

## GOD, ASTRONOMY, AND MATHEMATICS: AN INVESTIGATION OF SPIRITUAL ASPECTS OF JOHANNES KEPLER'S THOUGHT

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### Abstrak

Kepler adalah tokoh astronom terkemuka yang membuat penemuan tentang orbit planet yang elips. Teori astronominya telah menyajikan visi tentang bagaimana kosmos mencerminkan keagungan Tuhan melalui hukum matematika. Penelitian ini akan melihat ide-ide astronomi dan matematika Kepler, yang dipengaruhi oleh keyakinan pada Tuhan. Diskusi dalam kajian ini menggali pemikiran Kepler tentang: struktur dan genealogi ide-ide Kepler; keyakinan diri Kepler sebagai seorang ahli agama dan astronom; harmoni kosmos dalam interaksi Tuhan, geometri, dan alam; serta metafora, dan esensi keilahian. Kepler percaya pada alam semesta yang harmonis dan keterkaitan antara Tuhan, geometri, dan alam semesta. Menurut Kepler, Manusia dapat merangkul esensi ketuhanan, karena geometri yang mengatur tatanan alam semesta setara dengan keilahian.

**Kata kunci:** kepler; tuhan; astronomi; geometri; matematika

### Abstract

*Kepler was a prominent astronomer who made discoveries regarding elliptical planets' orbits. His astronomical theory has presented a vision of how the cosmos reflects God's magnificence through mathematical laws. The discussion in this study explores Kepler's thoughts on the structure and genealogy of Kepler's ideas; Kepler's self-confidence as a religious scholar and astronomer; the harmony of the cosmos in the interaction of God, geometry, and nature; as well as metaphors, and the essence of divinity. Kepler believed in a harmonious universe and the interrelationship between God, geometry, and the universe. Kepler believed in a harmonious universe and the interconnectedness of God, geometry, and the universe. According to Kepler, Humans can embrace the essence of divine, because the geometry that governs the universe's order is equivalent to divinity.*

**Keywords:** kepler; god; astronomy; geometry; mathematics

### Introduction

In today's modern era, mathematics and astrology are considered as separate fields from divinity and spirituality (Krajewski 2021). In fact, the two are considered contradictory, and many studies show a conflict between the two. But if we look at in history, we will see that mathematics and astrology are a form of unity with religiosity. At the beginning of its development, various mathematical concepts were part of an

interrelated religious system. Even in the 17th century, many mathematicians were religious in perceiving mathematics, such as Newton, Pascal, Leibniz, and Cantor (Krajewski 2021). At the beginning of the scientific revolution in Europe, mathematics was still considered a religious field. For example, History records that Kepler's thoughts on astronomy reflected the divinity and spirituality he believed in.

Johannes Kepler was one of the brilliant thinkers at the beginning of the scientific revolution who confirmed Copernicus's heliocentric theory as a brilliant mathematician (Armstrong 1999). On the other hand, Kepler was also an avid learner of religion. Kepler was a figure at a classic astronomer who made discoveries about the elliptical orbits of planets. His various works such as *New Astronomy* and *Harmonies of The World* have provided a view of how the cosmos, which works based on mathematical principles, and those reflect God's majesty.

Johannes Kepler was born on December 27, 1571, in Germany. Kepler is considered a philosopher, mathematician, astronomer, and a devout Lutheran (Boner 2013; Rothman 2017). Kepler had a brilliant career in astronomy. Before finishing his studies at Tübingen, Kepler was asked to teach mathematics at a Protestant school in Graz (present-day Austria). Kepler was also an assistant to the great astronomer Tycho Brahe and later became the royal mathematician for Rudolf II. Throughout his career, Kepler thought about devotion to God. Thus, in one of his books, *Mysterium Cosmographicum*, he calls himself a servant of God who reads His verses in the universe. In Kepler, there is a belief that divinity can be embraced through mathematics/geometry, which is the blueprint for constructing the universe.

In history, mathematics is a broad study and closely related to divinity. Etymologically, the word mathematics is rooted in the word "mathesis" which means "study" (Raju 2006). Therefore, mathematics was considered a broad scientific discipline in the ancient world and included various endeavors to fulfill the desire to know. Then, it is not surprising that the great Greek philosopher, Plato, wrote at his academic entrance: "Let no man ignorant of geometry enter here".

Johannes Kepler lived in an era where modern science began to grow and develop. However, the connectivity between spirituality and mathematics is still robust. At that time, the mathematics curriculum was divided into four sections called quadrivium, namely: arithmetic, astronomy, geometry, and music (Boner 2013:39). The four are a series of knowledge that tries to investigate order, logic, quantity, and harmony. At that time, astrology also still had a strong influence and was considered an essential part of astronomy. Therefore, the astronomy curriculum is not like today's modern era, a vacuum of spirituality. Astronomy at that time, as understood and studied by Kepler, was a broad form of knowledge that was not only counting and measuring celestial entities but was an attempt to understand how God works in the universe. Astronomy offers a worldview and a philosophical view of the nature and behavior of divinity (Raju 2006).

Leach said that Empirical science cannot answer metaphysical questions (Leach 2008:659). The link between mathematics and metaphysics and religion is firm, as

Bradley explains that many mathematics-related questions are spiritual and metaphysical :

Nevertheless, questions that have the potential to engage both disciplines have persisted. For example , some major questions are: Is mathematics discovered or invented? Do math concepts like infinity point beyond themselves to a higher reality? can the idea that randomness exists in nature be reconciled with God's sovereignty? what is the nature of truth? How do we account for the fact that mathematics is so effective in describing the natural world ? Mathematical entities like 2,  $\pi$ , and 4 are not physical objects like atoms and galaxies; are they ideas in the mind of God , as Augustine argued, or something else entirely? Do principles of logic apply only to the natural world or to God also? (Bradley 2011:1)

In fact, mathematics is not completely separated from the sacred in this modern era. Voker Kessler (2019) says that there are four gates through which spirituality can enter mathematics. The four gates are the view of Platonism, the beauty of mathematics, the study of patterns, and mathematical inner vision (Kessler 2019:49). Broadly speaking, the four gates require mathematicians to have a spiritual perspective or paradigm in viewing mathematics. So, what is in mathematics can be considered as a form of interaction with God. These four things describe the phenomenon of how mathematics and spirituality come together. Kurniawan and Hidayati (2020) explained that Kessler mentioned four things were more about the form of interaction, not the area where mathematics and spirituality encounter. Kurniawan and Hidayati (2020) said that there are at least five dimensions where mathematics and spirituality can interact, namely the ontology, epistemology, teleology, and theoretical and practical dimensions of mathematics. From the explanation above, it can be concluded that mathematics and divinity have the opportunity to interact with each other in various study areas and forms.

The emergence of sacred things in mathematics is not only in the paradigm of mathematicians. Every mathematical activity contains elements of metaphysics as revealed by Rittberg that metaphysical thinking and mathematical activity develop together as a reciprocal thing in mathematical activity (Rittberg 2020). In geometry, mathematicians see how the ideal geometric size and shape concepts have beautiful order and harmony. These geometric forms are an eternal entity and an immaterial view (Rittberg 2020). Therefore, geometry is nothing but a form of metaphysical activity.

Various great thinkers associated geometry with the divine, such as Pythagoras, Galileo, Plato, and Kepler. In Kepler 's view, geometry is not just the language of God, as Galileo said, moreover, it is the essence of divinity. As an astronomer, Kepler did not abandon his religious thinking. Even Kepler views his mathematical activities as part of reading God's verse in the universe.

Various studies on Kepler have been carried out from various perspectives. Like Boner, who saw Kepler's thinking as a form of synthesis between astrology and astronomy and bridged Lutheran views in the new astronomy (Boner 2013). In

addition, Aviva Rothman examines Kepler's thoughts in the perspective of the search for the harmony of the cosmos (Rothman 2017). Kepler's specific studies of light were also carried out by Gebhart which provided the concept of harmony in universe (Gebhart 2009). The above studies have provided a comprehensive view of Kepler's thoughts on astronomy and its relation to divinity. However, there needs to be further study of how Kepler's ideas about divinity manifested in his astronomical work. Therefore, this study will investigate Kepler's thoughts in astronomy and mathematics, inspired by his religious belief in God.

Kepler's mathematical and astronomical concepts reflect his belief in divinity, a study will be described in the form of the foundations and genealogy of Kepler's thoughts, Kepler's self-confidence as a religionist as well as astronomer, the harmony of the cosmos in the interaction of God, geometry and nature, metaphors and the essence of divinity.

### **Research Method**

The research method used is the literature review method. This study analyzes various literatures related to the themes raised. In this case, the theme raised is about Johannes Kepler's thoughts regarding divinity in his astronomical works. This study analyzes the works of Johannes Kepler such as *The Harmonies of Word* and *Mysterium Cosmographicum*. In addition, this study also uses various books and journals that are relevant to the theme. The research stage in this literature review is to determine the study topics, look for sources relevant to the topic, carry out in-depth reading and analysis, perform reduction by coding and determining patterns, and finally analyze the patterns in the existing discourse.

### **Result and Discussion**

#### Kepler 's Genealogy of Thought

To understand more deeply about Kepler's thinking, here will be discussed about the various discourses and thoughts that underlie the mindset of the astronomer Johannes Kepler. In his book *Convinced by Comparison: Luterian Doctrines and Neoplatonic Conviction in Kepler's theory of Light*, Gebhart explained that in general, Kepler was strongly influenced by religious thought, especially Lutheran (Gebhart 2009). The religious concept that he adheres to provides a paradigm for the knowledge he gains. In this case, we can see how Kepler tried to reconcile and harmonize the Christian theology of the trinity with the astronomical discoveries he made. In terms of geometry and mathematics, Kepler also followed the Pythagorean thinking, which gave a sacred value to numbers and shapes. As Bradley, He (Kepler) stood firmly within the Pythagoreans tradition by affirming that astronomy is based on fundamental harmonies analogous to musical harmonies and within the Platonic tradition by affirming that geometry has a special form of transcendence (Bradley 2011:13).

However, what is different is that Kepler refers to the Godhead according to religious dogma, rather than to the divine impersonal like the Pythagoreans. His

professor, Michel Maestlin, introduced Kepler's thoughts on Copernicus at Tubigen, In addition to supporting the Copernican concept, Maestlin promoted the Lutheran beliefs that underlie Kepler's study of Astronomy. Maestlin explained that knowledge of nature is knowledge of God's plan and knowledge of geometry is a gift of God where it is already written on the human soul when it was created (Gebhart 2009).

Despite having a different view of the Pythagoreans, regarding divinity, Kepler has a general thing in common: Kepler saw mathematics as the archetype of the universe. Cardona (2016), In his paper entitled Neopythagoreanism in the work of Johannes Kepler, explained that there are technical similarities in viewing the cosmos between the Kepler and the Pythagoreans (Cardona 2016). The fundamental similarity is the recognition of the existence of universal harmony. This harmony is an implication of the mathematical/geometric paradigm used to understand the universe. As the Pythagorean understanding that the universe is arranged with specific numbers and ratios that manifest as natural harmony. In this case, Kepler can indeed be considered a follower of Pythagorean thought, but regarding divinity, it seems Kepler maintains his belief as a true Protestant. Kepler differed significantly in his views on numbers. The Pythagoreans refer to numbers as things that refer to metaphysical entities, but Kepler relies more on quantities which refer to concrete and empirical sizes and spaces (Rothman 2017). In *Mysterium*, Kepler stated, "I had then reached the point of ascribe to this same Earth the motion of the Sun, but where Copernicus did so through mathematics arguments, mine were physical, or rather, metaphysical" (Kepler 1981).

#### Religious Mathematicians

As a Lutheran, Kepler held the faith in his daily life and in his intellectual work. Therefore, he defines himself as an priest-astronomer who serves the Highest God with respect to the "book of Nature" (Rothman 2017:19). In his letter to Masline, Kepler wrote "I wanted to be a theologian; for long time I was distress; behold, God now celebrated too in my astrological work" (Rothman 2017:5). This confirms that Kepler realized that his desire to serve God could also be channeled through mathematical activity in astronomy. This activity is considered as a worship to God because geometry is the link between God, Man, and nature (Rothman 2017:5).

In his book *Mysterium*, which he published in 1596, Kepler wrote that he was a priest who studied the "books of nature", the works of God the creator glorified by an astronomer. This explains that the word of God in nature is another religious field that deals with divinity besides the scriptures. Here Kepler views nature modeled in geometry as something sacred.

#### Cosmos Harmony: The Relationship of Geometry, Nature and God

The concept of a harmonious cosmos is widely discussed in Plato's works. In addition, the views of the Pythagorean sect also carry this idea. It seems that the idea of the Ancient Greek era still resonated at the beginning of modernity in Europe, as adopted by Johannes Kepler. In his book *Harmonies of The World*, Kepler seemed to

emphasize that the idea of the Cosmos was still relevant for that era (Kepler 1997; Rothman 2017).

The existence of harmony in the universe implies the mathematical-geometric paradigm in viewing the universe. It was believed by Plato, Pythagoras, and also Kepler that geometry could perfectly model the universe. Because geometry is an ideal concept that is logical, harmonious, consistent, and obvious, it is also a characteristic of what is being modeled, namely Nature. Boner (2013) explained that Harmonies of The World is an entirely well-organized work of Kepler (Boner 2013). In his book Kepler understands that the celestial configuration (sky) and resonance archetypes resonate in the sublunary sphere.

Galileo Galilei argued that the language of God in the universe is geometry. This is because geometric concepts can describe the order of the universe. In Kepler's opinion, the idea is still resonating and evolving. Kepler views that this harmonious geometry is a blueprint for the universe's design.

In his view and the theological interpretation of his own work, Kepler sees the harmony of the form of the solar system as an illustration of the concept of religious theology. The regularity of the planets' motions and their distances and trajectories is described as a metaphor for the trinity concept.

#### Metaphor Kepler on Divinity

One of Kepler's metaphors for the cosmos is the assumption that the universe is like a clockwork that is ordered and driven by a single force. In addition, the solar system is also a metaphor as an illustration of the concept of the Trinity. Gingerich (2011) explained that Kepler has a theological framework in his work based on the metaphorical symbolism of the trinity, with the sun as God the Father, the Firmament as the Son, and the intervening space as the Holy Spirit (Gingerich 2011:43). With this, Kepler tries to reconcile or harmonize how the Heliocentric theory can be accepted and following the concept of the Trinity. This endeavor, although risky, appears to be paying off, considering that a sentencing case like Galileo's did not happen. Kepler argued that the planets move faster the closer they are to the sun. Then it is concluded that the source of the motion is the sun. This is used as a metaphorical identification that the sun in the middle is likened to God providing action, as in the Copernican system. This depiction of the Trinity in the solar system was why Kepler accepted the idea that the cosmos was centered on the sun (Gingerich 2011).

In the metaphor of a clockwork, Kepler explained that the causes of planetary motion are the same as the gears in a clock (Boner 2013:5). There is an order to it, and what makes this more of divinity is the notion of the origin of the movement. A clockwork movement that has a single source of motion, even though the machine has many gears that move intertwined. It is used as a metaphor for the solar system and the universe has a single source of motion.

In this case, Kepler was referring to the Platonic notion of a celestial machine driven by the soul. However, Kepler rejects the conception that the source of motion is

the soul, and this is because he does not want to regard the soul as the causal essence of the motion of the universe. To regard the soul as the mover is tantamount to discrediting God as the Almighty (Boner 2013:12–13).

#### Finding God's Essence

As understood by ancient mathematicians, Mathematics is considered as a bridge to a noumenal world (Bradley 2011:18). Rationality in mathematics presents knowledge that cannot be obtained from empirical sensory experience. Therefore, mathematics is seen as a tool to unravel the mysteries of the universe that are not accessible to the human senses. In his view, Kepler saw mathematics as more than just a tool to enter the divine world that exists in the cosmos. Furthermore, Kepler viewed mathematics or geometry as part of God, which describes the astronomical order.

As an astronomer based on the belief in divinity, Kepler saw geometry as something theological. As explained by Rothman (2017) in a chapter of his book entitled *The Study of Divine Things: Kepler as Astronomer-Priest*, that “ Kepler's personal metaphysics was itself theological from the start, as it starts with a particular conception of God and proceed to link God, man, and nature via the idea of geometry ” (Rothman 2017:5). There is a fundamental difference between Kepler and Pythagoreans, where Kepler saw the harmony of the universe in geometry as a theological form. On the other hand, the Pythagoreans refer to something more metaphysical about the phenomenon.

Kepler's theological view of astronomy also differed from that of other theologians of his time and other thinkers such as Galileo who saw God as an entity outside the universe. Theologians around Kepler viewed that there is a barrier between divinity and human. Therefore, geometry and mathematics are tools to see the signs of divinity, not the essence of divinity. But Kepler did not think so. Kepler seems to have a negative theological view. In the concept of negative theology, there is a premise that God is different from his creation. Therefore, to identify divinity, it can be detected with something that has contradictory (negative) properties with creation. The properties in geometry is in the form of regularity, truth, and eternity which are certainly not the nature of creation. Therefore, geometry has divine characteristics. Kepler's opinion on this is explained by Bradley (2011) that:

Kepler restricted all primary causes in creation to the mathematics archetypes. Mathematical knowledge is based on definitions plus formal logic, so in doing mathematics we share God's thoughts — that is , we speak with one voice with God. Hence it is possible for humans to read God's design in the universe on the basis of a rigorous mathematics methodology (Bradley 2011:13–14).

From this it can be concluded that Kepler rejected the existence of boundaries between humans and God. Kepler argued that the essence of divinity was in geometry. Geometry is coeternal with God and geometric entities are part of God's essences; the constructible geometric objects served as the archetypes of creation (Bradley 2011:13–

14). Consequently, when he deepens geometry, he is actually in a state of epiphany or encounter with divinity.

### **Conclusion**

Various mathematics-related things such as geometry and astronomy have a strong connection with God and spirituality. Secularism and modernity make the two things seem separate from each other. In fact, in its history, mathematics and divinity are interrelated discussions. In the thought of Johannes Kepler, there is a strong and reciprocal correlation between God, Mathematics, and Astronomy. Kepler has brought a new theory about the solar system in the form of elliptical orbits of the planets. More than that, Kepler still carries the divinity and spirituality he embraces in his theory. Kepler believed in the existence of a harmonious universe and the interrelationship between God, geometry, and the universe. As a form of resonance for the theology he professes, Kepler forms a metaphor for the theory he makes. In addition, Kepler argues that humans can embrace the essence of divinity because the geometry that applies to the order of the universe is equivalent to divinity.



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