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Copernicus and Copernicans: Galileo, Kepler, Bruno

Abstract

Copernicus claimed the Earth revolves around itself and the Sun. He also claimed that the universe was finite and that no intelligent life existed on other planets. Galileo and Kepler shared these claims; therefore, they deserve to be called Copernicans. But what about Giordano Bruno? He adopted Hermetic philosophy and opposed Copernicus's mathematical (geometric) method; he also claimed, unlike Copernicus, that the universe was infinite and that there were intelligent life forms on other planets. So, can we define Bruno and those who thought like him as Copernicans? Ernan McMullin answers this question in the negative. In this paper, I will argue that the differences between Bruno and Copernicus mentioned by McMullin cannot be used as criteria for claiming that Bruno and others who thought like him were not Copernicans; instead, I argue that believing the

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Earth rotates around itself and the Sun should be considered sufficient to call someone a Copernican.

Keywords: *Copernicus, Giordano Bruno, geocentrism, heliocentrism, anthropocentrism*

Kopernik i kopernikańczycy: Galileusz, Kepler, Bruno

Abstrakt

Kopernik twierdził, że Ziemia kręci się wokół siebie i Słońca. Uważał również, że wszechświat jest skończony i że na innych planetach nie istnieje inteligentne życie. Galileusz i Kepler podzielali te poglądy, dlatego zasługują na miano kopernikańczyków. A co z Giordanem Brunem? Przyjął filozofię hermetyczną i sprzeciwiał się matematycznej (geometrycznej) metodzie Kopernika; w przeciwieństwie do niego był także zdania, że wszechświat jest nieskończony, a na innych planetach istnieją inteligentne formy życia. Czy możemy zatem zdefiniować Bruna i tych, którzy myślą podobnie jak on, jako kopernikańczyków? Ernan McMullin odpowiada na to pytanie, mówiąc „nie". W artykule tym będę argumentował, że różnice między Brunem a Kopernikiem wspomniane przez McMullina nie mogą służyć jako kryteria twierdzenia, że Bruno i jemu podobni nie byli kopernikańczykami; zamiast tego twierdzę, że wiara w to, że Ziemia obraca się wokół siebie i Słońca, powinna wystarczyć, aby nazwać kogoś kopernikańczykiem.

Słowa kluczowe: *Kopernik*, *Giordano Bruno, geocentryzm*, *heliocentryzm, antropocentryzm*

1. Introduction

In his article titled *Copernicus and Bruno*, Ernan McMullin says:

> Bruno's sympathies with the characteristic Neoplatonic themes of the Renaissance are more evident. The primary clue to cosmological understanding for writers like Marsilio Ficino was soul, not geometrical form. They saw the universe as alive, as actively striving toward ends consciously entertained (McMullin 1987, p. 61).

Marsilio Ficino translated texts attributed to the Egyptian philosopher, Hermes Trismegistus, from Greek to Latin and adopted the philosophy expressed in these texts, so his Neoplatonism was a mixture of the Hermetic philosophy found in these texts. Bruno also adopted this kind of philosophy. McMullin says the following in the aforementioned article:

> In what sense, then, can Bruno be said to have been a "Copernican?" Is it appropriate to characterize his work as an "interpretation" of Copernicus or as making "additions" to the Copernican system? To call Bruno a "Copernican" requires one to empty the label of all content save the assertion that the earth and planets move around the sun. Not only does his arrangement of the planets differ entirely from that of Copernicus, as we have seen, but he separates himself in the most emphatic way from the methodology on which Copernicus rests his case (McMullin 1987, p. 64).

In McMullin's words, we can also see that Bruno should not be considered a Copernican because he did not adopt the mathematical method used by Copernicus. Another reason, according to McMullin, was that Bruno differed from Copernicus in his ideas about the arrangement of the planets. Therefore, according to McMullin, seeing Bruno as a Copernican means that we must ignore any differences between Bruno and Copernicus other than their common claim that the Earth revolves around itself and the Sun.[1]

Bruno also differs from Copernicus in his claim that the universe is infinite. McMullin refers to Arthur A. Lovejoy on this subject and says:

> Lovejoy, in fact, makes a point of asserting that the Copernican theory did not in any way imply (i.e., require) the much more far-reaching infinitist cosmological theses of Bruno (McMullin 1987, p. 68).

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[1] Dennis Danielson agrees with McMullin and quotes his words above, see 2014, p. XX. Contrary to McMullin and Danielson, Robert Westman sees Bruno as one of the Copernican realists who lived in the sixteenth century, see Westman 1975.

Therefore, according to McMullin,

> … Bruno's cosmology is only very loosely related to the *De revolutionibus*, so that it is, on balance, misleading to label him a "Copernican" (McMullin 1987, p. 68).

Since Bruno's cosmos is infinite, mentioning other consequences related to the infinity is necessary. Lovejoy lists the claims not accepted by Copernicus, Galileo, and Kepler but accepted by Bruno and those who thought like him:

> (1) the assumption that other planets of our solar system are inhabited by living, sentient, and rational creatures; (2) the shattering of the outer walls of the medieval universe, whether these were identified with the outermost crystalline sphere or with a definite "region" of the fixed stars, and the dispersal of these stars through vast, irregular distances; (3) the conception of the fixed stars as suns similar to ours, all or most of them surrounded by planetary systems of their own; (4) the supposition that the planets in these other worlds also have conscious inhabitants; (5) the assertion of the actual infinity of the physical universe in space and of the number of solar systems contained in it (Lovejoy 2001, p. 108).

The first and fourth heads concern the claim that there are intelligent life forms on other planets. The second, third and fifth heads are about the claim that the universe is infinite. And the infinity of the universe causes others to think that there cannot be any center of this infinite universe. As Lovejoy states,

> the physical universe ceased to have any center; it was broken up into (at the least) a vast multiplicity of isolated systems distributed upon no recognizably rational plan; it ceased to be a shape and became a formless aggregate of worlds scattered irregularly through unimaginable reaches of space (Lovejoy 2001, p. 109).

The heliocentric models of Copernicus, Galileo, and Kepler can be considered as a unitary system because, according to their models, the

cosmos is finite and, therefore, has a center, which is the Sun.[2] However, considering an infinite universe consisting of an infinite number of suns and an infinite number of planets revolving around these suns, according to some, it cannot be claimed that this infinite universe has a center; therefore, this infinite universe cannot be considered as a unitary system. Francis Bacon says the following about this:

> The first question therefore is, *whether there be a system?* that is, whether the world or universe compose altogether one globe, with a centre; or whether the particular globes of earth and stars be scattered dispersedly, each on its own roots, without any system or common centre? (Bacon 1861, p. 514).

Now let me summarize the differences mentioned between Bruno and Copernicus, together with other claims that arise if the universe is accepted as infinite:

1. Not considering the mathematical method sufficient.
2. A difference in the alignment of the planets.
3. Adoption of Hermetic philosophy.
4. The claim that the universe is infinite; therefore, the infinite universe cannot be a unitary system, the infinite universe cannot have a center, and there is the possibility of the existence of extraterrestrial intelligent life forms in an infinite universe.

This study aims to show that the above-mentioned claims cannot be seen as an obstacle to the identification of someone who accepts the claim that the Earth revolves around itself and the Sun as a Copernican.

It may also be thought that there can be two types of Copernicanism: first, scientific Copernicanism in the astronomical and mathematical sense; second, philosophical, theological and metaphysical Copernicanism (with different metaphysical foundations, such as Hermeticism). Bruno's Hermeticism may have been the reason why he applauded Copernicus's

[2] Paolo Rossi says the following about the idea of the universe as a unitary system, a view supported by Copernicus, Galileo, and Kepler: "Copernicus, Kepler, and Galileo, beyond the differences, the affinities, and the divergences, maintain the firm image of a universe as a unitary system" (Rossi 1972, p. 134).

theory; however, based on this, we cannot claim that there is a theological and metaphysical Copernicanism because there were Hermetics, such as Robert Fludd, who did not accept the heliocentric model. The accuracy of our criteria in deciding whether Bruno was a Copernican should also apply to others. Therefore, if there are other Hermetics who did not accept the heliocentric theory, we should not regard Hermeticism as the source of the existence of a certain kind of Copernicanism. As for Copernicanism, in the astronomical and mathematical sense, I would argue that this type of Copernicanism is also inappropriate because there are astronomers who adopted the mathematical model but did not accept the heliocentric model, such as Tycho Brahe and Christopher Clavius. Therefore, the adoption of the mathematical method in the investigation of the structure of the universe should not be seen as the source of the existence of a certain kind of Copernicanism.

I would also like to emphasize that heliocentrism is a scientific argument regarding the positions and orbits of the Sun and the Earth, and there are also conclusions that can be drawn from this scientific claim, such as the infinity of the universe and the possibility of extraterrestrial life. So, would we be doing the right thing if we divided people into two groups: those who accept the truth of a scientific claim and those who believe in some of the conclusions that can be drawn from this scientific claim? This would be wrong, because those who believe in some of the conclusions that can be drawn from the scientific claim in question already believe in that scientific claim.

In the second section, I will demonstrate that the adoption of Hermetic philosophy cannot be an obstacle for someone to be called Copernican. The third section aims to show that belief in the infinity of the universe and the existence of extraterrestrial intelligent life forms cannot be the criterion for not defining a person as a Copernican.[3] The fourth section will discuss those who did not see any contradiction in an infinite universe being a unitary system, which shows that it would be a mistake to see the finite universe as a requirement for being a unitary system.

[3] For a discussion on how Copernicus overturned the dominant Earth-centered model and became a Copernican, see Westman 2019.

2. Bruno, Hermetic Philosophy, and the Mathematical Method

The Merriam-Webster dictionary defines the term 'Copernican' as follows: "of or relating to Copernicus or the belief that the earth rotates daily on its axis and the planets revolve in orbits around the sun."[4] So, could the belief that the Earth makes a daily rotation around itself and an annual rotation around the Sun be enough to be called a Copernican? For McMullin, the answer is no. Apart from the reasons mentioned above, to prove that Bruno cannot be considered a Copernican, McMullin quotes Bruno's words as evidence, and says:

> Though a man of "diligent and mature genius, not second to any astronomer before him," Bruno comments, Copernicus never really succeeded in transcending the vulgar philosophy. "Being more a student of mathematics than of nature, he could not penetrate deeply enough into matters to enable him to remove unsuitable and empty principles" (McMullin 1987, p. 64).

Seeing Copernicus as a student of mathematics indicates his use of the mathematical method. However, Bruno also said the following about Copernicus:

> It was ordained by the gods that he should announce the dawn that precedes the rising sun of the ancient and true philosophy […] (Bruno 2018, p. 31).

The reader who reads these words will not easily accept that Bruno was not a Copernican. Is there a contradiction between the words quoted from Bruno and the ones McMullin quotes? My answer would be 'no'. Bruno saw the heliocentric model as evidence of ancient and true philosophy, and he believed that this model of the universe revealed many possibilities, such as the infinite universe and extraterrestrial intelligent life, and that Copernicus could not see these because he could not go beyond applying the mathematical method to nature. However, since Copernicus proved that the heliocentric model is the true model of

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[4] *Merriam-Webster Dictionary*. URL: <https://www.merriamwebster.com/dictionary/Copernican>. (accessed November 20, 2023).

the universe,[5] according to Bruno, he should be seen as the harbinger of the new age that will be built on true philosophy.

Bruno accused Copernicus of being a student of mathematics rather than nature because he failed to see the possibilities provided by the heliocentric model. What Bruno means by this accusation is that Copernicus was a mathematician rather than a natural philosopher.[6] Thus, according to Bruno, there was a Copernicus who proved that the heliocentric model was correct and deserved to be called the herald of the new age; there was also a Copernicus who could not understand what this new model really meant. For this reason, Bruno's above-mentioned words about Copernicus were not contradictory. They emphasize both Copernicus's contribution to true philosophy and his failure to grasp the possibilities of the heliocentric model.

I have stated above what, according to McMullin, is the common claim of Copernicus and Bruno: that the Earth rotates around itself and the Sun. However, it has been said that this common claim is not sufficient to call Bruno a Copernican. So, what are the differences between Copernicus and Bruno? In this section, Bruno's adoption of Hermetic philosophy will be discussed as one of the differences between Copernicus and Bruno; another difference discussed is that Bruno opposed Copernicus's mathematical method. As mentioned, when trying to decide whether Bruno should be considered a Copernican, it is

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[5] After the Copernican revolution, but especially after Galileo saw the celestial bodies, which had been unknown until then, the Copernican model of the cosmos became a stronger argument. In his *Cosmotheoros* (1698), Christiaan Huygens emphasizes that Copernicus's cosmic model became stronger by the discoveries made through the telescope: "A Man that is of Copernicus's opinion, that this earth of ours is a planet […] the later discoveries made in the heavens since Copernicus's time, namely, the attendants of Jupiter and Saturn, and the plane and hilly countries in the moon, which are a strong argument of a relation and kin between our earth and them, as well as a proof of the truth of that system" (Huygens 2018, pp. 5–6).

As Brake also states well: "Galileo's little book *The Starry Messenger* struck like a bomb. It was the first time that anyone had provided strong visual evidence in support of the Copernican theory. Until then, the theory had seemed to challenge common sense and perception. As we have seen, the impact of Galileo's telescopic discoveries was utter shock" (Brake 2013, p. 80). See also Nicolson 1939, pp. 32–33.

[6] Paolo Rossini states that Bruno recognized the distinction between mathematical astronomy and natural philosophical investigations of celestial phenomena, see Rossini 2020, p. 257.

not correct to think only about Bruno; it is necessary to mention others who share similar views as Bruno. If Bruno has claims that prevent us from identifying him as a Copernican, these claims must also apply to others with similar claims.

McMullin considers Galileo and Kepler to be Copernicans because they accepted that the Earth rotates around itself and the Sun, and adopted the mathematical method, but they stayed away from Hermetic philosophy. However, when we consider the adoption of the mathematical method, what can we say about literary figures, such as Giacomo Leopardi and Cyrano de Bergerac, who accepted the claim that the Earth revolves around itself and the Sun? (See Leopardi 1982; Bergerac 2016.) Can we ask them to adopt the mathematical method? Do we have to choose our Copernicans from among astronomers or natural philosophers who adopted the mathematical method? This would be very wrong. Leopardi and de Bergerac were men of letters, not natural philosophers or astronomers, so we cannot expect them to adopt the mathematical method.

As for the adoption of Hermetic philosophy, we can say that Kepler is not as far from Hermetic philosophy as McMullin thinks, because Kepler says:

> But now since the first light eight months ago, since broad day three months ago, and since the sun of my wonderful speculation has shone fully a very few days ago: nothing holds me back. I am free to give myself up to the sacred madness, I am free to taunt mortals with the frank confession that I am stealing the golden vessels of the Egyptians, in order to build of them a temple for my God, far from the territory of Egypt (Kepler 2002, p. 3).

I do not mean that Kepler was as interested in Hermetic philosophy as Bruno was, but it should be asked: what level of interest in Hermetic philosophy must be required for someone to be considered a Copernican? McMullin should have given us the answer to this question. It should also be taken into account that Kepler may have concealed much of his interest in Hermetic philosophy since Bruno was burned to death for his Hermetic ideas. In addition, we see that philosophers such as Robert Fludd, who adopted the Hermetic philosophy, did not support the heliocentric model, but instead continued to believe that the geocentric

model reflected the true structure of the universe. Therefore, the adoption of Hermetic philosophy should not be considered a criterion for defining someone as a Copernican.

3. The Infinite Universe and Extraterrestrial Intelligent Life

As mentioned above, according to McMullin, the condition for being defined as Copernican is that the universe is accepted as a finite, heliocentric, and unitary system. However, although Copernicus thought the universe was finite, he did not exclude the possibility of an infinite universe because he said in his work *On the Revolutions*: "But let us leave to the philosophers of nature the dispute as to whether the world is finite or infinite" (Copernicus 1995, p. 17). As can be seen, the question whether the universe is finite or infinite cannot be answered by considering astronomical observations or mathematical evidence; this question can be answered by natural philosophers. Copernicus's words imply that the infinite universe may be the result of the heliocentric model.[7]

Thomas Digges was the first British astronomer to argue that the infinite universe was a corollary of the heliocentric model. According to Francis R. Johnson and Sanford V. Larkey, Bruno was the second person to see the infinite universe as a natural consequence of the heliocentric model (see Johnson, Larkey 1934, p. 105).[8] Kirschner and Kühne say the following about this issue: "What Copernicus regarded as possible, Digges regarded as certain" (Kirschner, Kühne 2015, p. 23).

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[7] Regarding this, Mark Brake also states: "The new universe of Kepler and Galileo was, at least potentially, decentralised, infinite, and alien" (Brake, 2013, p. 209). In his paper titled "Why Nicolaus Copernicus (1473–1543) Is Still Interesting?", Michał Kokowski argues that according to Copernicus, the universe is similar to infinite, see Kokowski 2023, p. 98, fn. 20.

[8] Stillman Drake also states that it was the British Copernicanism of Digges which affected Bruno (see Drake 1975, p. 181). Drake emphasizes the differences among the Copernicanism of Bruno, Kepler, and Galileo by saying, "Bruno gives us an extended Copernicanism, Kepler a modified Copernicanism, and Galileo a restricted Copernicanism" (Drake 1975, p. 178). Hilary Gatti also argues that "Bruno also extended the Copernican hypothesis to infinite dimensions" (Gatti 2004, p. 26). According to Omodeo, "Bruno parallels Copernicus's celestial reform with the moral one of the *Spaccio*" (Omodeo 2014, p. 341).

In fact, this idea of Kirschner and Kühne can be expressed as follows: What Copernicus saw as possible, Digges, Bruno and many others saw as certain.

So, why was the infinite universe seen as a consequence of the heliocentric model? We must start with Aristotle. According to him, the universe is finite because the sphere of fixed stars has a circular motion, and if the universe were infinite, there would be no circular motion of the sphere of fixed stars. Bruno thought that if the motion of the sphere of fixed stars proves to us the finitude of the universe, its immobility would prove the infinity of the universe. While the heliocentric model makes the spheres of the fixed stars immobile, it makes the Earth mobile, thus proving to us the eternity of the universe (see Granada 2004, p. 98).

Since in Aristotle's geocentric model it is believed that the Earth is fixed and at the center of the universe, that is, the Earth does not rotate either around itself or the Sun, the daily rotations of the fixed stars were considered evidence of the mobility of the sphere of fixed stars; but the heliocentric model proves that the apparent daily motion of the sphere of fixed stars is the result of the daily rotation of the Earth around itself, which means there is no daily motion of the sphere of fixed stars. Bruno used the immobility of the sphere of fixed stars as proof of the infinity of the universe: if its mobility proves the finitude of the universe, then its immobility proves the infinity of the universe.

When we consider the heliocentric model as the model of the finite universe, as accepted by Copernicus, Galileo and Kepler, it has been said that the finite heliocentric model has an illogical consequence. Copernicus's heliocentric model presents two motionless regions: one is the center of the universe, the Sun, and the other is the sphere of fixed stars. And the area between these two regions moves circularly. This result indicates an illogical situation because, in this case, we are faced with the problem of the origin of the circular movement of the region between two motionless regions. According to Aristotle, the sphere of fixed stars is mobile, receiving its movement from the unmoved mover beyond the sphere of fixed stars and transferring this movement to the spheres of the planets. The sublunary region was a changing and perishable region, unlike the incorruptible superlunary region, and the change in the sublunary region resulted from the circular movements of the planets. However, considering that both the sphere of the fixed stars and the center (the Sun) were motionless, it seemed difficult to explain

the movement of the region between them. According to Robert Palter, this illogical situation arising in Copernicus's heliocentric model "could only be removed by making the Universe infinite and assimilating the sun to the fixed stars" (Palter 1964, p. 155). Alexandre Koyre also states that the infinite universe is a result of Copernicus's theory of astronomy with the following words:

> It is rather natural to interpret Copernicus this way, that is, as an advocate of the infinity of the world […] As a matter of fact, it is in this way that the Copernican doctrine was interpreted by Gian Battista Riccioli, by Huygens, and more recently by Mr. McColley (Koyre 1957, pp. 30–31).

Again, Karl S. Guthke argues that Bruno derived the idea of an infinite universe from Copernicus's heliocentric model (see Guthke 1990, pp. 72–73). In his book *Discours Nouveau Prouvant La Pluralité Des Mondes*, published in 1657, Pierre Borel interprets the heliocentric model as evidence of an infinite universe. Marie-Rose Carré expresses Borel's interpretation as follows: "the new image of the world reveals God's creation as infinite as Himself […]" (Carré 1974, p. 332).

I mentioned above some of those who believed the infinite universe resulted from the heliocentric model. Robert Burton (1577–1640) also thought the Earth's motion in the heliocentric model proved the infinity of the universe, but he also believed that extraterrestrial life forms were a logical consequence of the Earth's motion, that is, the heliocentric model (see Barlow 1973, p. 298). Again, Giacomo Leopardi (1798–1837) thought that millions of Earth-like planets with extraterrestrial life forms were the logical outcome of the heliocentric model (see Leopardi 1982, pp. 437–439).[9] Therefore, it seems that not only the infinity of the universe but also the existence of extraterrestrial life forms is considered the logical outcome of the heliocentric model. If the universe is infinite, this means there are an infinite number of planets in an infinite universe, which infinitely increases the possibility of the existence of intelligent extraterrestrial life forms, which means the end of anthropocentrism. Then, it would not be correct to say that those who saw the heliocentric model as evidence for the eternity of the universe and, therefore, the existence of extraterrestrial life were not Copernicans.

[9] For the extraterrestrial life debate from Democritus to Kant, see Dick 1982.

In this study, I do not want to prove that the universe is infinite or say that it has been proven. I am proposing the idea that those who saw the infinite universe as a logical consequence of the heliocentric model cannot be regarded Copernicans is wrong. As mentioned below, Democritus thought the universe was infinite, but he also believed that the Earth did not revolve around the Sun, but the Sun revolved around the Earth, and that there were an infinite number of similar systems. Even though Democritus believed the universe was infinite, he did not believe the Earth rotates around the Sun. According to Democritus, all these systems, including our own, were geocentric, not heliocentric. Therefore, the distinguishing feature of Copernicanism should not be the infinity or finitude of the universe, but the rotation of the Earth around itself and the Sun. Even though Kepler believed in a finite universe and Digges believed in an infinite universe, they should be considered Copernicans because both believed that the Earth revolved around itself and the Sun.

4. A Unitary System and Teleology

First, let us explain what we mean by a unitary system. When Democritus talked about the plurality of worlds, what he meant was that the infinite universe consists of an infinite number of limited systems with worlds at their centers, and their suns and planets revolving around these centers, that is, their worlds (see Brake 2013, p. 25). Bruno, on the other hand, suggests that there are an infinite number of systems with the sun at the center and planets around these suns. If we accept the universe as infinite, then we will have to assume that the stars we see in the universe are suns with planets revolving around them. In this case, the universe will consist of many systems that are not connected to each other, and since these systems do not affect each other, there will not be a unitary system for the entire universe. According to Copernicus, Galileo, and Kepler, Democritus' universe was not a unitary system, because if there is more than one system, as we mentioned, then there will be systems (worlds) that are not connected to each other; this would mean a fragmented, disordered universe, but such a universe cannot be possible. So, how can they claim that a universe formed by the coexistence of more than one system must be a disordered universe? Can't it be assumed that the infinite number of worlds, or systems,

may be interconnected? Once we accept the plurality of worlds, why should we have to assume these worlds will be unconnected? For example, Democritus, who claimed there were an infinite number of worlds (systems), did not claim that the universe was a disordered whole. I believe the reason for suggesting that an infinite number of systems cannot be connected and that the universe would lack order in this case is to form a model of the universe that supports anthropocentrism. It is not possible to both accept the infinity of systems, that is, the plurality of worlds, and defend anthropocentrism.

Although Copernicus, Galileo, and Kepler accepted the possibility of extraterrestrial life, they rejected the possibility of human-like intelligent life forms outside the Earth because, in this case, the problem arose as to whether Jesus came also for extraterrestrial intelligent beings. Regarding this, Thomas Paine said: "Are we to suppose that every world, in the boundless creation, had an Eve, an apple, a serpent, and a redeemer" (Paine 2014, p. 410).

Copernicus, Galileo, and Kepler did not see a finite heliocentric model as a threat to anthropocentrism. For example, Kepler related a finite heliocentric model to anthropocentrism as follows: the Earth "is most suited to the most important and most noble rational creature among all physical bodies" (quoted by Rossi 1972, p. 142); the reason for this is explained by Rossi as follows: "Its orbit is inserted between the two orders of a) the three primary bodies – cube, tetrahedron, dodecahedron – and b) the two secondary bodies – icosahedron, octagon" (Rossi 1972, p. 143).[10] However, Kepler, the author of *Somnium*, accepts that there may be life on the Moon, but this does not mean that he isn't anthropocentric, because even if there are creatures outside the Earth, they cannot be intelligent creatures like humans. Earth's unique position in the finite universe proves that humans are superior to any other possible creature in the universe.

Copernicus, too, presents the finite heliocentric universe as evidence of anthropocentrism. The following statement can be read in his letter to Pope Paul III:

> […] the philosophers [...] could not agree on a more reliable theory concerning the motions of the system of

[10] For Kepler and his inferior Lunarian people, see Guthke 2003, p. 180.

> the universe, which the best and most orderly Artist of all framed for our sake (quoted by Danielson 2001, p. 1031).

Although Kepler's and Copernicus's reasons are different, they believe the heliocentric model rather than the geocentric one is more suitable in terms of the uniqueness of the human being, but with one condition: the heliocentric model must be finite. In defense of anthropocentrism, it doesn't matter where the Earth is placed in the universe. To put it in the words of Fernand Hallyn:

> if man is the beneficiary of the world, his profound 'centrality' remains, wherever he is physically located [...] Copernicus' universe, while removing man from the geometrical center remains from this perspective profoundly anthropocentric (Hallyn 1990, p. 58).

So, can we consider that not only an infinite universe but also a finite heliocentric universe invalidates anthropocentrism? I suggest that we can. I think that the heliocentric model, even if it is finite, makes anthropocentrism untenable. The geocentric model advocated by the Church was a model based on the distinction between the superlunary and sublunary regions. In this model, the superlunary region is a region composed of ether, and this is an incorruptible element. Therefore, all planets, the Moon, Sun, and the sphere of fixed stars are incorruptible celestial bodies composed of ether. But the sublunary region consists of the perishable elements of earth, water, fire, and air; therefore, the sublunary region is characterized by decay and generation, which means that life is only possible in the sublunary region. The possibility of life in the superlunary region is logically impossible because if there is no change (decay and generation), we cannot talk about life. In this model based on Aristotelian physics, defended by the Church, the incorruptibility of the superlunary region arises from the circular motion of the celestial bodies in this region. Circular motion is the natural motion of the ether element. Since circular motion, which has no beginning or end, can continue forever, it signifies immortality, that is, indestructibility. However, the natural motions of the four elements in the sublunary region are linear. While fire and air have a linear motion from the center outwards, that is, upwards, earth and water have a linear motion towards the center, that is, downwards. In a finite universe, linear

motion cannot continue forever, because it will end at the periphery or center of the universe; therefore, unlike circular motion, linear motion is finite, so decay and generation are possible in the sublunary region. And since the downward motions of earth and water and the upward motions of fire and air are opposite, these two opposite motions are the cause of the change in the sublunary region, because decay and generation can happen when everything turns into its opposite. Change in the sublunary region, namely decay and generation, makes life on Earth possible. This universe based on Aristotelian physics is perfect for anthropocentrism. It does not even allow the possibility of any living being, let alone the possibility of intelligent beings outside the Earth, because the superlunary region is a region free from change, that is, decay and generation.

In the heliocentric model, the Earth is also a planet, and the other planets are bodies where decay and generation occur, like the Earth; and if other planets are Earth-like,[11] then there may be life there too, and there is no reason to say that creatures that may exist in the superlunary region cannot be intelligent like us. Although Copernicus's heliocentric universe is finite, it does not deny the possibility of intelligent life outside the Earth; on the contrary, it opens the door to such a possibility. Copernicus and Kepler denied the possibility of intelligent life except human in their finite heliocentric universe. They must have done this because of their own religious beliefs or because they were afraid of the Church. Otherwise, they could not logically deny the possibility of intelligent life on other planets in a finite heliocentric universe. So, what is the difference between a finite heliocentric universe and an infinite universe in terms of the likelihood of extraterrestrial intelligent life? Although both contain this possibility, we can say that the infinite universe increases this possibility infinitely and brings it to the level of certainty.

It is claimed that if the universe is infinite, it cannot have a center. The fact that the universe has a center makes it a unitary system. However, Pierre Borel (1620–1671), for example, proposed that the Sun was at the center of an infinite universe (see Rossi 1972, p. 147). Kant also accepts the universe as infinite and says: "We well note that to think of creation

[11] As John Wilkins states: "Now if our earth were one of the Planets (as it is according to them) then why may not another of the Planets be an earth?" (Wilkins 2018, p. 50).

in relation to the power of the Infinite Being means it must have no boundaries at all" (Kant 2008, p. 102). However, Kant, like Borel, thinks that the infinite universe has a center:

> It is indeed the case that in an infinite space no point can really justifiably be called the centre. But thanks to a certain relationship based upon the inherent levels of density of the primordial stuff, according to which at the time of creation this material had accumulated more densely particularly at one certain location and its density had grown increasingly scattered with the distance away from this point, such a place can have the privilege of being called the centre. And it truly does become that through the development of the central mass because of the strongest power of attraction in it. It becomes the point to which all the remaining basic material incorporated in particular developments moves down, and thus, no matter how far unfolding nature may extend, it creates out of the entire totality only a single system in the infinite sphere of creation (Kant 2008, p. 105).

As is seen, Kant believed the center of the universe is the place where the primary matter spreads and begins to form the universe. And, he also thought this infinite universe was a single system.

As a result, we cannot associate having a center and being a unitary system only with a finite universe, because although the universe was infinite, there were those who claimed that it had a center and was a unitary system. Democritus, who thought that the universe was infinite, claimed that the universe did not have a center, but he also thought that the universe was a unitary system, because he believed this infinite universe operated according to strict physical laws. Therefore, for him, the universe was a cosmos, that is, order, not chaos. It should not be forgotten that the fact that the universe is infinite does not necessarily mean that it cannot be a unitary system with all the worlds it has. There is no reason not to think that the entire universe, with its infinite number of worlds, is a unitary system subject to the same laws of physics.

In this case, if the fact that the universe is infinite does not necessarily follow that it is not a unitary system and that it lacks order, what is the

reason for this opposition to the universe being infinite or having no center? The answer to this question can be seen in Tomasso Campanella's defense of Galileo. Campanella says:

> Furthermore, it must be noted that nowhere in the canons of the Church is there to be found a decree which denies that there are many worlds. Nor does St. Thomas say that this is contrary to the faith when he discusses the matter in Part I, Question 47, Article 3. The passage in John [1:10], "The world was made by him," does not deny that God made other worlds at other times; it states only that he made our world. But St. Thomas correctly shows that it would be an error of faith to claim that there are many worlds without any order as a whole, as Democritus and Epicurus thought. For from this it follows that these worlds came into being by chance, as they believed, without being ordered by God (Campanella 1994, p. 111).

We see in Campanella's words that the reason why some people stayed away from the idea of a plurality of worlds was that such a universe excludes God. In other words, in the case of infinity, it was thought that there is no purpose (teleology) in the universe and that it is completely dominated by chance.[12]

According to Democritus and Epicurus, there was no teleology or conscious design in the universe, but they still thought, as mentioned earlier, that the universe operated according to certain laws of nature, so it was not a disordered entity. And since these laws of nature covered the entire universe, it was actually a single system with all the worlds within the universe, but Democritus and Epicurus designed a universe devoid of any purpose. However, we have seen that although Kant accepted an infinite universe consisting of an infinite number of systems, he had no problem accepting that such a universe was God's design. Bruno also did not accept a universe dominated by coincidence, and his own universe

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[12] Aquinas saw the infinity of the universe as denial of the involvement of God. If there is no end, there would be no final cause; that is, God (see Rubenstein 2014, pp. 71–73). For the problems provided by infinity for Christianity, see Kuhn 2003, p. 193. For the theories of infinity and the plurality of worlds in medieval cosmology, see Duhem 1987, Koyre 1957, and Harries 2001.

was a universe designed by God. Not only Bruno, but many others who considered the universe infinite, saw it as an orderly whole and God's design. Many of those who saw the universe as infinite, like Bruno, did not exclude God from this infinite universe. So, what was the problem? As previously mentioned, I think the problem is anthropocentrism. Bruno accepted the universe as infinite, as a unitary system, and as the design of God, but unlike the Church, he believed that there were intelligent life forms other than humans in the universe. And, in fact, as we mentioned above, if we accept the universe as infinite, the possibility of intelligent life on an infinite number of Earth-like planets is almost certain. This was not a problem for Bruno; he believed that God, who designed the universe, could have created intelligent beings other than humans. But for the Church, this was unacceptable. The existence of intelligent life in the universe other than humans was devastating for the Church's vision of God and religion.

5. Conclusion

In this paper, I have argued that McMullin's reasons why Bruno cannot be described as a Copernican are invalid. Being defined as a Copernican should not mean being limited to what Copernicus said. There were issues where Galileo and Kepler differed from Copernicus, but McMullin saw no harm in describing them as Copernicans. For example, Galileo included the moons of Jupiter in his system, which Copernicus did not know about. As you may recall, McMullin sees Bruno's difference in the arrangement of the planets as one of the reasons for not identifying him as a Copernican. Kepler, on the other hand, accepted the orbits of the planets as ellipsoidal, not circular, like Copernicus. However, McMullin saw the differences between Bruno and Copernicus as an obstacle to defining Bruno as a Copernican.

Considering the universe as infinite should not be an obstacle for defining someone as a Copernican. If we do that, we cannot call Thomas Digges, Robert Burton, Kant and many others Copernicans. If we consider belief in the existence of extraterrestrial intelligent life forms an obstacle, not only Bruno but many others cannot be considered as Copernicans. If we consider the adoption of Hermetic philosophy an obstacle for being defined as a Copernican, can we be sure that Kepler should be considered a Copernican? Also, we cannot establish

a relationship between the adoption of Hermeticism and the heliocentric model, because philosophers such as Fludd did not adopt the heliocentric model, but they adopted Hermetic philosophy. When we considered whether accepting the mathematical method was necessary to be defined as a Copernican, we saw that this also could not be a criterion, because if someone who is a poet or theologian rather than an astronomer or natural philosopher has adopted the heliocentric model, we cannot expect them to adopt the mathematical method. Therefore, it would not be right to say that we can choose the people we will define as Copernicans only among astronomers and natural philosophers who apply the mathematical (geometric) method.

The only valid criterion we have in deciding whether a person can be defined as a Copernican or not should be whether that person accepts that the Earth revolves around itself and the Sun. The claim that the Earth revolves around itself and the Sun was very important, because it meant the end of Aristotle's physics. This claim opened the door to both the possibility that the universe is infinite and that there are intelligent beings other than us in the universe. The possibility of extraterrestrial intelligent life is valid not only if the universe is infinite but also, as explained above, if the heliocentric universe is finite. Thus, rather than refusing to identify Bruno and those like him as Copernicans, we must recognize that there are both Copernicans who consider the universe to be finite and are anthropocentric (e.g., Kepler and Galileo) and Copernicans who consider the universe to be infinite and are not anthropocentric (e.g., Bruno). Just as we can speak of a Christian Aristotelian or a Christian Platonist, why not speak of someone as both a Hermetic and a Copernican?

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