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The Cosmos and Human Beings from an Interdisciplinary Perspective. “Paradigmatické zmeny v chápaní kozmologickej a antropologickej problematiky. Minulosť a súčasnosť,” [“Paradigmatic Changes in the Understanding of Cosmological and Anthropological issues. Past and Present”] edited by Zlatica Plašienková, Univerzita Komenského v Bratislave, Bratislava 2021, pp. 308

Abstract. This book presents a complex picture of the universe and man from historical and contemporary perspectives, including philosophical, theological, and scientific perspectives. It consists of several papers by authors from various fields, and it is divided into three main parts. The first part addresses some interesting questions from the history of philosophy and theology; the second part focuses on contemporary astrophysics and astrobiology and the question of extraterrestrial life; the third part considers the ethical and environmental dimensions of these questions.

Keywords: universe; extraterrestrial life; cosmology; humankind

The perception of the universe and the image of man have been related in perhaps every historical period. Cosmological and anthropological issues are thus naturally intertwined in the individual contributions of this publication. The authors explore the philosophical, ethical, theological, legal, and scientific aspects of these questions. They look for possible overlaps and even possibilities of “convergence of ideas in their view of the universe, the existence of life and man in it” (p. 5). Bringing together authors with different scientific backgrounds yields interesting results. The different scientific disciplines can explore cosmological and anthropological questions together in a surprisingly coherent way, sometimes overlapping disciplines even within a single paper. Thus, Jozef Masarik and Marek Števček, a physicist and a lawyer, can explore the question of the search for life in space from the perspective of astronomy, astrophysics, and astrobiology, as well as international law in a single text (*Hľadanie*

života vo vesmíre z pohľadu fyziky a práva [*Search for Life in the Universe from the Perspective of Physics and Law*]).

Topics such as the exploration of space, the possibility of populating potentially habitable celestial bodies, the exploitation of their resources, and the search for life, including intelligent life, entail issues that inevitably intermingle with various fields. Roman Nagy and Tomáš Paulech (*Ludstvo ako interplanetárny druh* [*Humankind as an Interdisciplinary Species*]) manage to bring these different aspects together in one paper. Although both authors are physicists, they manage to reflect on the legal and ethical aspects of the issues outlined. What is man's place in the universe? What are the motivations that lead humans to intend to populate the universe – other objects of the solar system, including Mars and some moons of Jupiter and Saturn, being among the potentially suitable ones (pp. 234-235)? Masarik and Števček (pp. 204-208) ask similar questions, listing Jupiter's moon Europa, which has a large amount of water in its subsurface ocean, among the space objects that have the potential to harbor life, in addition to Mars. To look for potential life in space, Saturn's icy moons have also been investigated, including Titan, where lakes and seas filled with liquid hydrocarbons have been found on its surface, and Enceladus, which appears to contain salt water and organic chemicals. All these discoveries may indicate that some form of life may have existed on these objects (p. 205).

What realistic steps would be needed for space settlement? This is a question asked by Nagy and Paulech (pp. 225-233). In this context, the authors examine not only the technological but also the physiological (meaning the physical and mental health of potential astronauts), ethical and legislative challenges. The strongly interdisciplinary character of the book is also demonstrated by the other contributions as well as by the structuring of the content itself.

Modern science is accustomed to narrow specialization and strict separation of such areas as law and natural science, questions

of knowledge, and questions of power. Ethical and legal aspects are to remain on one side and are not to be confused with questions of natural science (Latour 2003). But this strict separation is no longer possible today (and, as B. Latour shows, perhaps it was never entirely possible). Space exploration itself poses not only technological difficulties but also ethical and legal challenges that can affect virtually all of us. Consider, for example, the question of the many satellites in the sky. On the one hand, we want the best possible worldwide Internet connection, but, on the other hand, the number of satellites in the sky causes a light smog that can affect us biologically and psychologically, while at the same time hindering astrophysicists' perception when observing deep space. Who is in the right? The companies that want to ensure good Internet connections and television broadcasts, or astrophysicists and ordinary people who want to observe the universe and sleep peacefully (p. 292)?

This collection of contributions begins with a group of papers dealing with historical explorations of cosmological and anthropological questions. Jozef Jančovič (*Kozmogónia a kozmografia v prvej správe o stvorení v knihe Genezis 1,1-2,3* [*Cosmogony and Cosmography in the First Creation Story of the Book of Genesis*]) examines biblical texts, especially the book of Genesis, and traces how these texts describe the world and the creation of the world – thus exploring cosmographic and cosmogonic issues in the Bible. Similar questions are explored by Zuzana Zelinová (*Premeny chápania kosmu v antickom myslení: od Homéra k Platónovi* [*Transformation of the Kosmos in Ancient Thought: from Homer to Plato*]) and Andrej Kalaš (*Kozmos, hylozoizmus, panteizmus a sociomorfizmus u prvých gréckych filozofov* [*Cosmos, Hylozoism, Pantheism, and Sociomorphism in the Conceptions of Early Greek Philosophers*]) in ancient texts rather than biblical texts. How did the meaning of the concept of *kosmos* change among ancient Greek thinkers? In Zelinová's paper, we discover that this concept had various meanings, ranging from ornaments and jewelry to a harmoniously ordered universe. The author distinguishes

between the aesthetic-structural and the ethical-normative meaning of the term *kosmos* (pp. 47-50). Kalaš traces the development of thought in the works of early Greek philosophers – especially Thales, Anaximander, and Anaximenes. He reveals some common features of pre-Socratic thought and suggests the need for a more adequate interpretation of the original sources that are not so heavily affected by Aristotle's reception of pre-Socratic thinkers (p. 92). Historical explorations are complemented by Gašpar Fronc's paper (*Premeny interpretácie teologického a matematického jazyka "knihy prírody"*) [*Changes in the Interpretation of the Theological and Mathematical Language of the "Book of Nature"*], which discusses the different meanings of the well-known claim about the mathematical language of the "book of nature." Fronc traces back these interpretations to biblical texts and the works of the pioneers of modern science in the early modern period.

Is there life only on Earth or can it be found elsewhere in the universe? This is the question that perhaps best describes the second part of the book, and which in some ways connects the first and second groups of contributions. In both antiquity and the Middle Ages, the idea of a two-sphere universe prevailed; the universe was thus seen as heterogeneous, consisting of two distinct spheres, the sublunar and the supralunar. In the supralunar sphere (delineated by the orbit of the Moon around the Earth), life as we know it could not exist since this sphere was reserved for celestial bodies (and possibly spiritual, divine beings). The idea of a heterogeneous two-sphere universe ceased to dominate after the Copernican Revolution in the early modern period. It was also in the early modern period, after the emergence of a new cosmology, that ideas suggesting the existence of life on other cosmic bodies became widespread. The idea of a barren universe filled with stars and planets no longer made sense to early modern thinkers. There was also a belief in the existence of intelligent extraterrestrials, i.e., intelligent life. According to several early modern thinkers (e.g.,

Ralph Cudworth) the universe cannot be empty, which in their conception entails intelligent life (Špelda 2018).

What is the view on extraterrestrial life today? From historical explorations, we are taken into contemporary natural science by Patrik Čechvala (*Náhľad do astročasticovej fyziky [Insight into Astroparticle Physics]*) and Tomáš Paulech (*Astrobiológia – poznávanie života vo vesmírnom kontexte [Astrobiology – Exploring Life in the Cosmic Context]*). Čechvala explores the question of cosmic and gamma-ray bursts, which help us to gain valuable information about exotic, variously distant space objects and about the processes that take place in their vicinity. Paulech introduces us to the discipline of astrobiology, which is devoted to the study of various forms of life in the universe, for example by detecting so-called biogenic elements (p. 139). The basic biogenic elements that are important for the construction of living organisms include carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur. Terrestrial life is primarily based on water and carbon. His investigation is naturally focused on (but at the same time not limited to) planets and objects (e.g., moons) in our solar system. Astrobiology, a multidisciplinary but predominantly natural science, also asks questions about the origin of life, evolution or distribution, and the future of life (p. 135). In his paper, Paulech examines theories that attempt to explain the origin of life on Earth, since life may have arisen in similar ways in other parts of the universe (see p. 147). Of particular interest to astrobiology is the origin of life from inorganic initial ingredients – that is abiogenesis (p. 142).

In this context, it would be interesting to look at other theories on the origin of life (not mentioned in the book). One of the newer, bolder theories proposes that life may have originated in conditions resembling volcanic environments, where cyclical hydration and evaporation occur. The so-called “hot spring hypothesis for an origin of life” is based on the discovery that polymers can be synthesized from their component monomers through a process of repeated hydration and dehydration to form protocells essential for life. This

hypothesis has also implications for astrobiology and could be helpful in the search for life on outer space objects such as Mars or the icy moons Europa and Enceladus (Damer, Deamer 2020).

A more detailed look at ways of investigating life in outer space is also provided by Tomáš Paulech in a different paper (*Základné aspekty života optikou astrobiológie [Basic Aspects of Life from the Perspective of Astrobiology]*), which focuses on describing selected processes of the microworld from an astrobiological point of view. Thus, we learn more specific procedures (at the level of the microworld and focusing on biological aspects) on how potential life forms in outer space. What are the fundamental aspects of life?

It is interesting to compare the contributions of Tomáš Paulech and Jozef Masarik and Marek Števíček. Both papers present the main features of life. Paulech lists “three fundamental requirements for any form of life” – cell membrane, metabolism, and heredity (pp. 142-143). Masarik and Števíček state that living organisms must exhibit all of the following characteristics: orderliness, reproduction, growth and development, metabolism, response to stimuli, and evolution (p. 195).

The contributions of Masarik and Števíček and Nagy and Paulech address issues in contemporary natural science regarding the exploration of space and life in it, as well as its habitability and sustainability. All contributions in the second part of the book consider the future of space exploration, the search for any form of life in it, its colonization and the possibility of using resources from outer space.

The third part of the book consists of papers dealing with environmental, philosophical-political, and media-ethical aspects of contemporary cosmological and anthropological issues. This part begins with a paper by physicists Matej Zigo, Jiří Šilha, and Juraj Tóth (*Výskum kozmického odpadu [The Basic Motivation of Space Debris Research]*). The technological progress that has enabled more intensive space research carries with it the problem of so-called space debris. According to the European Space Agency, “space debris includes all

man-made, artificial and non-functional bodies of all sizes in orbit around the Earth” (p. 245). These include defunct satellites, old launch rockets, various fragments, and other objects left in space. Debris may result from an accidental collision of two satellites, but there are also reported cases of deliberate destruction of satellites in so-called anti-satellite tests, through which a country tests the ability of ballistic missiles to shoot down its satellite (p. 246). Space debris disposal is technically challenging, though not impossible. All data needed for space debris disposal (including the accurate position of bodies, their rotational state, and shape) can be obtained using available methods. However, given the technical and especially financial challenges, it is worth investing in the prevention of further space debris. The authors thus address the environmental aspect of space exploration.

Ivan Buraj’s paper (“*Späť na zem*”, *ale ako? (alebo medzi kozmocentrizmom a antropocentrizmom)* [*Down to Earth, But How? (Between Cosmocentrism and Anthropocentrism)*]) is also related to environmental issues. It engages mainly with B. Latour, a contemporary thinker who has made important contributions to the field of political ecology, among others. Latour, in Buraj’s words, criticizes the one-sidedness of our approach to the environmental crisis. We get to know nature only from the outside and such nature seems too distant and vague. That is why people lose interest when it comes to nature protection, while they are more emotional and become immediately attentive to political issues (p. 259).

Why is it that we get bored and start yawning during lectures on the protection of nature or when discussing environmental issues? What can we do about it? How should we address people about the environmental crisis? On these questions, we may find answers in the work of Charles Eisenstein (Eisenstein 2018). After all, climate discussions usually deal with issues such as temperatures, measurements or forecasts, and the concentration of carbon dioxide in the air. This may appear too abstract and distant. Instead, our attention should be directed to concrete and local problems. According to Eisenstein, what

appeals to humans is above all the encounter with beauty and death. We cannot develop a genuine relationship with data on temperature; rather, we care for a concrete mountain from which the trees are disappearing; we feel connected to a river in which we could bathe in our childhood, but which is now polluted and the fish are dying because of contaminants; we can relate to a sacred place that has been desecrated by human pettiness. The reductionism of modern science has led us to notice only measurable things. However, these are often less essential to our authentic relationship with nature. By focusing on measurable qualities, we diminish the value of the immeasurable. The loss of biodiversity, the disruption of traditional ways of life of indigenous people, and ecological degradation are all difficult to measure, but it is precisely these concrete and local manifestations of the environmental crisis that we can perceive on an emotional level and that enable an existential relationship with nature itself (Eisenstein 2018).

Latour, in Buraj's words, accuses us of being too anthropocentric, focused only on humans and their perspective, while being too scientific and technocratic (too cosmocentric) on cosmic issues (pp. 260-261). The solution might be to take an entirely new path, to go "back to earth," equipped with "a new world view, new values and categories reflecting at the same time cosmological considerations and questions in close connection with social, political, class, ecological, climatic, etc. – in a word, eminently human problems" (p. 265). The most important goal of our efforts, Buraj concludes, is the preservation of life on this planet (p. 269).

The last contribution by Anna Sámelová, Tomáš Paulech and Roman Nagy (*Etické a mediálne kontexty terraformácie [Ethical and Media Contexts of Terraforming]*) raises further interesting questions. The authors first examine the historical origins of the concept of terraforming, which has appeared in the periodical press, film, radio plays, and television, including documentaries and other educational programs as well as entertainment shows (p. 275). Terraforming, and

space exploration itself, has become of interest to the wider public. Media coverage of issues concerning the legitimacy of human action that would fundamentally encroach on outer space and could have unintended (perhaps even unpredictable) effects on the pristine territories of alien space objects, has now decreased. Some thinkers hold that we have no moral right to colonize other space bodies. Human encroachment on the inanimate entities of the universe can be seen as a moral evil, as massive or arrogant vandalism (pp. 276-281). The authors of this paper also illustrate viewpoints that support the idea of terraforming or even consider it necessary. They also show how these views, thanks to media exposure, influence public perception much more than scientific discourse itself. However, we should remember that greater influence does not entail greater accuracy and that terraforming of other space objects cannot solve our (social and environmental) problems, which are deeply rooted in human thought and actions and which we need to address as humans or as “Earthbound,” as Latour would suggest (pp. 265-266). Perhaps, this point could have been made clearer by the authors of this paper.

This last contribution thus raises serious questions of environmental ethics that are becoming more and more relevant because of technological advances in space exploration. Cosmological issues naturally raise not only anthropological but also ethical, even axiological questions. In the face of the environmental crisis and other global challenges, we face as a society, we have to address several issues, including what entities have intrinsic value, what it means to be human, and how human beings relate to the world and the cosmos.

The book edited by Zlatica Plašienková covers a rather broad field of study, including philosophical, theological, scientific, legal, moral, and environmental aspects of cosmological and anthropological questions. It has the advantage of combining these disciplines into a single thematic unit. The collaboration between scientists and philosophers is open, creative, and in some ways original. It is certainly interesting and fruitful, not least because it addresses

important questions and offers relevant ways of approaching them creatively.

That said, the answers to the cosmological and anthropological questions explored are not exhaustively developed and need further research and elaboration. This is acceptable in a publication such as this, which does not have the ambition to provide ready-made or final answers. However, one would expect from a publication of this type a deeper philosophical reflection on this otherwise interesting interdisciplinary project. The book does contain philosophical contributions, which are mainly concerned with the history of philosophy and partial problems. They do not provide philosophical insights that could integrate individual contributions from different disciplines. Similarly, the theological section is relatively underrepresented. Other contributions do in places indicate such deeper philosophical reflection, especially in cosmology, but they are not developed in much detail. The anthropological problem is also relatively underrepresented – the question of man has been left in the background at the expense of cosmological questions.

Despite these shortcomings, the positives eventually outweigh the negatives. The book is thus a valuable contribution to the discussion of cosmological and anthropological questions as well as many contemporary problems that are becoming increasingly relevant in the context of current events.

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