretation provides a basic understanding of the Fermi paradox, one that is less exposed to falsification. The WeakFP, instead, says that "the absence of extraterrestrial or their artifacts on Earth and in the solar system is incompatible with the multiplicity of extraterrestrial civilizations and our conventional assumptions about their capacities." As we can notice, WeakFP is more inclusive than ProtoFP. Indeed, it encompasses the Earth and the solar system. As far as our view is enlarged, we consider more and more data from astrobiological research.

StrongFP says that "the lack of any intentional activities or manifestations or traces of extraterrestrial civilization in our past light cone is incompatible with the multiplicity of extraterrestrial civilizations and our conventional assumptions about their capacities." The latter formulation expands the boundaries of WickFP by including the entire observable universe. StrongFP is, indeed, the proper Great Silence paradox. According to this interpretation, we are alone in the universe. The universe is nothing more than a desert, an empty, lifeless place with a glint of life within a pale blue dot.

The Rare Earth hypothesis is the other hypothesis that an increasing number of cosmologists and astrobiologists are embracing to cope with the data provided from the observational activities revealed throughout these years (Ward and Brownlee, 2000).

In other words, the Fermi paradox is a picture of the current astrobiological research. So far, it reveals that there are no signals of extraterrestrial activities somehow detected from humans. The Rare Earth hypothesis provides a plausible explanation of this picture.

This hypothesis tells us that Earth-like planets are unlikely. There should be a lot of biosignatures for life's emergence. The more biosignatures proof to be essential for life's emergence, the more unlikely would be the appearance of life on other celestial bodies. Also, it is even more unlikely the emergence of intelligent life given the number of evolutionary constraints at work.

4 The cosmic bet argument

The Fermi paradox and the rare Earth hypothesis suggest considering life and *a fortiori* intelligent life a rare event within the entire universe. *Sic stantibus rebus* suggests that should humanity be wiped out from the planet, something precious would disappear from the cosmic scenario (Ord, 2020).

However, the human predicament is troubled with endless and inescapable contingency, that is, we are an entity whose survival is not guaranteed. Instead, we are overexposed to the threats of nature and in recent times to the damaging outcomes of our own activities (Bostrom and Ćirković, 2011).

So, we are both vulnerable-contingent and someway indispensable. To reconcile our structural contingency to our alleged indispensability, the article proposes to consider an argument: the cosmic bet argument.

Should we bet on the preferability of human extinction or human preservation, we ought to bet on the latter, as far as the consequences of our extinction would be bad for us and maybe for the entire universe, whereas the consequences of our permanence would be good for us and maybe for the entire universe.

In the remainder of the article, a sketch of this argument is given.

Why should we escape extinction? Somebody might say this is a trivial question. However, things may appear differently for several reasons. First, there is no agreement on what ought to be carried out in order to preserve our planetary balance: somebody says that humanity has some priority, although its actions could sometimes represent a threat to our persistence and the maintaining of a general equilibrium with regard to biosphere, whereas some suggest that man is the main agent of planetary unbalancing, a sort of endemic virus whose persistence is a fatal threat for virtually all species (cf. the voluntary human extinction movement).

Second, should we admit that man's extinction is something bad, it would be bad only for our own species. It sounds

meaningless to affirm that man's persistence would be good from a cosmic perspective, since the universe has literally no point of view (Benatar, 2017).

Anyhow, the very fact that human activities could bring about pain and suffering for other living beings or unbalance planetary thresholds does not entail that extinction would be a good thing at all.

Also, the idea that the universe has no point of view is trivially true from the one hand, misguiding on the other hand.

Although the first claim "man represents a threat for planet Earth" is unfortunately true, man's persistence is something to pursue not only for humanity's sake but also for the universe itself.

Given the current data from astrobiology, we are likely the only intelligent species all around the universe. We are the only species to be aware of the universe and to be self-aware (Sagan, 1997).

It is incorrect to say that the universe lacks a point of view. Indeed, if there is a group of individuals and within that group there is an only man who can yield a specific point of view, then there is a sense, which is not trivial, in saying that that group exhibits a point of view. That sense is not merely a figurative one. We can affirm that the point of view of the group itself coincides with or is conveyed by that single member of the group. In fact, it would be meaningless to claim that, since that point of view is the only one within that group, it does not matter at all.

This objection is only able to show that there is no point of view of the universe considered as a whole, a sort of living totality. However, the universe in its very nature is nothing but an aggregate of the individuals and the single parts it is made of. Thereby, should an individual or some individuals or a specific part of the universe show a point of view, that one would be the point of view, that the universe has been generating on itself.

Once this premise has been accepted, we should conclude that even if our cosmic evaporation would be a good thing, that good would not be absolute, maybe just a good thing for a part of the universe. Anyhow, the article presumes that that argument would tell us even something more, that is, "our cosmic annihilation would represent the annihilation of a precious and exceptional part of the universe".

So, we can argue for the survival at any cost principle. This principle says that given the fact we are likely something precious and exceptional within the universe, we ought to preserve our very existence and the existence of the planet Earth which is so far the only habitable place we know in the entire cosmos.

These conclusions may represent a sort of new anthropic renaissance in which the awareness on how we posit within our planet is balanced through a renewed understanding of our place within the universe.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Author contributions

LL is the sole author and responsible for the contribution presented in this article.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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References

Benatar, D. (2017). *The human predicament. A candide guide to life's biggest questions*. Oxford: Oxford University Press.

Bostrom, N., and Ćirković, M. (2011). *Global catastrophic risks*. Oxford: Oxford University Press.

Chon-Torres, O. A. (2018). Astrobioethics. *Int. J. Astrobiology*" 17, 51–56. doi:10.1017/s1473550417000064

Ćirković, M. (2018). *The great silence. The science and philosophy of Fermi's paradox*. Oxford: Oxford University Press.

Couprie, D. L. (2011). *Heaven and earth in ancient Greek cosmology. From Thales to heraclides ponticus*. Germany: Springer.

Covone, G., and Giovannelli, D. (2022). Stellar metallicity is a key parameter for the search of life in the universe, arXiv:2207.03748v1", submitted to Nature Astronomy

Guthrie, W. K. C. (1979). *The presocratic tradition from Parmenides to Democritus*. Cambridge: Cambridge University Press.

Klenk, M. (2019). Moral philosophy and the "ethical turn" in anthropology. *Z. für Ethik Moralphilosophie* 2, 331–353. doi:10.1007/s42048-019-00040-9

Koyré, A. (1968). *From the closed world to the infinite universe*. Baltimore: Johns Hopkins University Press.

Lachenhaud, G. (2022). *Democritus. Traces and interlines: reading fragmentary texts*. Chisinau: Our Knowledge Publishing.

Lederberg, J. (1960). Exobiology: approaches to life beyond the earth. *Science*" 132, 393–400. doi:10.1126/science.132.3424.393

Ord, T. (2020). *The precipice. Existential risk and the future of humanity*. Oxford: Oxford University Press.

Pascal, B. (2013). *Blaise Pascal thoughts. Selected and translated*. Cambridge: Cambridge University Press.

Principe, L. M. (2013). *The scientific revolution. A very short introduction*. Oxford: Oxford University Press.

Sagan, C. (1997). *Pale blue dot. A vision of the human future in space*. New York: Ballantine Books edition.

Schwartz, J. S. J. (2018). *The Ethics of space exploration*. Germany: Springer.

Ward, P., and Brownlee, D. (2000). *Rare Earth. Why complex life is uncommon in the universe*. New York: Copernicus Book.

Webb, S. (2002). *If the universe is teeming with aliens where is everybody?*. Switzerland: Springer.