

The Phenomenon of Tides in Byzantine Science

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Abstract

In this work, we explore Byzantine scholars' views and ideas on tides by revealing the fusion of their scientific, philosophical, and religious thought. In an attempt to bridge the Aristotelian and the Christian cosmology they attributed tides to lunar phases, terrestrial features, or metaphysical forces, weaving intricate interpretations. Our research revealed that lunar phases were linked to tidal rhythms by Eustathius of Antioch and Basil of Caesarea, in 4th c. detailing lunar influence on atmospheric and oceanic patterns. Nikephoros Blemmydes, in the 13th century, emphasized geomorphic explanations, while Nikon the "Metanoite", in the 10th century, attributed mystical symbolism to tides. References in Byzantine literature underscored the metaphorical relevance of tides. Ultimately, the study elucidates how Byzantine scholars grappled with integrating diverse worldviews to comprehend the enigmatic tidal phenomenon within their holistic understanding of nature and divinity.

Keywords

Byzantine Science, Tides, Lunar Phases, Cosmology, Natural Philosophy, Aristotelian Tradition, Christian Theology, Metaphysics

1. Introduction

Byzantine science has attracted increasing scholarly attention in recent decades, evident in the growing number of publications, conferences, and research programs dedicated to the field. This suggests that the study of Byzantine science is now an integral part of Byzantine history, and that the international community of Byzantine science historians is developing rapidly, formulating and answering concrete questions of relevance to broader fields of inquiry (Katsiampoura, 2022).

There are many historiographical and epistemological problems to be considered when it comes to the sciences and natural philosophy in Byzantium. Some of these problems are related to the general historiographical approach to By-

zantium while others are related to the perspective of the history of science. In principle, if we see science as the body of ideas, practices and institutions, an encyclopaedical account is not sufficient to account for the scientific endeavor. Then, the question that arises concerns the way science is defined in any particular spatio-temporal and social context and hence also in Byzantium.

In this sense, the attempt of understanding the natural world does not have a zero point in the Scientific Revolution, since it is now accepted that truth is not an achronic concept and has a historicity. The question of what science in Byzantium is has been and still is of interest, as will be discussed below. Another issue concerns the understanding of the scientific discourse, a topic which is directly related to the question of its autonomy. To what extent, then, the scientific discourse was autonomous and how it was linked to the political, social and economic conditions of the particular social formation in which it was situated (Katsiampoura, 2022).

According to contemporary methodological approaches in the historiography of science, the scientific discourse is influenced by the cultural environment, philosophical beliefs, and ontological commitments of its actors, and therefore, the process leading to changes in perceptions of the natural world is embedded in a complex web of social and cultural processes (Renn, 2015).

This methodological perspective is further supported by recalling Zilsel's thesis (Zilsel, 1942: pp. 544-562) asserting that in the early modern period, most of the knowledge produced had at its core the practical knowledge of craftsmen, engineers, doctors or alchemists that had accumulated in the previous centuries.

Consequently, research in the field seeks to respond to the interpretation of the scientific endeavor in the context of the social formation in which it was born.

The historiography of Byzantine science and natural philosophy is confronted with the challenges mentioned in the previous paragraphs. There is already a vast body of literature of portraits of Byzantine scholars and an increasingly rich publication of commented primary sources. Thus, the next goal is to understand and interpret Byzantine Science not only in terms of persons, genius personalities, etc., but only by trying to integrate scholarly production into the continuity with ancient Greek thought.

Indeed, if the aim of the research goes beyond the level of integration of Byzantine Science into the ancient Greek tradition (as Byzantine Science has been treated and evaluated to a greater or lesser extent up to now), a wider field of reflection opens up, which will contribute to the question of what Byzantine science and natural philosophy were by placing emphasis in their interactions with the antinomies of the specific social formation (Katsiampoura, 2021).

Lazaris (2020) identifies two sources of Byzantine science: the ancient Greek tradition and the Islamic, Latin, and Hebrew traditions that influenced Byzantine scholars. This dispels the myth that Byzantine science was simply a continuation of ancient Greek science.

Tihon (2020), also, points out that Byzantine science involved many activities,

such as studying, teaching, writing manuals, commenting on scientific treatises, and conducting experiments and emphasizes that the Byzantine world was open to not only its ancient heritage, but also to sources from other civilizations, such as Arabic, Persian, and Western.

Also, there are specific difficulties in the study of Byzantine natural philosophy and science. At first, the sources are very few and fragmentary. Also, philosophy, arts, and technology were not demarcated by impenetrable boundaries, as the surviving sources reveal. So, a clear definition for each one, although necessary, is very problematic. In addition, the more one considers the differences among texts, contexts, and even social roles of the Byzantine thinkers, the more one realizes how multifaceted this tradition is (Trizio, 2007: pp. 247-294).

In our previous works we have tried to address the afore mentioned questions by studying, among others, the characteristics of Byzantine science (Katsiampoura, 2021), the relation between natural philosophy and alchemy (Katsiampoura, 2018), the relation between science and religion (Katsiampoura, 2010a) and the relation between two Byzantine quatrivia (Katsiampoura, 2010b).

In this context, this paper addresses a previously unexplored area in the current historiography of science in the Byzantine era by surveying and mapping the explanations given by Byzantine scholars for the phenomenon of tides. Indeed, the explanation of tides remained an open question from the time of Aristotle till the 17th century, when Newton provided a comprehensive theory of tides in his *Philosophiæ Naturalis Principia Mathematica*. Our study of the relevant literature revealed that the contribution of the Byzantine scholars is missing from important works dealing with the history of tides and the tidal phenomena (Cartwright, 1999).

It is our task to fill an important void in the current historiography of science dealing with the history of tides and at the same time to enrich the body of research on Byzantine Science by presenting the works of Byzantine scholars by surveying and analyzing the relevant primary sources.

2. On the Tidal Phenomenon

Most of the times, Byzantines use the terms *physica*, or *physiki akroasis*, according to Aristotle, or *natural science*¹, or *physikos logos* (discourse about nature) according to the definition by the Suidae Lexicon (Gaisford, 1834), from 10th century, where we are reading: “*discourse about nature by philosophers, i.e. about bodies, principles, elements, about universe and space and vacuum*” etc. (c.3862)².

The domination of religion during that era, required that whenever a thinker or a philosopher was referring to a natural phenomenon, it was necessary to af-

¹As Michael Psellos wrote: “[Aristotle] was the first who intenfined the natural science” (“[Ο Αριστοτέλης] τὴν φυσικὴν πρῶτον ἐπιστήμην ἀκρίβωσαι”) (Boissonade, 1838: p. 163).

²Original in Greek: “Φυσικός λόγος παρά φιλοσόφους. Μετά τὸν ἠθικὸν διεξέρχονται περὶ τοῦ φυσικοῦ. τουτέστι, περὶ σωμάτων, περὶ ἀρχῶν, καὶ στοιχείων, καὶ περὶ τοῦ κόσμου, καὶ τόπου, καὶ κενοῦ. [...]” (c. 3862).

firm the principle of everything being rooted in God and His will, even if the explanation given for the specific phenomenon was not based on the “divine intervention”. The statement of Michael Psellos³ in *De Omnifaria Doctrina* 83, *Περί των αρχών, τι εισίν*, that “*God is the creator and the first cause, but after him in the natural world we could find a lot of causes*”⁴ which explains the creation and function of bodies, perfectly depicts the atmosphere within which natural philosophy was developed and texts were written (Katsiampoura, 2018; Nicolaidis, 2011).

The phenomenon of tides, complex and multiparametric, is not the result of a directly visible action. It requires observation for a long time period and presents the evident difficulty of placing the observer within its evolving framework. Also, it is correlated—for the thorough observer—with celestial phenomena, the sun, and the moon, which implicated scholars having strong religious cosmological perceptions. This is because Byzantine scholars displayed considerable interest in the early chapters of *Genesis*, and often wrote detailed commentaries or preached series of Homilies⁵ on the Hexaemeron—the Six Days of Creation—among them Eustathius of Antioch, Basil of Ceasarea, Gregory of Nyssa, Theodore of Mopsuestia, Ambrose, John Chrysostom and Augustine. At the same time, they were following the Aristotelian tradition that posited a division between the celestial realm, where heavenly bodies (stars and planets) were located, and the sublunar realm, which was subject to change and decay, aligning their discussions of the divine, the material world, and the relationship between the two. They integrated this division into the framework of Christian theology and adapted it to their religious worldview. As a result of this division, natural philosophy was distinct from the mathematical sciences that mainly concerned the superlunar (celestial) realm, which was eternal and immortal. It incorporated divine wisdom and could therefore be studied with mathematical principles, in contrast to the sublunar realm (Hunger, 1997, vol. III).

The interpretive richness offered by Aristotelian natural philosophy, and its compatibility with the Christian cosmological framework, after the rejection of the eternity of the world by Christian scholars, facilitated the formulation of generally accepted perspectives on the phenomenon of tides under study. However, it also significantly challenged scholars in their attempts to adequately decipher them. For example, the need to align with the Mosaic Genesis narrative,

³Michael Psellos was one of the scholars who attached particular importance to the study of the natural world, also as a subject for teaching. He was a scholar in the imperial court, monk for a while, head of the Imperial School of Philosophy under Constantine IX Monomachos (1042-1055) with the rank of the consul of the philosophers (hypatos), and was called “polyhistor” on the grounds of his multiplicity of interests. He lived in the 11th c., when the interest in the natural world essentially made its appearance and probably was associated with a more general secularization of Byzantine thought. Psellos’ contemporary historiographers, like Zonaras or Skylitzes’ Continuatus, criticize his work from a traditional Christian perspective (Ljubarskij, 2004).

⁴Original in Greek: “*Αρχή των όντων πρώτη μεν και υπεράρχιος ο θεός, μετά δε θεόν πολλai αρχai των φυσικών πραγμάτων εισί*” (Westerink, 1948: p. 50).

⁵Sermons.

according to which light was the first creation (“*Let there be light*” being God’s first command), while the sun and the moon were created on the fourth day of Creation, seemed to present an insurmountable puzzle for Christian thinkers such as Eustathius of Antioch or Basil of Caesarea, whom we discuss below. They developed distinctive theories about light, the sun, and, by extension, the moon, stars, and their effects.

Following Aristotle, the phenomenon of tides, apart from the moon, was attributed to terrestrial phenomena by other philosophers the most prominent being Nicephoros Blemmydes (Migne, 1865).

Lastly, as we will present later, a number of scholars addressed the tidal phenomenon, either attributing its existence to metaphysical causes with the aim of teaching “divine truth,” or, according to the common practice of the time, it was metaphorically used to emphasize the variability of life. It’s worth noting that people experiencing conflicting emotions were also referred to as “*euripoi*” depicting the changing flow of waters in narrow passages, such as the Euripus Strait in Chalcis.

3. The Explanation Frameworks of the Tidal Phenomenon

In the following, we present the interpretative frameworks of the tidal phenomenon formulated by the scholars of the Byzantine period, depending on how they explained it and more specifically on the causes that they attributed to it. A preliminary categorization of the causes follows the thematic arrangement as outlined below:

- Moon, lunar light, and lunar phases;
- Terrestrial and marine phenomena;
- Metaphysical (supernatural) interpretations.

We have also added a fourth category in our paper which includes the scholars who simply mention the phenomenon of tides in their works (3.4. “Simple references to the tidal phenomenon”).

3.1. Moon, Lunar Light, and Lunar Phases

The moon, its phases, and its light have always held a special fascination for people. Specifically, the possible connection between lunar phases and the tidal phenomenon, for which the earliest written testimony (Cartwright, 1999) we have so far, comes from Pytheas of Massalia. According to Aetios (382b3-383b34) (Diels, 1965: p. 383),

“*Pytheas of Massalia explains the causes of both the waxing and waning of the moon.*”⁶

This observed connection is a classic example of attributing causation for a phenomenon based on the presence of another related factor (correlation-causation). Thus, tides were attributed by certain natural philosophers, scholars and

⁶Original in Greek: “*Πυθέας ὁ Μασσαλιώτης τῆ πληρώσει τῆς σελήνης καὶ τῆ μειώσει τὰς ἑκατέρου τούτων αἰτίας ἀνατίθειν*”.

ecclesiastical fathers of the Byzantine era (see Eustathius of Antioch, Basil of Caesarea, Nicholas Cabasilas) to the phases of the moon or its lunar light. The absence or presence of lunar light, when separated from heat (fire), was challenging to perceive and explain its impact on humans and living beings in general.

Lastly, tides, being a worldwide and exceptionally intriguing phenomenon, are presented in parallel with various meteorological phenomena, such as winds, rains, etc. These phenomena operate together in a continuous cause-effect relationship, and some philosophers attributed them to lunar phases. Among them was the Bishop Eustathius of Antioch.

3.1.1. Eustathius of Antioch

Eustathius was one of the members of the First Ecumenical Council at Nicaea (Doundoulakis, 2006: p. 163) in 325. He was born in Sida of Pamphylia and became the bishop of Beroea. He was elected as the bishop of Antioch in 323. He passed away in Trajanopolis of Thrace around 337 (according to some sources, 360). He was distinguished for his knowledge and was accused of heresy, although he was vindicated after his death (Sellers 1928: p. 81).

In a work attributed to him, *Commentary on the Hexaemeron*, as it is evident from the title, Eustathius delves into the creation of the world in six days by the God of the Old Testament. This appears to be a common endeavor during this specific historical period, as we can also observe from the corresponding work by Basil of Caesarea, which chronologically belongs to the immediate next generation of bishops⁷.

In the surviving text (Migne, 1857a), although its authenticity is disputed by many researchers who argue that it falls short of Eustathius' erudition and style (Doundoulakis, 2006: p. 163), in the analysis of the fourth day, he describes the

⁷To further strengthen this claim, the alignment of certain passages between the two bishops regarding celestial bodies is quite remarkable. For example, the following reference to a belief that traces its origin back to Aristotle and persisted at least until the mid-20th century concerning the old women who "pull down" the moon:

Eustathius, *On the Hexaemeron*: "Myths (55), however, have been kept alive by the wild tales of intoxicated old women everywhere. They claim that by means of certain spells, the hearth is moved from its place and brought down to the ground. But what place received this descending hearth? Did the apparent illusion deceive us into thinking it was something insignificant? For our perception is limited, and what we see, we assume to be small, projecting our own bias onto what is visible." (Original in Greek: Ευστάθιος, *Περί εξαήμερον*. "Μύθοι (55) δὲ ληρώδεις ὑπὸ μεθύντων γραϊδίων πανταχοῦ διεσώθησαν· ὅτι μαγγανείαις τισὶ τῆς οἰκείας ἔδρας ἀποκινεῖται, καὶ πρὸς τὴν γῆν καταφέρεται. Καὶ ποῖος ἂν τόπος καταχθεῖσαν αὐτὴν ὑπεδέξατο, Μὴ (724) γὰρ ἐξηπάτησε τὸ φαινόμενον ὡς μικρόν τι εἶναι νομιζόμενον. Μικρὰ γὰρ ἢ ὄψεις ἡμῶν γινομένη, μικρὰ ἐποίησε νομίζεσθαι καὶ τὰ ὁρώμενα, τὸ οἰκείον πάθος τοῖς ὄρατοῖς ἐπιφέρουσα.").

Basil of Caesarea, *Homilies on the Hexaemeron* (Homily vi.11): "Everywhere ridiculous old women's tales, imagined in the delirium of drunkenness, have been circulated, such as that enchantments can remove the moon from its place and make it descend to the earth. How could a magician's charm shake that of which the Most High has laid the foundations? And if once torn out what place could hold it?" (Original in Greek: Βασίλειος Καισαρείας, *Ὁμιλία εἰς τὴν εξαήμερον* (Ὁμιλία 6η): "Μύθοι τινες καταγέλαστοι ὑπὸ γραϊδίων κωθωνιζομένων παραληρούμενοι πανταχοῦ διεδόθησαν, ὅτι μαγγανείαις τισὶ τῆς οἰκείας ἔδρας ἀποκινήθησα σελήνη πρὸς γῆν καταφέρεται. Πῶς μὲν οὖν κινήσει γοήτων ἐπαοιδῆ, ἣν αὐτὸς ἐθεμελίωσεν ὁ Ὑψιστος, Ποῖος δ' ἂν καὶ τόπος κατασπασθεῖσαν αὐτὴν ὑπεδέξατο; Βούλει ἀπὸ μικρῶν τεκμηρίων λαβεῖν τοῦ μεγέθους αὐτῆς τὴν ἀπόδειξιν;").

creation of the sun and the moon by God. He presents his cosmological perspectives as well⁸:

“6. *On the fourth day, God created the two great luminaries, the sun and the moon, in the firmament of the sky, to provide light upon the earth, to separate day from night. This solar light was prepared as a vehicle for that original light. [...] And let no one think that the day is the same as the sun. First, the Creator fashioned simple light, which He called ‘day,’ then He created the sun from fire and light. [...] The appearance of the moon is coal-like, as can be observed during an eclipse; when the sun’s own light is obscured, it darkens the moon while also illuminating it, creating a distinct brightness. [...] To separate day from night. Just as He assigned the sun for measuring the day and the moon for measuring the night. [...] The sun does not create the day; let no one conceive it thus. For the day and night are older than it. Rather, it initiates only the day, as the psalmist tells us, ‘The sun He set to rule the day, the moon and the stars to rule the night’*” (Migne, 1857a).

According to these views, on *the fourth day*, God created the sun and the moon to illuminate the Earth and distinguish day from night. In fact, day and night are phenomena independently created by these two celestial bodies.

He perceives fire (heat) and light as distinct elements, as one warms us while the other illuminates us. To reinforce this differentiation, he uses the example of the contrast between whiteness and a white-painted object.

To strengthen his perspective that day and the sun are distinct phenomena, he describes how, initially, God created the day as simple light, and then the sun as fire, which is additionally illuminated by the daytime light. And if anyone has objections, they can observe this differentiation during dawn, where we have light without fire (the sun), and even in lightning, which illuminates but does not provide warmth. However, this differentiation is most noticeable in the moon (which is dark—“charcoal-like”—as seen during eclipses) when it is illuminated by the sun, becoming more distinct, like how the sun is enhanced by daylight. The sun received light from God from the beginning and contains it within forever, in contrast to the moon, which undergoes phases (thus explaining the phases of Earth’s satellite).

These two celestial bodies (along with the stars) also serve as instruments of time and indicators of meteorological and seasonal phenomena, depending on

⁸Original in Greek: 6. Τῇ δὲ τετάρτῃ ἡμέρᾳ ὁ Θεὸς τοὺς μεγάλους δύο φωστῆρας ἐδημιούργησεν, ἡλίον τε καὶ σελήνην ἐν τῷ στερεώματι τοῦ οὐρανοῦ, εἰς φαῦσιν ἐπὶ τῆς γῆς, τοῦ διαχωρίζειν ἀναμέσον τῆς ἡμέρας καὶ ἀναμέσον τῆς νυκτός. Τοῦτο τὸ ἡλιακὸν φῶς, ὄχημα ἐκείνῳ τῷ φωτὶ τῷ πρωτογόνῳ παρεσκεύασται. [...] Καὶ μηδεὶς νομίση ταυτὸν ἡμέραν εἶναι καὶ ἥλιον. Πρῶτον μὲν γὰρ ὁ δημιουργὸς ἀπλοῦν φῶς κατεσκεύασεν, ὃ δὴ καὶ ἡμέραν ἐκάλεσεν, ἔπειτα τὸν ἥλιον ἐκ τοῦ πυρὸς καὶ φωτός συγκείμενον. [...] Τὸ γὰρ τῆς σελήνης εἶδος ἀνθρακοειδὲς τυγχάνει, ὡς ἔστιν ἰδεῖν ἐπὶ τῆς ἐκλείψεως· ἀπάρας γὰρ ἀπ’ αὐτῆς τὸ οἰκεῖον φέγγος ὁ ἥλιος ἀμαυρὰν αὐτὴν καθίστησι· φωτίζων δὲ αὐτήν· πλησιφαῖ ἀπεργάζεται. [...] Τοῦ διαχωρίζειν ἀναμέσον τῆς ἡμέρας καὶ ἀναμέσον τῆς νυκτός. Οἷον τὸν ἥλιον τῆς ἡμέρας τοῖς μέτροις ἔταξε, καὶ τὴν σελήνην τῆς νυκτός. [...] Οὐ ποιεῖ δὲ τὴν ἡμέραν ὁ ἥλιος· μηδεὶς οὕτως ὑπολάβη· πρεσβυτερεῖ γὰρ τούτου ἡ ἡμέρα καὶ νύξ· ἀλλὰ κατάρχει μόνον τῆς ἡμέρας, καθὼς καὶ ὁ ψαλμωδὸς διαγορεύει ἡμῖν· Ἔθετο, λέγων, τὸν ἥλιον εἰς ἔξουσίαν τῆς ἡμέρας, τὴν σελήνην, καὶ τοὺς ἀστέρας εἰς ἔξουσίαν τῆς νυκτός.

their positions in the sky. Regarding the influence of the moon on these phenomena, including tides, he writes⁹:

“The moon, completing its cycle twelve times, also determines the year [An. which is artificially constructed], but it requires an intercalary month to achieve its exact duration. For the solar year, from the same point to the same point in the sun’s own motion, it is a restoration according to the sun’s proper movement. As the moon wanes, the bodies of animals become emaciated and hollow, but when it waxes, they fill up again. This is because moisture combined with warmth is secretly infused. Those who sleep under the moon’s influence are filled with excess moisture in their heads, as well as freshly slaughtered meats and anything of that sort; all these quickly undergo a change due to the moon’s influence. Similarly, atmospheric phenomena of such a nature originate from similar causes. When we have a new moon [An. Noumenia], and everything is calm, sudden winds arise, clouds start moving and thickening, and tides occur in narrow straits, causing fluctuations in the sea level in the oceans.” (Migne, 1857a).

So, according to Eustathius, the phenomenon of tides is a result of those atmospheric changes that are attributed to the influence of the moon.

3.1.2. Basil of Caesarea

Basil of Caesarea (330-379) was the bishop of Caesarea in Cappadocia, Asia Minor. He was one of the Three Hierarchs in the Greek Orthodox Church, considered patrons of education, and bestowed the title of “Great” by the Orthodox Church. He received advanced education in Caesarea where, according to Gregory of Nazianzus, “*he excelled in rhetoric and philosophy among the most accomplished*”. Following that, he spent 4.5 years in Athens, a center of Neoplatonic philosophy. There, he encountered Gregory and formed a close friendship (Nicolaidis, 2011: pp. 6-9).

He studied rhetoric, grammar, philosophy, astronomy, geometry, and medicine. Basil authored numerous works spanning dogmatic, ascetical, ethical, pedagogical areas, as well as speeches, letters, and a liturgy. His works have been compiled in their entirety by J.P. Migne in *Patrologia Graeca*, t. XXIX-XXXII.

The *Homilies on the Hexaemeron* are considered among the most significant works of Basil, dealing with cosmological interpretation and commentary on the first chapter of the Book of Genesis. They were possibly delivered shortly before

⁹Original in Greek: *Ἡ δὲ σελήνη, ἐπειδὴν δωδεκάκις τὸν ἑαυτῆς ἐκτελέσῃ δρόμον, ἐνιαυτοῦ τυγχάνει ποιητικῆ, πλὴν ὅτι (35) μηνὸς ἐμβολίουμ δεῖται πρὸς τὴν ἀκριβῆ τῶν ὥρῶν συνδρομῆν. Ὁ γὰρ ἡλιακὸς ἐνιαυτὸς ἀπὸ τοῦ αὐτοῦ σημείου ἐπὶ τὸ αὐτὸ σημεῖον κατὰ τὴν οἰκείαν κίνησιν τοῦ ἡλίου ἐστὶν ἀποκατάστασις. Τῆς δὲ σελήνης ληγούσης, ἀραιούται τῶν ζώων τὰ σώματα, καὶ πό-(40)κενα γίνεται· αὐξομένης δὲ, ἀναπληροῦται. Διότι ὑγρότητα μετὰ θερμότητος κεκραμμένην λεληθότως ἐνίσχιν· οἱ γὰρ καθεύδοντες ὑπὸ σελήνην ὑγρότητος περισσῆς πληροῦνται τὰς κεφαλὰς, καὶ τὰ νεοσφαγῆ δὲ τῶν κρεῶν, καὶ πᾶν εἴ τι τοιοῦτον, τῇ προσβολῇ τῆς (45) σελήνης ταχέως τρέπεται. Ὁμοίως δὲ καὶ τὰ περὶ τὸν ἀέρα πάθη τοιαύτης αἰτίας συνίσταται. Νομηνιας γὰρ ἐνστάσης, γαλήνης οὔσης σταθερᾶς, αἰφνιδίων ἀνέμων ταραχαὶ γίνονται τῶν νεφῶν κλονουμένων καὶ συμπιπτόντων ἀλλήλοις· καὶ γίνονται περὶ τοὺς εὐ-(50)ρίπους παλίρροιαί, καὶ περὶ τὸν ὠκεανὸν ἀναδρομὴ τῆς θαλάσσης.*

370 over the course of a week (with a speech each morning and afternoon), and they were transcribed by stenographers.

It is evident that Basil's effort is to logically establish the Christian understanding of the creation of the world, both in contrast and agreement with the natural philosophy of ancient Greece. He aims to persuade others of the truth of this unique cosmological system, which, of course, is based on the creation of the world *ex nihilo* and its perishable nature, in contrast to the Aristotelian tradition. Basil's argumentation is marked by a profound knowledge of the views of Greek philosophers (notably his use of Plato's *Timaeus*, Aristotle's treatises on natural philosophy, Poseidonius, and Plotinus), a reflection of his studies in Athens. He doesn't fail to observe that the narration was concise, intending to train and sharpen the minds of people, who, by using the few details, would discover the rest (Migne, 1857b).

In the Homily VI "*On the Creation of Luminaries*", Basil develops his views on the creation of the sun and the moon. His perspectives, based on the Genesis account, do not differ from those presented by Eustathius of Antioch, who preceded him chronologically by 30 years, and apparently from the collective body of ecclesiastical writers as well. This concerns the differentiation between day and night, light and fire, the reasons for the creation of these two celestial bodies, their relationship with day and night, and so on. In this Homily, he writes¹⁰ about the tides:

"11. On its variations depends also the condition of the air, as is proved by sudden disturbances which often come after the new moon, in the midst of a calm and of a stillness in the winds, to agitate the clouds and to hurl them against each other; as the flux and reflux in straits, and the ebb and flow of the ocean prove, so that those who live on its shores see it regularly following the revolutions of the moon. The waters of straits approach and retreat from one shore to the other during the different phases of the moon; but, when she is new, they have not an instant of rest, and move in perpetual swaying to and from, until the moon, reappearing, regulates their reflux. As to the Western sea, [1601] we see it in its ebb and flow now return into its bed, and now overflow, as the moon draws it back by her respiration and then, by her expiration, urges it to its own boundaries [1602]" (Migne, 1857b).

According to Basil, therefore, the lunar phases are the cause of tides.

The influence of Basil was highly significant in the years that followed, and his theological view on distinguishing between the study of the "Κτιστόν" (Crea-

¹⁰Original in Greek: "Καὶ τὰ περὶ τὸν ἀέρα δὲ πάθη ταῖς μεταβολαῖς ταύτης συνδιατίθεται, ὡς μαρτυροῦσιν ἡμῖν αἴ τε κατὰ τὴν νομηνιαὴν πολλακίς ἀπὸ γαλήνης καὶ νηνεμίας αἰφνίδιοι ταραχαί, νεφῶν κλονουμένων καὶ συμπιπτόντων ἀλλήλοις, καὶ αἱ περὶ τοὺς εὐρίπους παλirroιαί, καὶ ἡ περὶ τὸν λεγόμενον ὠκεανὸν ἄμπωτις, ἦν ταῖς περιόδοις τῆς σελήνης τεταγμένως ἐπομένην ἐξεῦρον οἱ προσοικοῦντες. Οἱ μὲν γὰρ εὐριποὶ μεταρρέουσιν ἐφ' ἑκάτερα κατὰ τὰ λοιπὰ σχήματα τῆς σελήνης· ἐν δὲ τῷ καιρῷ τῆς γενέσεως οὐδὲ τὸ βραχύτατον ἀτρεμοῦσιν, ἀλλ' ἐν σάλῳ καὶ ταλαντώσει διηγεκεῖ καθεστήκασιν, ἕως ἂν ἐκφανείσῃ πάλιν, ἀκολουθίαν τινὰ τῇ παλirroίᾳ παράσχηται. Ἡ δὲ ἐσπερία θάλασσα τὰς ἀμπώτεις ὑφίσταται, νῦν μὲν ὑπονοστοῦσα, πάλιν δὲ ἐπικλύζουσα, ὡπερ ἀναπνοαῖς τῆς σελήνης ὑφελκομένη πρὸς τὸ ὀπίσω, καὶ πάλιν ταῖς ἀπ' αὐτῆς ἐμπνοαῖς, εἰς τὸ οἰκίον μέτρον προωθουμένη".

tion) and the “Ἀκτιστον” (spiritual world), became dominant. Michael Glykas, a historian, chronicler, and poet of the 12th century (Hunger, 1997, vol. III: p. 26, 256), in his work *Bibliotheca Chronica* (Bekker, 1836) arguing on the size of the moon—a matter that concerned both Eustathius and Basil—refers to Basil’s discourse, acknowledging his authority, characterizing him as “great,” and restating his views on tides and winds:

*“So, from this cause, various conditions in the air are formed, as witnessed by us in the sudden disturbances of clouds during the new moon due to calmness and windlessness, when clouds are stirred up and collide with each other. Similarly, the euripus tides, as well as the tidal phenomenon known as ‘amphotis’ near the so-called Ocean, which, following the phases of the moon, the surrounding regions have discovered. These things, then, are perceived by Basil the Great, as he seeks to demonstrate the magnitude of these luminaries”*¹¹ (Bekker, 1836).

3.1.3. Nicholas Cabasilas

The Byzantine scholar Nicholas Cabasilas (14th c.) (Konstantakopoulou, 1996), in one of his letters attributes the tides to the gravitational pull caused by the moon’s force, which travels in a straight line along with its light¹². In the same letter, he provides an explanation for the formation of the rainbow, using an interpretation similar to those offered by Western optics much later, during the 17th century. Cabasilas conducted experiments on light refraction and the path of rays using a transparent sphere filled with water.

3.2. Terrestrial and Marine Phenomena

A dominant category of explanations for the phenomenon of tides is those related to geomorphology or the sea itself, including rivers. From Aristotle to the scholars of later Byzantium, the effort to explain the phenomenon based on the configuration of coasts, the slope of the sea level, or even the underwater sources and the inexplicable fluctuation of waters, constituted options that were more or less worth discussing.

Nicephoros Blemmydes

Nicephoros Blemmydes was a scholar, teacher, and monk. He was born in Constantinople in 1197 and died near Ephesus around 1272. He served as the official instructor at the imperial school in Nicaea, also teaching the future emperor Theodoros II Laskaris and the scholar and historian George Akropolites. Around 1248, he founded his own school at the Monastery of Lord

¹¹Original in Greek: “οὕτω μὲν οὖν ἐκ τῆς αἰτίας ταύτης καὶ τὰ κατὰ τὸν ἀέρα πάθη συνίστανται, ὡς μαρτυροῦσιν ἡμῖν αἱ κατὰ τὴν νομηγίαν πολλάκις ἀπὸ γαλήνης καὶ νηνεμίας αἰφνίδιοι ταραχαὶ τῶν νεφῶν κλονουμένων καὶ συμπιπτόντων ἀλλήλοις, αἱ περὶ τοὺς εὐρίπους τε παλῖρροιαί, καὶ ἡ περὶ τὸν λεγόμενον Ὠκεανὸν ἄμπωτις, ἣν ταῖς περιόδοις τῆς σελήνης τεταγμένως ἐπομένην (44) ἐξεῦρον οἱ προσοικοῦντες. ταῦτα μὲν οὖν καὶ ὁ μέγας διαλαμβάνει Βασίλειος, ἀποδείξει θέλων τῶν φωστήρων τούτων τὸ μέγεθος”.

¹²It was found among the works of Nicholas Cabasilas in the codex of the Monastery of Varlaam of Meteora, in Thessaly (Angelopoulos, 1970).

Christ-Who-Is in Emathia, near Ephesus, where he taught until his death. His work had a significant influence even up to the 19th century (Zografidis, 2011; Constantinides, 1982).

His principal texts, reflecting his profound scientific exploration, include *Introductory Synopsis of Books Two* (Migne, 1865) on natural philosophy, written after 1258, consisting of 32 chapters on natural phenomena, and *Concise Geography or Geographical Synopsis* (Spohn, 1818).

As we read in the *Introductory Synopsis of Books Two*, in the section “On the Sea”, Blemmydes supports the view of altitudinal difference¹³:

“γ. It appears that the sea flows through narrow places where there is sea on both sides. For wherever the sea gathers from the broad expanse of the sea into a narrow place, due to the land encompassing the sea being higher, in this case, it seems to reverse and flow elsewhere intermittently due to the water’s rocking back and forth here and there. The same occurs in an open sea; however, it’s unclear whether there is land on either side of it, near which this alternating flow of water would be apparent.”¹⁴

Also:

“δ. The sea also flows from its higher areas to the lower ones due to the abundance of rivers flowing from higher points into its elevated regions. Water naturally tends to flow and move from higher places to the concave ones. In the sea, there are both higher and more concave areas. However, no matter how the sea flows, the current always remains within itself and does not pour into another container, unlike rivers flowing into it. Therefore, the water of the sea is stationary, but it does not overflow.”¹⁵

3.3. Metaphysical (Supernatural) Interpretations

Nikon the “Metanoite”

Nikon (925-980), also known as Niketas, possibly of Armenian descent, was born in a village in Trebizond, Paphlagonia. He came from a prominent family in the region. His upbringing was shaped by “education and instruction in the Lord”.

At the age of 20, Nikon entered the Holy Monastery of Chrysopetra in the mountains of Pontus, where he embraced monasticism under the name Nikon. After 12 years, he traveled as a missionary to Crete, which had recently been li-

¹³“On the Sea”, sections γ and δ (Migne, 1865).

¹⁴Original in Greek: γ’. Φαίνεται δ ἡ θάλασσα ρέουσα κατὰ τοὺς στενοὺς τόπους, ὧν ἐκατέρωσε πλατεῖα θάλασσά ἐστιν. Ὅπου γὰρ ἂν ἐκ πλατέος πελάγους εἰς στενὸν ἢ θάλασσα συνάγεται ὑπὸ τῆς περιεχούσης τὸ πέλαγος γῆς ὑψηλοτέρας οὐσης, κατὰ τοῦτο φαίνεται καὶ μεταρρέουσα ἄλλοτ’ ἐπ’ ἄλλο μέρος διὰ τὸ ταλαντεύεσθαι τὸ ὕδωρ δεῦρο κάκεισε πολλάκις. Ὅ γίνεται μὲν καὶ ἐν τῇ ἀναπεπταμένη θαλάσσει· ἄδηλον δέ ἐστι, τῶ μὴ εἶναι τὴν αὐτῆς ἐκατέρωσε γῆν πλησίον, παρ’ ἣν ἀμείβουσα ἢ μεταρρῦσις ταύτης γνωρίζοιτ’ ἂν.

¹⁵Original in Greek: δ’. Πρὶ δ ἡ θάλασσα καὶ ἀπὸ τῶν ὑψηλοτέρων αὐτῆς ἐπὶ τὰ κοιλότερα διὰ τὸ πλῆθος τῶν εἰς τὰ ὑψηλότερα ταύτης ἐμβαλλόντων ποταμῶν· πέφυκε γὰρ τὸ ὕδωρ ἐκ τῶν ὑψηλοτέρων τόπων εἰς τὰ κοῖλα καταφέρεσθαι τε καὶ ρεῖν. Ἔστι δὲ καὶ κἀν τῇ θαλάσσει τὰ μὲν αὐτῆς ὑψηλότερα, τὰ δὲ κοιλότερα. Ὅπως δ ἂν ἡ θάλασσα ῥῆ, πάλιν ἐφ’ ἑαυτὴν ἔχει τὸ ρεῦμα, καὶ οὐ πρὸς ἄλλο δοχεῖον ἐμβάλλει, καθάπερ οἱ ποταμοὶ πρὸς αὐτήν. Διὰ τοῦτο καὶ στάσιμον ἐστὶ τὸ ὕδωρ τῆς θαλάσσης, ἀλλ’ οὐκ ἀπόρρυστον.

berated from the Arabs by Nicephoros Phocas. He was a preacher of the Gospel, with repentance as the central theme of his preaching. He repeatedly emphasized the phrase of John the Baptist, “*Repent, for the kingdom of heaven is near*”. This is why he was named “Metanoite” (in Greek: Μετανοείτε) meaning “Repent”.

We know about his life and work from the *Vita et miracula* (Life and Miracles) which exists in two versions, as well as from the Testament that has been preserved in vernacular translation.

Nikon, as mentioned in his *Vita et miracula* believes that the tides in the Euripus Strait are the result of mystical forces hidden within the waters. These forces symbolically move the waters seven times a day, resembling the creation of the world in seven days. Their purpose is to teach humans about the changeable and uncertain nature of life, which necessitates repentance. Specifically, he says:

“19. Taking leave from there, he arrives at Euboea, which they have metaphorically called Euripus from ancient times due to the constantly changing flow of the tide within it, which alternates and occurs seven times on each day and night, as they say. This symbolizes and teaches those capable of deep intellectual understanding, without deception and with truth, to perceive through their faculty of the mind, not simply and not as a mere occurrence, the ebbing and flowing of this sea wave’s tide, devoid of human effort or skill. Rather, there is a hidden power of mystery in this phenomenon, in which the fluid, unstable, uncertain, changeable, ever moving, and nothing entirely stationary or permanent is observed. This common characteristic of the weekly cycle, a thousand-year period of life, and life itself. For it seemed fitting to the skilled Craftsman, even in this instance, to grant insight not to those who merely chance upon it, but to those capable of continually embracing higher contemplations, elevating and directing all that is seen and perishable towards the heights of divine concepts and from the superior things”¹⁶ (Sullivan, 1987).

3.4. Simple References to the Tidal Phenomenon

References to tides were made by various scholars throughout the centuries, either as simple descriptions of the phenomenon or metaphorically to symbolize oscillating behaviors, customs, and perceptions. The avoidance of explaining the mechanism behind the phenomenon indicates that it was an unsolvable enigma, a mysterious nature that was difficult to fit within the framework of the percep-

¹⁶Original in Greek: 19. Απάρας οὖν ἐκείθεν, τὴν Εὐβοίαν καταλαμβάνει, ἣν δὴ καὶ (10) Εὐριπον κεκλήκασιν οἱ ἀνέκαθεν μεταφορικῶς ἀπὸ τῆς ἐν αὐτῇ τοῦ παλιρροῦ ροθίου συνεχοῦς μεταβολῆς, εἶτ’ οὖν μεταπτώσεως, ἐπτάκις γινομένης, ὡς λόγος ἐστίν, ἐφ’ ἐκάστῳ αἰὲ ἡμερονυκτίῳ, τοῦ συμβόλου δηλοῦντος, ὡς οἶμαι, καὶ διδάσκοντος τοὺς δυναμένους τῇ τοῦ νοῦς ἐπιστάσι τὸν λογισμὸν ἐμβαθύνειν ἀπλανῶς καὶ φιλαλήθως τεκμαί-(15)ρεσθαι, ὡς οὐχ ἀπλῶς οὕτω καὶ ὡς ἔτυχε συμβαίνειν σπουδῆς ἀνευ ἀνθρωπίνης καὶ τέχνης τὴν τοιαύτην τοῦ θαλαττίου κύματος παλίρροιαν, ἀλλὰ τινα δύναναι εἶναι μυστηρίου ἐγκεκρυμμένην τῷ πράγματι, ἐν ἧ θεωρεῖται τὸ βρεστὸν καὶ ἄστατον καὶ ἀβέβαιον καὶ εὐμετάβλητον καὶ μηδὲν ὄλως στάσιμον ἔχον ἢ μόνιμον, τῆς ἐβδομάδος ταυτησί χιλιοῦτα-(20)ετηρίδος ζωῆς ἅμα καὶ βιοτῆς. Ἐδοξε γὰρ τῷ τεχνίτῃ λόγῳ κἀν τούτῳ τῷ μέρει ὄνησιν οὐ τὴν τυχοῦσαν καρποῦσθαι τοὺς δυναμένους αἰὲ ταῖς ἀμείνοσι θεωρίαις προσκεῖσθαι καὶ ἀνάγειν διὰ παντὸς τὰ ὀρώμενα καὶ φθειρόμενα πρὸς ὕψος θεῖων νοημάτων καὶ ἐκ τῶν κρειπτόνων.

tions of natural philosophy during that long period. As a result, it became fertile ground for the development of pre-scientific representations and understandings. Furthermore, the recurring motion of the waters easily acquired metaphorical significance. We must not forget that for centuries, the erratic people were called “euripoi”. Illustratively, we present below such references that were identified during our research, dating back to the later Roman-Byzantine centuries.

3.4.1. Maximus of Tyre (2nd Century)

Maximus, who was a Platonist rhetorician and philosopher, metaphorically mentions in his work *Dialexeis* (33, 4, d4) comparing the tides to the sufferings of Tantalus:

*“And the riddle of Tantalus was this: an unending thirst of a pleasure-loving man, reaching for the delights of a stream and receding, and a tide of desires ebbing and flowing, and bitter sorrows mixed with these, and disturbances, and fears”*¹⁷ (Trapp, 1994).

3.4.2. Joannes Damascenus (676-749)

In the study *Sacra Parallela* by this Syrian monk and priest (Nicolaidis, 2011: pp. 246-249), we come across the following reference (Migne, 1864) regarding the tide, which is used to characterize the foolish and fickle individuals:

*“To those whose disposition is easily given to change, nothing is consistent, and life seems to them unordered. People are like clouds, moved by the shifts of the winds, carried at times to different parts of the sky. We consider those who are light and foolish to be those who are easily swayed in both directions, and who change course like gusts of wind falling, or variations, or the shifting tides of euripi, or the unsteady waves of the sea.”*¹⁸

3.4.3. Patriarch Photius A' (820-893)

Photius is considered one of the most significant scholars of the Byzantine period (Lemerle, 1985: pp. 154-183). He composed the work *Myriobiblos* or *Bibliotheca* (*Βιβλιοθήκη* or *Μυριόβιβλος*) (Ier & Bekker, 1824), a literary encyclopedia of critiques and excerpts from books written solely in Greek, covering authors from both classical antiquity and the early Byzantine period. It contains entries for 280 book titles (the 89th title is lost), resulting in the preservation of numerous important ancient texts by authors that had been forgotten during that era. These texts would have been lost without the Bibliotheca. In this work, Photius focuses solely on the content of the books he has read, without attempting to be comprehensive and systematic.

¹⁷Original in Greek: *Καὶ τὸ τοῦ Ταντάλου αἶνιγμα τοῦτο ἦν ἄρα δίψα διηνεκῆς ἀνδρὸς φιληδόνου, καὶ ἡδονῆς νάματα προσιόντα καὶ ἀπίοντα αὐθις, καὶ παλίρροια ἐπιθυμιῶν, καὶ λῦπαι πικραὶ ταύταις ἀνακεκραμέναι, καὶ ταραχαί, καὶ φόβοι.*

¹⁸Original in Greek: *Οἷς εὐκόλος πρὸς μεταβολὴν ἢ διανοία, τούτοις οὐδὲν ἀπεικὸς καὶ τὸν βίον εἶναι μὴ τετάγμενον. Ἄνθρωποι ταῖς νεφέλαις εἰκόασιν, πρὸς τὰς τῶν ἀνέμων μεταβολὰς, ἄλλοτε κατ' ἄλλο μέρος τοῦ ἀέρος ἐμφερομένους. (30) Κούφους καὶ ἀνοήτους, τούτους ὑπολαμβάνομεν, τοὺς ῥαδίως ἐπ' ἀμφοτέρα φερομένους, καὶ μεταρρέοντας, καθάπερ αὔρας μεταπιπτούσας, ἢ μεταβολὰς, ἢ παλίρροιας εὐρίπων, ἢ θαλάσσης ἀστάτου κύματα. (35)*

For the phenomenon of tides, Photius has included (Jer & Bekker, 1824) the following reference, noting that it is a continuous phenomenon, which, alongside fire, serves to demonstrate that the climatic differences observed on Earth are essentially the same and unchanging since the creation of the world. Verbatim¹⁹:

“If we were to say, as would anyone of sound judgment, that each region continues in its diversity of characteristics since the creation of the cosmos, and remains unchanged and undisturbed by the alterations of existence, neither ceasing the tides of the sea nor the fountains of fire, the distinctions between the climates of living creatures, nor the countless other differences, how could they claim that anything would come into being or be regulated without this; things which, having been exempt from their generation, how would they say that anything happens or is administered?” (Jer & Bekker, 1824).

3.4.4. Anna Comnena (1083-1153)

Anna Comnena, the female Byzantine scholar, daughter of Emperor Alexios Komnenos, is one of the most significant figures in the intellectual life of the empire during the 12th century. In her work *Alexias*, she mentions²⁰ (Kambylis & Reinsch, 2001):

“[...] Indeed, the most light-hearted customs, somehow, seem to have taken on a metaphorical journey akin to the ever-shifting tides of Euripus”.

4. Conclusion

This paper addresses a previously unexplored area in the current historiography of science in the Byzantine era by surveying and mapping the explanations given by Byzantine scholars for the phenomenon of tides. In this work we presented and commented on Byzantine scholars' perceptions of tides, revealing the intricate interplay between empirical, philosophical, and religious contexts.

Byzantine scholars' interpretations of tides rest on a bridge connecting the Aristotelian and the Christian cosmology. They attributed tides to lunar phases, terrestrial features, or metaphysical forces. Lunar phases were linked to tidal rhythms by Eustathius of Antioch and Basil of Caesarea, detailing lunar influence on atmospheric and oceanic patterns. Nicephoros Blemmydes gave prominence on geomorphic explanations while Nikon the “Metanoite” attributed mystical symbolism to tides.

In our analysis of the primary sources, we have observed that the views of Byzantine scholars on tides were reflecting the complex interaction between religion and natural philosophy which is apparent in the relevant literature which

¹⁹Original in Greek: ἄν ἡμεῖς εἶπομεν οὐτε ἕτερος εὖ φρονῶν, ἔτι δὲ εἰ κλίμα ἕκασον διαμένει μυρίαὶς ταῖς πρὸς ἄλληλα δια-30φοραῖς ἀπὸ καταβολῆς κτίσεως κοσμοῦμενον, καὶ ἀκίνητον ἀπ' αἰῶνος ἔσκηκεν ὑπὸ τῶν τῆς γενέσεως μεταβολῶν οὐδὲν βλαπτόμενον (οὔτε γὰρ παλίρροιαὶ θαλάσσης ἐπαύθησαν, οὐ πυρὸς ἄσβεστοι πηγαί, οὐ ζώων ἕκασον κλίματος διαφοραί, οὐ μυρίων ἄλλων ἑτερότητες ἀμετάβλητοι), τοσαύτων πραγμάτων τῆς παρ' αὐτοῖς γενέσεως ἀπηλλαγμένων πῶς οὐδὲν ἄνευ ταύτης οὔτε γίνεσθαι λέγουσιν οὔτε διοικεῖσθε;

²⁰Original in Greek: [...] Τὰ γὰρ τοι κορυφώτατα ἦθη εὐμετάφορα πάως καὶ Εὐρίπου δίκην ὡς ἐν παλιρροία περιπλαζόμενα.

we have studied. In fact, their explanations were influenced by Aristotelian natural philosophy and Christian theology elegantly situated on the available empirical observations of their era.

The diverse interpretations of tidal phenomenon, as revealed in the primary sources we have studied, highlight the rich tapestry of Byzantine thought and its efforts to comprehend the intricate workings of the natural world. Through their writings, these scholars contribute to a broader understanding of how Byzantines perceived and explained natural phenomena within the context of their cultural and intellectual milieu.

It is to our knowledge that further work is required in order to give a detailed and comprehensive analysis for the contribution of each individual scholar in the field of tidal understanding. However, we believe that our research task to fill the void in the current historiography of science concerning the scientific history of tides has been to a certain degree accomplished and at the same time the body of knowledge on Byzantine Science has been enriched.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Angelopoulos, A. A. (1970). *Nicholas Kabasilas Chamaetos. His Life and Work*. TPatriarchal Foundation for Patristic Studies. (In Greek)
- Bekker, I. (Ed.) (1836). *Michaelis Glycae Annales*. CSHB, Weber.
- Boissonade, J.-F. (Ed.) (1838). *Michael Psellus, De Operatione Daemonum*. Fr. Nap. Campe.
- Cartwright, D. E. (1999). *Tides: A Scientific History*. Cambridge University Press.
- Constantinides, C. N. (1982). *Higher Education in Byzantium in the Thirteenth and Early Fourteenth Centuries*. Cyprus Research Center.
- Diels, H. (Ed.) (1965). *Doxographi Graeci*. The Gruyter.
- Doundoulakis, E. (2006). *Saint Eustathius of Antioch, the Confessor*. PhD Dissertation, Aristotle University of Thessaloniki. (In Greek)
- Gaisford, T. (Ed.) (1834). *Suidae Lexicon, II*. E Typographeo Academico.
- Hunger, H. (1997). *Byzantine Literature, II and III*. National Bank of Greece Cultural Foundation. (In Greek)
- Ier, P., & Bekker, I. (Eds.) (1824). *Photii Bibliotheca*. G. Reimer.
- Kambylis, A., & Reinsch, D. R. (Eds.) (2001). Annae Comnenae Alexias. In *Corpus Fontium Historiae Byzantinae, Series Berolinensis XL/1*. De Gruyter.
<https://doi.org/10.1515/9783110881172>
- Katsiampoura, G. (2010a). Faith or Knowledge? Normative Relations between Religion and Science in Byzantine Textbooks. *Almagest, I*, 112-122.
<https://doi.org/10.1484/J.ALMA.3.7>
- Katsiampoura, G. (2010b). The Quadrivium of 1008 and Pachymeres' Syntagma: Comparing Two Byzantine Quadrivia. In L. del Corso, & O. Pecere (Eds.), *Libri di scuola e pratiche didattiche, dall'Antichità al Rinascimento, II* (pp. 409-424). Edizioni Univer-

sità di Cassino.

- Katsiampoura, G. (2018). The Relationship between Alchemy and Natural Philosophy in Byzantine Times. In E. Nicolaidis (Ed.), *Greek Alchemy from Late Antiquity to Early Modernity* (pp. 119-129). Turnhout: Brepols Publishers.
<https://doi.org/10.1484/M.DDA-EB.5.116315>
- Katsiampoura, G. (2021). Why the Byzantium? From the Point of View of Natural Philosophy and Sciences. *ICON, Journal on Byzantine Philosophy, 1*, 23-29. (In Greek)
- Katsiampoura, G. (2022). An Appraisal of the Current Status of Research on Byzantine Sciences. *Centaurus, 64*, 919-924. <https://doi.org/10.1484/J.CNT.5.133232>
- Konstantakopoulou, A. (1996). *Byzantine Thessaloniki*. University of Ioannina-Dodoni, Appendix 42. (In Greek)
- Lazaris, S. (2020). Introduction. In S. Lazaris (Ed.), *A Companion to Byzantine Science* (pp. 1-26). Brill. <https://doi.org/10.1163/9789004414617>
- Lemerle, P. (1985). *Byzantine Humanisme*. National Bank of Greece Cultural Foundation. (In Greek)
- Ljubarskij, J. N. (2004). *Michael Psellos: Personality and work*. Kanakis Editions. (In Greek)
- Migne, J. P. (Ed.) (1857a). *S.P.N. Eustathii Commentarius in Hexaemeron*. Patrologia Graeca XVIII, Migne.
- Migne, J. P. (Ed.) (1857b). *S.P.N. Basilii Homiliae in Hexaemeron*. Patrologia Graeca XXIX, Migne.
- Migne, J. P. (Ed.) (1864). *Johannes Damascenus Sacra Parallela*. Patrologia Graeca XCV, Migne.
- Migne, J. P. (Ed.) (1865). *Nicephori Blemmydae Opera Omnia*. Patrologia Graeca CXLII, Migne.
- Nicolaidis, E. (2011). *Science and Eastern Orthodoxy*. The John Hopkins University Press.
<https://doi.org/10.1353/book.11152>
- Renn, J. (2015). From the History of Science to the History of Knowledge—And Back. *Centaurus, 57*, 37-53. <https://doi.org/10.1111/1600-0498.12075>
- Sellers, R. V. (1928). *Eustathius of Antioch and His Place in the History of Christian Doctrine*. Cambridge University Press.
- Spohn, F. A. W. (Ed.) (1818). *Nicephori Blemmidae Duo Opuscula geographica*. Libraria Weidmannia.
- Sullivan, D. F. (Ed.) (1987). *The Life of Saint Nikon*. Hellenic College Press.
- Tihon, A. (2020). Conclusion. In S. Lazaris (Ed.), *A Companion to Byzantine Science* (pp. 496-501). Brill. https://doi.org/10.1163/9789004414617_016
- Trapp, M. B. (Ed.) (1994). *Maximus Tyrius Dissertations*. Teubner.
<https://doi.org/10.1515/9783110955613>
- Trizio, M. (2007). Byzantine Philosophy as a Contemporary Historiographical Project. *Recherches de Théologie et Philosophie Médiévales, 74*, 247-294.
<https://doi.org/10.2143/RTPM.74.1.2022841>
- Westerink, L. G. (Ed.) (1948). *Michael Psellus, De Omnifaria Doctrina*. J.B. Beijers.
- Zilsel, E. (1942). The Sociological Roots of Science. *The American Journal of Sociology, 47*, 544-562. <https://doi.org/10.1086/218962>
- Zografidis, G. (2011). Nikephoros Blemmydes. In H. Lagerlund (Ed.), *Encyclopedia of Medieval Philosophy* (pp. 892-895). Springer.
https://doi.org/10.1007/978-1-4020-9729-4_359