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**PHILOSOPHY OF NATURE  
OF ABU ALI IBN SINA:  
ANALYSIS OF THE CONCEPT OF  
MOVEMENT, SPACE AND TIME**



Sunatullo Jonboboev



## **Cultural Heritage and Humanities Unit's Research Paper #18**

### **Philosophy of Nature of Abu Ali ibn Sina: Analysis of the Concept of Movement, Space and Time**

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#### **Abstract:**

A scientific perception of the world in the present independent Tajikistan, and Central Asia in general, is more in demand than ever. Our intellectual heritage, including the views of Al-Khwarizmi, Ar-Razi, Al-Biruni, Abu Ali ibn Sina, and others, are a source of new inspiration and resource for addressing the many societal issues of post-Soviet communities, including the existing secular political system and scientific worldview, the emergence of fundamentalist and radical religious interpretations, depreciation of traditional values, existing poorly developed analytical thinking among youth and others.

The intellectual heritage of our ancestors from Central Asia and Iran has been used during the Reformation and the New Age by the societies and scholars of Western Europe, including Dante Alighieri, Albertus Magnus, W. Ockham, Thomas Aquinas, F. Bacon (inductive logic), G. Galileo (movement and rotation of Earth), and R. Descartes (the concept of "flying man"). This intellectual heritage also has been reinterpreted by thinkers of the twentieth century, even if indirectly, such as Einstein. The fruitful influence of Muslim culture on the development of modern civilization has long been known and studied in such works as G. Sarton's "Introduction to the History of Science", Henri Corbin's "History of Islamic Philosophy", W. M. Watt and many others. However, surprisingly our young compatriots today are indifferent toward this intellectual heritage. How can we fill the intellectual and spiritual gap in the minds of today's youths, who are holding shaking worldviews, some of whom are moving towards radicalism? How important is the actualization of the history of sciences and rationalism?

To address these concerns and others, we should refresh our mind and focus our analysis on selected works of Abu Ali ibn Sina concerning the philosophy of nature, namely the issues of motion, time, and space. Ibn Sina's theories generally are comparable to Aristotle's however, they are original in terms of putting forward new aspects of these theories, including the theory of plurality of worlds, the theory of movement, space and time, the concept of impetus (inertia), the relativity of time and space, the concept of eternity time and God, in the forms of the concepts of Dahr, Qadim, and Sarmad, the details of which will be shown and be discussed in this paper.

Modern generations of Central Asia can use such intellectual heritage and cultural capital (as an example) for the purpose of modern regional educational and scientific development.

**Keywords:** Abu Ali ibn Sina, natural philosophy, movement, space, time as a form of being, eternity or existence without beginning, eternity as coexistence, *Sarmad* (infinity), etc.

**About the author:**

Sunatullo Jonboboev is the candidate of philosophical sciences (1988); graduated from Tajik State University (1976) in the field of journalism and Tajik philology. Postgraduate studies were completed at the Institute of Philosophy of the Academy of Sciences, Tajik SSR (1980–1983).

Jonboboev's research is aimed at studying the history of the intellectual heritage of Central Asia, the history of Tajik and Muslim medieval thought, as well as the role of humanities in Central Asia space. Sunatullo has served as Senior Manager of the Faculty Development Programme under the Aga Khan Humanities Project (AKHP), a researcher at the Institute of Philosophy, taught philosophy at the Tajik Technical University, and worked as a researcher at the Institute of Muslim Civilizations at the Aga Khan University (UK) and at the Justus-Liebig-Universität Gießen (Germany). Currently, he is studying Eastern Peripatetics (Al-Farabi, Ibn Sina, etc.), the history of natural philosophy (Ar-Razi, Abu Reykhan Biruni), poetic philosophy (Rudaki, Omar Khayyam), and the pre-Islamic ideology of Central Asia. He published several books and monographs, a dissertation devoted to "Problems of universals in Eastern peripateticism", contributed to the three-volume *"History of Tajik Philosophy from Ancient Times to the 15th Century"* (in Russian language) and the five-volume *"History of Tajik Philosophy until the 20th Century"* (in Tajik language). He is the author of the monograph *"The Epistemology of Abu Ali ibn Sina (Avicenna)"*, dozen articles on the epistemology of education in Central Asia, the history of scientific and philosophical thought of the Tajiks.

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## Introduction

**Relevance of the topic.** Modern postmodernism and post-secularism challenge the existing paradigms of classical rationalism, pointing out their insufficient potentials and opportunities for a comprehensive knowledge of the world and reality around us. This may be true, and therefore, as a response to such a phenomenon, scientific paradigms change in certain eras. But have the possibilities of forms of rationalism been studied and analyzed to the end? Especially when it concerns the place of Reason in Islamic Middle Ages. It seems to us that the scientific picture of the world, and the development of the scientific worldview, even in its historical form, have not exhausted their possibilities, since the specific scientific perception of the world at the present stage of post-Soviet development, independent Tajik, as well as the entire Central Asian society, is more in demand than ever. Why today? We think that this is connected, on the one hand, with the revival of the religious perception of the world (*“religion is returning”*), and the fact that the religious approaches are gaining a strong position in the minds of millions of people in the East after crisis of one polar world, not only, but it is also connected with the crisis of the modern worldview, with the depreciation of traditional values associated with the choice of the education system and the emergence of new forms of scientific comprehension of the world. The study of intellectual heritage is also relevant because, according to contemporary intellectuals, including Edward Said (1935–2003), today most of the youth in Muslim countries have poorly developed analytical and critical thinking. And accordingly, therefore, they fall into the networks of religious extremists and, inspired by the ideas of anti-colonialism, literally perceive the propaganda of radical groups, joining the calls of jihadists. Moreover, all this is fueled by the financing of global transnational criminal companies, which for young people do have not the last place in life and in their system of values, especially after the collapse of the norms of the socialist system in our region. This process is also facilitated by the fact that in the modern world, the balance between secular and religious values is often disturbed, they are dichotomously opposed to each other’s.

What measures can be taken to counteract such alienation (G. W. F. Hegel, K. Marx), how to prevent the negative development of this process, the process of dehumanization? How to organize social life, as well as public consciousness, more intelligently, and use our cultural, scientific, and social resources, that is, social capital, for this? What lesson can the intellectual heritage of our ancestors give us, the views of such giants of thought as Abu Nasr Al-Farabi, Abu Rayhan Al-Biruni, Abu Ali ibn Sina (Avicenna), and others? What can be borrowed from them to fill the intellectual and spiritual gap in the minds of today’s youth? Can their call to Reason, to a deeper comprehension of the laws of the Universe, be heard and become useful? Can their scientific and philosophical thought help in solving the worldview problems of contemporaries? Why was the intellectual heritage of our ancestors used for centuries by the peoples of Western Europe during the Reformation and the New Age, was interpreted in a new way even by the thinkers of the twentieth century (for example, even indirectly, by Einstein), but unfairly ignored by our compatriots today? So, can this heritage become a source of new inspiration for the current generation in the way it has been for Europeans since the 13th–17th centuries. If we limit ourselves only to the influence of Ibn Sina, we can mention such European names, whose views he influenced, such as: Dante Alighieri, Albert of Cologne (Albertus Magnus),<sup>1</sup> V. Ockham, R. Bacon, Thomas Aquinas, Fr. Bacon (inductive logic) , G. Galilee,<sup>2</sup> R. Descartes

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1 Avicenna, Ibn Sina. By M. S. Asimi. // The UNESCOs Courier. October 1980. P. 8. See: Avicenna – UNESCO Digital Library. Time of reference: 10.12.2022.

2 Ibid. P. 8.

(cf., for example, the argument about the “flying man” of Ibn Sina and the statement “Cogito, ergo sum” – a philosophical statement made in Latin by Rene Descartes “I think, therefore I exist”, is a fundamental element of European rationalism). Such a fruitful influence of Muslim culture on the development of modern civilization has long been known, this phenomenon has been studied, including in the works of George Sarton “Introduction to the History of Science”, William Montgomery Watt “The Influence of Islam on Medieval Science”, Henri Corbin “History of Islamic Philosophy”) , Fazlur Rahman Malik, Nadir Birzi etc. But why is there such indifference towards this intellectual heritage on the part of our today’s compatriots? To somehow focus on these issues, we made the main subject of analysis the views of Abu Ali ibn Sina on the philosophy of nature, proposed in his natural science works, and specifically, the issues of motion, time, and space.

To put it simply, we are talking about the importance of cultural heritage as social capital and partly it uses for the sustainable development of society. Cultural capital, as it described by Pierre Bourdieu, in the forms of cultural goods (books, pictures, theories, machinery and equipment, representing the embodiment of theories or their criticism, under certain conditions can be converted into social and economic capital (40).<sup>3</sup>

**Background:** so, why this topic is important for modern Central Asia. First, the naturalistic view of our ancestors is important not just as a museum exhibition, but it is necessary for pragmatic purposes, for cultivation and the protecting scientific worldview of modern generation in Central Asia. We think that updating the intellectual and cultural heritage, particularly in the form of the history of science and philosophy, is incredibly important for modern Central Asian society. There is no doubt that all forms of human knowledge and the results achieved with their help as general forms of knowledge are important for the history of philosophy and science. As it was noted, most in demand in our days is the scientific perception of the world in the form of a crystallized scientific worldview, which, even in its historical form, puts a barrier to artificially created (politically motivated) modern ideologemes, myth-making and mythological consciousness (appearing in our region/country in the form of an exclusive approach of religious fundamentalism, which today claims a monopoly in the public mind). These mythologemes and ideologemes, gaining strength in times of crisis situations of history, sometimes divert people from the real, analytical, critical, and independent search for truth to the side of imaginary, collective, narrative knowledge.

The new publication of the eighth volume of the “Collections” of Abu Ali ibn Sina (Avicenna), which covers his physical and natural philosophical works, translated for the first time from Arabic into Russian and Tajik languages by a group of Arabic translators at the Center for Avicenna Studies of the Institute of Philosophy, Political Science and Law of NAST, can answer these and other topical questions of modern society indicated above. The publication is dedicated to the birthday of Avicenna, which falls on August 18.

Who was Avicenna? According to the sources, Abu Ali ibn Sina, a scientist-encyclopedist, was born in the village of Afshana near Bukhara in 980 in the family of a civil servant, an Ismaili Muslim. He studied with famous scientists of that time, reached a high level of education, was the court physician of the Emir of Bukhara, then worked at the Ma’mun Academy (“*Beit-ul-Hikmah*”, which was founded by the Khwarazm-Shah Abu-l-Abbas Mamun II in the XI century) in Khwarazm, but from where

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<sup>3</sup> Pierre Bourdieu. See: <http://bourdieu.name/bourdieu-forms-of-capital>. 28/09/23.

he was forced to flee from the persecution of Sultan Mahmud, the king of Ghazna (nowadays of Afghanistan) to the north-west of Iran, where he held high ministerial posts under the Buyid rulers, created a significant number of works in various branches of science of that time. He died in Hamadan (modern Iran) on the 18th of 1037 (the exact date of birth and death is unknown – it indicated the month of Shaban or Friday of the month of Ramadan, 428 lunar Hijri). His biography was written by himself and was supplemented by his disciple al-Jawzjani, has survived to this day.<sup>4</sup>

As it decided by scholars after the publication of this volume, the Center for Avicenna Studies invites the public to organize regular scientific Avicenna readings for various strata of society, with the aim of mastering and developing scientific heritage of Avicenna, and on this basis to develop the critical and analytical thinking of our young contemporaries. After all, the scientific and physical picture of the world, presented by Avicenna in the form of the philosophy of nature is original in many respects, and the ideas of natural science of Ibn Sina are instructive and topical for our society.

In this work, Avicenna, entering a covert polemic with his opponents, i.e., contemporary thinkers from other schools of thought, and theologians, even in the conditions of the then total domination of religious ideology and theology, comprehensively defends scientific and philosophical positions, explains physical phenomena, showing how the laws of nature operate based on the principle of causality. His position is outwardly close to the position of Aristotle, but it is original in terms of putting forward new approaches and new concepts and theories.



Physical picture of the world.<sup>5</sup>

The movement of his thought is more detailed and objective in explaining the theory of plurality of the worlds, in interpreting the natural philosophical theory of motion (movement), space and time, he discusses the concept of impetus (push-inertia) more widely, strictly adheres to the line of denying substantiality and supporting the relativity of time and space, he puts forward the concept of the eternity of time in the Absolute (God), develops the teachings about the concepts of *dahr*, *qadim*, *sarmad*, etc. All this characterizes the difference between the teachings of Ibn Sina and Aristotle. Even though some of these ideas belong to Aristotle, in the interpretation of Avicenna they are important for Islamic culture, since they affect the nature of infinity, which has a central position for Islamic culture in the form of a life-affirming idea of the eternity of God and the infinite worlds associated with him. An important point in Ibn Sina's theory of time is that, using individual arguments of the contemporary philosophy of the substantial nature of space and time, he rejects the theory altogether. At the same time, while defending his philosophical-rational goals, he denies both the subjectivism of theologians and the objectivism of his contemporary's philosophers, somehow demonstrated in the form of "realism" of ideas. As an important and extraordinary intellectual and cultural figure and personality, he managed to convey his thoughts to future generations through his numerous works (later they were reframed in Europe, just for example, by Jean Buridan into the doctrine of impetus,

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4 See: Abu Ali ibn Sina. Biography. // Abu Ali ibn Sina. Collections of works. Volume one. Dushanbe. "Danish". 2005, pp. 155–173 (in Russian); See also: My Odyssey. By Avicenna. // The UNESCO Courier. October 1980. P. 8. See: See: *Avicenna – UNESCO Digital Library*.

5 Physical picture of the world. Image from Internet: <https://ppt-online.org/458237>

and later in a different form and at a different level into the doctrine on the relativity of time and space by philosophers and physics, like Einstein, etc.). Avicenna, using the intellectual heritage of his ancestors, like Al-Khwarizmi, Al-Farabi, and his contemporaries, like Al-Biruni contributed to the change and development of Islamic thinking capacities, especially the way of analytical thinking and generally the culture itself.

The recently aggravated crisis at the global level of previously relatively stable socio-political systems, artificially created “organized chaos”, the spread of radicalism and religious extremism, and partly based on this the crisis of identity and the crisis of the scientific worldview in the Central Asian region encourages intellectuals and all thinking people and scientists involved in the study of the cultural and scientific heritage of the region. This is to ensure that, along with the development of effective strategic and practical measures to overcome existing difficulties, we turn to our intellectual capital, to the spiritual heritage of our ancestors, revealing new potentials and possibilities of Reason, the history of science and scientific and philosophical thinking in our search for ways to overcome these difficulties. The purpose of this study is to predict and explore how intellectual capital can be used in the modern development process, because with good will (at least) a new young generation can be inspired by a positive scientific and spiritual heritage.

In the modern world, there are different approaches and assessments to the intellectual heritage of the Eastern peoples; there are objective and subjective, there are also positive and negative. For example, some of them unilaterally declare religiosity, or epigonism. But it is known that the cultural history of the Muslim peoples, including Tajiks, Persians, and other peoples of Central Asia from the IX to the XI centuries, is characterized by researchers analogous to Western Europeans as the “*Muslim Renaissance*”. In this regard, W.U. Montgomery, a British Islamic scholar, condemns the bias of the French researcher Charles de Vaux for his controversial assessment of the contribution of Muslims to world culture, citing the statements of de Vaux, where he writes that “it is not necessary to seek among the Arabs “the genius of thought of the Greeks”, and allegedly that “the Arabs were only students of the Greeks.” Moreover, Montgomery emphasizes that de Vaux was eventually forced to recognize the scientific merits of the Arabs. In this regard, W.U. Montgomery writes “...however, he graciously completes the last phrase thus: indeed, the Arabs have made great strides in science. They taught the use of numbers (Arabic numerals – U.M.), although they did not invent them, and thus became the founders of modern arithmetic. They turned algebra into an exact science, significantly developing it, and laid the foundation for analytic geometry. They were undoubtedly the founders of planar and spherical trigonometry, which, strictly speaking, the Greeks did not have at all. In astronomy, they also made many valuable observations ...”<sup>6</sup>. Further, W. Montgomery names those Muslims, especially Central Asian scientists, who are known in the world for their great scientific discoveries. These are: al-Khwarizmi, whose name is associated with the invention of the algorithm (which comes to his name) and algebra (the title of his work is “*Al-Jabr*”), who created and presented a set of Indian and his own astronomical tables in “*Bayt-ul-hikmah*” – The Academy of al-Ma’mun (786–833), the Caliph of Baghdad (813–833), and who improved the geography of Ptolemy and for the first time proposed a ten-digit digital system to Muslim and world science. His works were based on Persian, Babylonian, and Indian astronomy, as well as on Indian and Greek mathematics; physicist and mathematician Al-Haytham (965–1051), known in Europe as Alhazen (Alhazen – born

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6 Watt W. M. The Influence of Islam on Medieval Europe. Edinburgh Univ. Press, 1972 // The Influence of Islam on Medieval Europe. Пер. с англ. Н. Терлецкого и М. Резван. – СПб.: Диля, 2011. – 192 с.; Мец А. Мусульманский ренессанс. Пер. нем. Д. Е. Бертеляса. – М.: ВиМ., 1996. – 538 с.

965-d.1039), is the father of the science of optics, who refuted the theory of Euclid and Ptolemy about the descent of a beam from the eye to objects, proving that on the contrary, the beam goes from the object to the eye; through this theory he came close to determining the density of the earth's atmosphere; al-Battani (Abu Abdullah Muhammad ibn Jabir-ibn Sinan ar-Rakki al-Harrani al-Sabi al-Battani (born in Harran in 858, died in Sammar in 929), who made more accurate observations of the celestial bodies (stars), developed methods for calculating spherical trigonometry, calculated solar year- his data almost completely coincide with modern calculations; other Muslims (al-Jabir and al-Batruḍi) also made great strides in spherical trigonometry. Great results, different from the Greek ones, were achieved by Muslims in the field of medicine, where Abu Bakr Muhammad Razi and Abu Ali ibn Sina (philosophers and scientists from Iran and Central Asia) succeeded. Avicenna's "The Canon of Medicine" dominated as a textbook in European universities until the 16th-17th centuries and went through dozens of publications in Europe.<sup>7</sup> With the invention of the printing press, "The Canon of Medicine" became the second largest print in Europe (after the Bible). It is not for nothing that Avicenna is still considered the founder or "Father" of Modern medicine. As noted earlier, his influence on European science and philosophy is undeniable.<sup>8</sup> This list could go on and on, ad infinitum.

But in this article, we restrict ourselves to the analysis of the scientific and philosophical heritage of Abu Ali ibn Sina (Avicenna), which is reflected in certain parts of his science of physics in the "Book of Healing" ("*Katab-ush-shifa*"), we will note in a brief form only his scientific achievements in the field of philosophy of nature. We confine ourselves to comments on questions of physics, mechanics (omitting even questions of geology, meteorology, etc.), which are included in his "Book on Physics" (the eighth volume of Avicenna's "Works").

In the study of the philosophical problems of movement, space, and time in modern Avicenna Studies and in the history of philosophy in general, a significant contribution was made by both domestic and foreign scholars such as A. Arberry, Watt W. M., A. M. Bahavaddinov, A. A. Semyonov, M. S. Asimi, Suheil Afnan, D. Gutas, M. Boltaev, M. Sagadeev, A. V. Dinorshoev, P. Muravvaj, H. Nasr, H. Korben, A. Mets, U. Sultonov, H. Dodikhudoev, M. Flanery, E. A. Frolova, B. Y. Shidfar, A. Komili, K. Olimov, F. Sirodzhev, Nadir-al-Berzi, N. Sayfullaev, S. A. Sultonzoda, F. I. Kalonzoda, S. Jonboboev, L. E. Goodman, L. Cardet, B. Brentjes, A. Bekboev and many others. In modern Tajikistan, a special contribution in the studies of problems of philosophy of physics belongs to M. Dinorshoev and A. Komili in "Physical views of Abu Ali ibn Sina (Avicenna)". The latter makes questions of physics and mechanics its focus of research, while problems of the philosophy of nature are discussed implicitly.<sup>9</sup> The historical-philosophical aspect is overlooked. For example, some important aspects of the Philosophy of space, time and movement in the teaching of Ibn Sina discussed in the dissertation of Faridun Kalonzoda.<sup>10</sup> We do not intend to retell what they all wrote, but we put problem of movement, space and time in broader cultural and intellectual context of natural philosophy of Avicenna, including its Islamic ideological context, using comparative studies, and directly turn to the original sources,

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7 Achievements of Muslims in science. See: Достижения мусульман в науке. См.: <https://history.wikireading.ru/326001>

8 Avicenna, Ibn Sina. By M. S. Asimi. // The UNESCOs Courier. October 1980. P. 8. See: *Avicenna – UNESCO Digital Library*.

9 Komili A. See: on several physical views of Avicenna, (in Russian) // Комили. А. См.: О некоторых физических взглядах Абу Али ибн Сины (Авиценны) (cyberleninka.ru). Sultonzoda S. A. Ibn Sina on the types of movement. Bulletin of the Institute of Philosophy, Political Science and Law of the NAST, 2020, No. 2, P. 56–64.; (Султонзода С. А. Ибн Сина о видах движения. Изв. Института философии, политологии и права НАНТ, 2020, №2, С. 56–64. in Russian). Время обращения: 20.02.23.

10 Kalonzoda F. I. The problem of movement, space and time in Ibn Sina's philosophical teachings. Dissertation abstract. Dushanbe. 2021. 47 p. // (Калонзода Ф. И. Масъалаи ҳаракат, фазо ва вақт дар таълимоти фалсафии Ибни Сино. Автореферат диссертации. Душанбе. 2021. 47 с.) (in Tajik). Время обращения: 20.02.23.

since there are gaps in the study of the heritage and teaching of the philosophy of nature of Ibn Sina, there are many unexplored and unresolved problems within these studies that are relevant to modern science and the history of science. This is evidenced by the published and still unpublished texts of his works devoted to the nature and phenomena of the material, natural world, i.e., in the “*Book of Physics*” (the book discussed here), as well as other works. First, let’s say a few words about the history of writing this book.



Photo of Avicenna.<sup>11</sup>

**The history of the book “Ash-Shefa” (The book of Healing).** The “Book of Healing” (“*Kitab-ash-Shifa*”) was created by Avicenna in 1020 in Hamadan (modern Iran) and completed in 1021 in Isfahan. About the time and reason for the creation of this masterpiece of scientific and philosophical thought, Abu Ubaid Abdul Wahid b. Muhammad Jawzjani, a student of Avicenna, writes in the continuation of his “*Biography*”. The topic concerns the book on physics (natural science). He reports that he asked the Teacher (i.e. ibn Sina) to write a commentary on the book of Aristotle. And Abu Ali ibn Sina in response put it this way:

“At present, I do not yet have free time to do this.” Then said: “If it satisfies you that I will write a book in which I include everything that I think is right (I can compose a book containing all the (rational) sciences (*ulumi aqli*) to the extent that they are described), without debating with opponents and not engaging in their refutation, then I will do it. I agreed, and he began to write a section of physics (“*Tabae*” – natural sciences) in a book, which he called “*Ash-Shefa*” (“*Book of Healing*”). By that time, he had already written the first book of the Canon (*The Canon of Medicine*).”<sup>12</sup>

<sup>11</sup> Photo of Avicenna (Авиценна), from Internet.

<sup>12</sup> Abu Ali ibn Sina. Collection of works. Vol.1. Dushanbe. “Donish”, 2005 (in Russian and Tajik). P. 165. A fact that M. Dinorshoev cites, and which is difficult to ignore: “*The Canon of Medical Science*” is a major work on medicine, written in 1013–1021. Avicenna's “*Canon of Medicine*” was translated into Latin back in the 12th century by Gerard of Cremona, and until the 17th century it was a textbook and desktop textbook in European universities. See: M. Dinorshoev. Commentary on the “*Biography of Ibn Sina*” // Abu Ali ibn Sina. Collection of works. Vol. 1. – P. 862.

Special attention should be paid to how Avicenna responds: “I am not going to engage in a debate with opponents, and I am not trying to refute them”! In this work, Ibn Sina, to put it in modern language, continues to apply the methodology of objectivist analysis of the scientific and philosophical heritage, as in his writings on logic. He excludes the subjective approach, does not focus on the mistakes and shortcomings of past thinkers, but tries to engage in an objective analysis of the content of the scientific and philosophical problems raised by them, especially the Philosophy of Nature. Therefore, according to Academician Muhammad Asimi, it becomes so problematic to raise the question of the originality of Avicenna’s teachings or his philosophical epigonism (fashionable accusations against him in European Oriental studies) (since, according to the generally accepted opinion, the problem of “plagiarism” did not exist in the Middle Ages, they quoted books from their own memory!).<sup>13</sup> So, Avicenna, apart from rare moments, does not criticize his First Teacher.

However, as he himself admits (including in this book), he consciously avoids subjectivism (so as not to distract the reader from the main subject of discussion), such is his method of research. We repeat that he writes about this in other of his works, for example, in logical works that we studied earlier. The fact is that, according to our observations, he compensates for what his predecessors lacked by filling in the gaps with his important reasoning and practical results.<sup>14</sup> In other words, Ibn Sina discusses problems on the facts, since he does not want to discuss the secondary topics and points. And if he quotes someone then, as we already mentioned, he usually does it only from memory! Moreover, proceeding from the considerations of Muslim ethics, he corrects his teacher without special criticism (without showing and announcing it all over the world!). However, it must be recognized that along with this, he strictly and reasonably rejects where necessary, the position of opponents of Aristotle and his own ideological opponents. The above approach is already given in the preface of academician Muhammad Asimi to the Tajik edition of the book (written back in Soviet times). He draws attention to the introductory part of the book “Reading about Nature” (“*Fanny samoi tabii*”), in the episode where Abu Ali Sina writes about the plan and purpose of his work “*Kitab-ash-Shifa*”:

“We decided to try to develop what was discovered before us and turn away from where we think the predecessors went wrong. We will also refrain from commenting on their books and the statements used by them...we have used here what we have discussed and benefited from in this short life, and (on this basis) we have created a collection called “*Kitab-ash-Shifa*”.”<sup>15</sup>

This fragment once again proves the originality of Avicenna’s thoughts, his personal contribution to the development of the proposed topics of natural philosophy. Returning to the question of the time of writing this work, we note that Muhammad Asimi, based on an analysis of the biography of Ibn Sina, mentions that Avicenna began this work when he was in the house of his friend Abu Ghalib Attar, when he was hiding from the persecution of Emir Shams-ud-davla, the ruler of Hamadan, and the whole book was written by him from memory. But unfortunately, he did not manage to complete the sections on logic and other parts, since he was arrested and imprisoned in the Farajon prison.

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13 Grunebaum G. G. *Classic Islam*. M. Nauka. 1970, 1986. 216 p. // Гронебаум Г. Г. *Классический ислам*. – М. Наука. 1970, 1986. – 216 с.

14 Jonboboev S. *Epistemology of Abu Ali ibn Sian (Avicenna)*. Bishkek, 2020, 200p. // Джонбобоев С. *Эпистемология Абу Али ибн Сины (Авиценны): движение мысли от иллюзии к истине*. – Бишкек. УЦА, 2022. – 200 с.

15 Abu Ali ibn Sina. *Discussion on Nature/Fanni Samoi Tabii*. // Асими М. *Китоб-уш-шифо-и Абуали Сино. Абу Али ибн Сина. Самон табии (на тадж. яз.) // Абуали ибн Сино. Осори мунтахаб. (Иборат аз дах чилд)*. Чилди 3. Душанбе. “Ирфон”, 1985. (Академияи фанҳои РСС Тоҷикистон. Шӯъбаи фалсафа). 448 с. – С. 6.

Fortunately, he was soon released by Ala-ud-davla, the emir of Isfahan, and was taken to this city. There he completes all other parts of the book, i.e., logic, arithmetic, geometry, and music.<sup>16</sup>

So, let's digress from particulars and find out what constitutes the natural science works that are part of the "Book of Healing" by Abu Ali ibn Sina and what place they occupy in the structure of the scientific and philosophical encyclopedia of Abu Ali ibn Sina? In this case, we need to pay attention to the medieval version of the theory of classification of sciences, presented by Al-Khwarizmi, al-Farabi and Avicenna. According to the accepted Avicenna theory of the classification of sciences (in all likelihood, following the theories of the Ikhwan-us-Safa (school of "Brothers of Purity") and Abu Nasr al-Farabi (developed in «*Ihso ul-ulum*»), Avicenna divides all sciences into four parts and therefore his "The book of healing" («*Kitab-ash-Shifa*») consists of four parts: 1. "Logic" (Mantiq), 2. "Nature" or natural sciences (Tabiyyot), 3. Educational sciences or "Ta'limiyot" (mathematics, geometry, music, similar to "Ikhvan-us-safa"), 4. Metaphysics ("Ilahiyot"). What is the similarity and difference between Avicenna's theory of classification of sciences and the congenial theory presented by the "Ikhwan-us-safa" ("Brothers of Purity")? Why is music located in mathematical sciences? Definitely because of its metric and harmonic nature. Although as R. Nazariyev writes about the relationship of natural sciences and philosophical sciences in the treatises (Rasail) "Ikhvan-us-safa", the inclusion of music in the mathematical sciences was not an innovation for the Eastern Middle Ages:

"Even before the authors of the treatises (Rasail) "Ikhvan-us-safa", al-Kindi, who had deeply studied the works of Aristotle, used exactly the same gradation of sciences and unequivocally singled out four mathematical sciences, namely arithmetic, geometry, astronomy and music, which constitute the so-called "Pythagorean quadrivium". In turn, the Pythagorean idea of these four mathematical sciences, as a prerequisite for any other research, was subsequently approved in the West by such great authorities as Nicomachus of Geras, Boethius, and Isidore of Seville».<sup>17</sup>

The issues of music are developed in more detail in the works of the Sogdian Abu Nasr al-Farabi, who analyzes music in detail, on the example of Persian music in the "Big Book of Music" (Kitabi musikii kabir), discusses musical instruments in Persian (*rud, shahrud*, etc.). In the books of al-Farabi and Abu Ali ibn Sina, the problems of phonetics, linguistics, the relationship between language and thought (logic) are also analyzed in detail, sections of logic are studied. But we should go back to the book about physics. Based on the content of the works of Abu Ali ibn Sina, and the theory of classification of sciences presented by him in the "Book of Healing", we can conclude that in the section "Natural Sciences" (Physics or Tabiyyat), three works of the thinker are important: 1) "Reading about nature" ("Samoi tabii"), 2) "The Universe and the World" ("Asmanu Jahan") and 3) "The rise and fall", or the "Emergence and death" ("Kavn va fasad"). Moreover, other sciences from the field of natural science are also indicated in this plan, such as "The State of the Universe" ("Akhwal-ul-Kainot"), the *Book of the Soul* ("Kitab-un-nafs"), the *Book of Plants* or "an-Nabat", *The Book of Animals* (Al-Khaiwan). Except for "Akhwal-ul-Kainat" (can be translated as the "Condition of Cosmos"), which, along with the twenty-volume book "Kitab-ul-Insaf", is still inaccessible or not found, all these works are being

16 Muhammad Asimi. The book of "Ash-Shifa" of Ibn Sina // Асими М. Китоб-уш-шифо-и Абуали Сино. // Абуали ибн Сино. Осори мунтахаб. (Иборат аз дах ҷилд). Ҷилди 3. Душанбе. "Ирфон", 1985. Там же.

17 Nazariyev R. Colorations of Science and Humanities in Philosophy of "Ikhwan us Safa" // Назариев Р. Соотношение естественных и гуманитарных наук в философии "Ихван ас-сафа". См.: [https://otherreferats.allbest.ru/philosophy/01056530\\_0.html](https://otherreferats.allbest.ru/philosophy/01056530_0.html). Там же.

prepared for publication at the Center for Avicenna Studies and will be released as a separate volume. Abu Ali ibn Sina in the “Book of Healing”, in addition to mathematical sciences, geometry, pays great attention to astronomy and its various sections. He, like *Ikhvan us-safa*, devotes separate treatises to astronomy. So, in the messages of “*Ikhvan-us-safa*” astronomy is developed from the following angle:

“They divide astronomy into three areas: 1) the knowledge of the celestial spheres, the number of stars, the Zodiac constellations (galaxy), their coordinates, magnitudes, movements, and everything connected with this; 2) knowledge of solutions in the astronomical Calendar (*zij*) regarding the dating of time and other issues related to it; 3) knowledge of ways to prove the rotation of the celestial spheres, the ascent of the constellations and the movements of stars under the sphere of the Moon. Modern astronomy is also divided into three similar directions, which are not much different from their interpretation of “*Ikhwan as-Safa*”.<sup>18</sup>

The astronomical views of Ibn Sina have both similarities with the above proposed interpretations of astronomy, and some significant differences. In sum, in the interpretation of mathematical questions and problems of music, Avicenna is close to the positions of Pythagoras, in astronomy he develops the ideas of Ptolemy, and in geometry he remains true to the ideas of Euclid. Being so devoted to Aristotle, he does not sharply and comprehensively criticize the Ptolemaic geocentric system of the celestial world, does not in any way touch upon the heliocentric theory, at least in the same form as Abu Reihan al-Beruni, citing examples of the heliocentric concepts of the ancient Indians, for example, Aryabhata.<sup>19</sup> But since the questions of astronomy and geometry are developed by Avicenna in other books (*Kitab ul-Hayat* and “*Kitab al-Khandasa*”), which will be published as a separate volume, and are, therefore, not considered here.

**Summary of Avicenna’s book on Physics (Natural Science).** Let us touch here briefly on some of the content of the works of the eighth volume of “Works” of Abu Ali ibn Sina. As it already mentioned the book includes his philosophical and natural science works (called “*Tabiiyyot*”, i.e. “Physics”), which reflect his philosophical and metaphysical views and understanding of the physical and philosophical nature of the world, of the Universe, of matter and form, of the substantial and accidental, of movement and its varieties, of the connection of movement with space (*makan*) or place and time (*zaman*), of the continuity of movement, space (place) and time, of the interaction of movement and rest (*harakat va sukun*), the nonexistence of the movement during particular time, of the divisions or the periods of time, of “indivisible particles-atoms”, of natural, meteorological and atmospheric phenomena, of beings as such, about the sea (seas), of the heavens, of the astral world and of the Universe as a whole, etc.

As it is already mentioned at the beginning of this work we can preliminarily convey the thought that the scientific picture of the world proposed here, and presented by Avicenna in the form of a philosophy of nature, is outwardly close to the positions of Aristotle, but it is original in terms of putting forward new concepts and theories, such as the detailed theory of plurality of the worlds, the

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18 Ibid.

19 Jonboboiev S. Abu Reyhan Beruni// Jonboboiev S. Aburaikhan Beruni. In: History of Tajik Philosophy (from ancient times to the 15th century). T. 2. Dushanbe. 2012 // Джонбобоев С. Абурайхан Беруни. В кн.: История таджикской философии (с древнейших времен до XV в.). Т. 2. Душанбе. 2012; Aryabhata) (476 – c. 550), Aryabhata, Indian astronomer, and mathematician. He found a very accurate value of the number “pi” (3.1416) and introduced the function  $(1 - \cos x)$  into trigonometry. The scientist conjectured that the rotation of the heavens is only apparent and is a consequence of the rotation of the Earth around its axis.

interpreting of the theories of motion, space and time; as the concept of impetus (push of inertia), as the concept of denying substantiality and supporting the relativity of time and space, the discussion on the concept of the eternity of time in God, the concept of *dahr*, *kadim*, *sarmad*, etc. characterize his difference from Aristotle, by the fact that they have importance for him and for Islamic culture, affecting the nature of infinity, which has a central position for Islamic culture. In sum even teaching, studying and freely developing philosophy and sciences during so called “the monopoly of religious worldview” and “religious ideology” was itself heroism of the intellectuals, great progress, and achievement of Muslim societies at that time of human history.

Now, to observe the real object, the essence and content of Abu Ali ibn Sina’s physics, let’s turn to its content in his book on Physics. The first article of Avicenna’s book of physics includes his reasoning about the causes and principles of physics, discusses a range of problems, of which there are fifteen, namely: about first principles of determining the path by which one can come to the science of natural things; about the enumeration of the general principles of natural things, specifically what these general principles might be. The content of what Parmenides and Melissus said about the principles of being and about the definition of nature is discussed. The following part is a discussion of the relation of nature to matter, form and motion. About how physical science conducts research and about the commonalities with other sciences. Further parts are devoted to the determination of the causes that are of the greatest interest in physics and in its study. Next, on the definition of classes of causes from among the four causes. About relationships between causes. On the division of states of causes. About mentioning luck and chances (*удачи и шансов*), the difference between them and explaining their true state. About the refutation of the arguments of those who were mistaken about chance and luck. On the state of causes in the study and the search for an answer to the question “why?”.<sup>20</sup>

Note that this is just the content of the first article of the book “*Samai Tabii*,” i.e., the “Readings on Nature”, on nature, causes and causality. But the book also includes other articles that touch on other aspects of physics. For example, the second article is about movement, place, and time, about the features of these phenomena. Arguments are given in favor of the refutation of emptiness, about the finiteness and infinite nature of bodies, about motion and rest, about a natural place, about the fact that every natural body has a source of motion in position and at rest, about accidental motion, about forced motion, about the state of the causes of the engine, etc. This book on physics contains other sections of physics, in addition, other works of Abu Ali ibn Sina are devoted to physics. This work is called as “*Osmon va Jahon*” (“Heaven and the world or the Universe”). In this work, Avicenna discusses the problem of the movement of stars, raises the question of whether the stars themselves sources of light and heat are, or whether they only reflect sunlight, like the Moon, also Ibn Sina raises the question of the center of the heavenly world. At the end of this section of work, an opinion is put forward about the unity and plurality of the worlds. Let us start with the meaning of the notion of “nature”.

### 1. What is “Nature” According to Avicenna?

A remarkable point in the interpretation of the physical world of Avicenna is that he connects the existence of nature with the phenomenon of causality. But first, he poses and answers the question: what is nature (*табоеъ*) in general? According to the thinker, the corporeal world, changes, and

20 Abu Ali ibn Sina (Avicenna). Collections. Vol. 8. «Danish, Dushanbe, 2023 // Абу Али ибн Сина. Сочинения. Т.8. Издательство «Дониш». 2023. – 791 с. (The manuscript is at the stage of publication at the Center for Avicenna Studies of the Institute of Philosophy, Political Science and Law of National Academy of Science, Dushanbe. 2023. 791 pp. – pp. 3–4. (in Russian).

transformations of bodies constitute the very nature of the physical world, and all transformations occur based on the existence of a force hidden in a particular body. Such physical force is called by Ibn Sina the “*nature of the body*”, but the key to the study of the corporeal world and the universe is the study of the cause, as well as the discovery of the causes of other causes behind them. On the basis of the known, a person begins to study hitherto unknown laws, their action or inaction. Proceeding from the recognition of the existence of causality, Avicenna emphasizes that the action of natural things depends entirely on the existence of general and partial causes.

Along with causality, the subject of Abu Ali ibn Sina’s natural philosophy is the relationship between matter and form. He also discusses the foundations and causes of the emergence, change, transformation, movement and rest, space and time, the problems of finiteness and infinity, organization and disorganization, divisibility and indivisibility of body parts. Ibn Sina points out that the causes of movement can come from within, but they can also arise from outside. If the cause of the movement is from outside, the body is subjected to an external force, and when this dominant force is eliminated, it continues to move towards its natural place. As a result, the bodies that move upwards based on their natural motion are called light bodies (“*jismhoi sabuk*”) and those that move downwards are called heavy bodies (“*jismhoi saqil*”). In this regard, Ibn Sina discusses the problem of nature with the ancient Greek philosophers Melissas (*Molissus*)<sup>21</sup>, Parmenides (*Barmonidus*), touching on their views on the problems of the fundamental principle of the world, and expresses the following characteristics of nature: firstly, for Ibn Sina, “nature is a force in body, which gives the body an image and structure, it is the root cause of the movement and regulation of the body, in which nature exists substantially, and not accidentally.”<sup>22</sup> They contrasted the sensual world (objects and phenomena of a material nature) with the “Being” as such (which, according to their teaching, included the concepts of God, the universe, nature). Being as such is immovable, because movement implies emptiness, which is “nothing”. Since “nothing” cannot exist, the movement of “Being” is also impossible. Aristotle pointed out the contradictions in the teachings of Melissa. For example, if “Being” is devoid of corporality or sensory data, then this contradicts the perception of “Being” as God (as well as matter or as nature). Avicenna defines “Nature” as the force in the body.

The thinker (ibn Sina) defines nature in this way: “Nature is a force that causes movement and change in the body, or the body acquires stability in it, coming from its essence (“being”).” It is important to note that Ibn Sina discusses the question of nature in connection with form: “Form is the essence by which the body is what it is.” He writes that the body becomes perfect at that moment if, when it arises, it acquires some form. Showing the relationship and difference between nature and form, he writes that “nature is sometimes the form of things, and sometimes not.” Further, Avicenna defines the relationship between the natural sciences and the four varieties of causes – i.e., material, formal, active, and final. Thus, Abu Ali ibn Sina uses the concept of nature mainly in 3 meanings: firstly, in the meaning of force and form (as a formative basis), secondly, in the sense of substance (i.e., as a basis for things), from which something is created, and, thirdly, the essence of things is called nature (i.e., they constitute the meaning of things).<sup>23</sup>

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21 Meliss from Samos is an ancient Greek thinker of the 5th century BC, a representative of the Eleatic school, a follower of Parmenides and Heraclid. In his teaching, he contrasted the sensual world with the “existing” (being). The sensory world includes objects that we can perceive with the help of hearing, vision, tactile and other types of sensitivity. Existence is eternal, infinite, immovable and one. By “existing” one can understand God, the universe and nature. Melissa's conclusion that “existing” is motionless, since movement implies the presence of emptiness, which is “nothing”, influenced the emergence of atomism.

22 Abu Ali ibn Sina. Works. Volume 8. Physics. (manuscript). – p. 527

23 Ibid, p. 14.

## 2. The Concept of Multiplicity of the Worlds (Macroworld)

This concept arose based on criticism of the ancient Greek geocentric system, and the dispute around it has been going on since the ancient time, i.e., from antiquity (in the teachings of Democritus), in the Middle Ages and continues to this day. Note that such debates also took place between Ibn Sina and Abu Raihan Biruni in their famous “Correspondence”. During the discussion on this topic, Avicenna argues against the theory of multiplicity of the worlds, but he does not completely reject this concept, but does not support it either based on the logic and physics of Aristotle, while Abu Raihan firmly expressed his sympathy for this concept. We abstract from a detailed discussion of the position of Abu Raihan Biruni in this article, because this topic is discussed by us in another work. But shortly, Abu Ali ibn Sina writes:

“We do not deny the multitude of bodies having a circular motion; it is necessary that this world be the last for a multitude of bodies having a circular motion. The world is finite, and this inevitable body is the last of the bodies, and its totality is between the middle, and that body is the integrity of the world, and there is no body outside it, and there is no corporeal matter since matter does not exist without form. Therefore, matter does not exist outside of form, and is presented as the form of the world”.<sup>24</sup>

Avicenna connects the integrity (целостность) of the world with the existence of matter and form, that the world is the last, final, that there is no body outside of it. And based on this, he concludes that the possibility of the existence of many worlds is excluded. Continuing this question, he further writes:

“Therefore, the form of the world is specially associated with one matter, and from both limited things arise in one world, and there is no possibility of the existence of many worlds. Consequently, the world is one, it is perfect, and categories of simple natures arise in it, the existence of which is possible. Circular and rectilinear motions continuously continue in its space, and in it the emergence and addition of things takes place. The Creator of this world, in accordance with his wisdom, brings this one world to the necessary perfection, according to the possibility inherent in the nature of the existence of the world, without the need to make the multiple worlds ...”.<sup>25</sup>

Thus, according to Avicenna, the world is one and finite, and the existence of many worlds is impossible. Simultaneously with this statement, he recognizes the knowability of the world. The creator of the world brings this single world to perfection. But the question arises: who is aware of the creator’s plans? This is yet to be known to all. Let us briefly note that Abu Raihan, unlike Avicenna, firmly stands on his own view: there are not one, but many worlds. In his work “*al-Āthār al-bāqiya*” (الأثار الباقية عن القرون الخالية) “*Chronology of Ancient Nations*” or “*The Remaining Signs of Past Centuries*,” Biruni writes: People cannot comprehend them (many worlds) due to the weakness of their cognitive abilities (as the blind cannot see what the sighted sees!). Avicenna (according to his correspondence with Biruni) can agree with him only if, even if we admit the existence of many

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24 Abu Ali ibn Sina. Works. Volume eight. Physics. (in Russian, manuscript). – P. 14. // Абу Али ибн Сина. Сочинения. Том восьмой. Физика. (на русском, рукопись). – P. 14.

25 Ibid.

worlds, they must have unity in essence.<sup>26</sup> This theory about the multi-world system of the Universe is supported in Europe by Giordano Bruno in the 16th century. The theory of the non-geocentric world also made it possible to overcome the geocentric system of Copernicus.<sup>27</sup> According to Herschel, it turned out that the Sun is just one of the stars of the Galaxy system, and according to the Hubble theory, the Galaxy and Metagalaxy are also not such central systems, but themselves exist in the system of many Metagalaxies. So, they also lose their privileged position – the world is endless.<sup>28</sup>

The section of physics and the treatise **“Creation and Destruction”** (Возникновение и уничтожение) cover a significant number of problems, in particular, about the emergence of things and objects, about changes in general, quantitative and qualitative changes, about the four elements, whether everything arises from moisture (like from sperm), or from qualities connected with fire, etc., about the suffering of objects from each other (there is between them “attraction”, craving, something similar to love, apparently later identified as gravity), about growth and development, etc., as well as a treatise **“On action and suffering”** (Fe’l va Infi’ol) (on the state of soil, water, seas, rivers, lakes, atmospheric phenomena, etc.). We are not going to give a description of all or each of these sections, but we will dwell only on some of the dominant problems and ideas of this book that are important from our point of view re the philosophy of nature.

Now let us start discussing his teaching on philosophy of nature in a concise form and this will open the field for further discussions. We prefer to start our intellectual journey with Avicenna’s description and analysis of the problems of nature in general, the divisibility and indivisibility of bodies (into atoms), and then we will proceed to the analysis of the forms of motion, space and time, since all these problems are connected with an understanding of his philosophy of nature and are included in the orbit of the philosophical problems of physics in the past, in the Middle Ages, and also in ontology as a part of philosophy of our time.

### 3. Problems of Indivisible Particles (Atoms) – Microworld

The connection between motion and “emptiness” in ancient Greek philosophy led to the studies of atoms (gr. a-tom – indivisible particles). In ancient times, questions related to clarifying the foundation of the world, that is, on what it rests and from what fundamental principles or “bricks” this existing world consists, were of exceptional importance. Historians of science and philosophy were aware of the pluralism of opinions on this issue even in the Middle Ages, when the version officially supported by religious authorities was “creation of the world out of nothing” – ex nihilo (differently by God). Some philosophers considered atoms (indivisible particles) to be such bricks (building blocks). Atomism was one of such widely known theories in medieval philosophical discourse, regardless of whether it came from the Indian teaching of the *vaiśeṣika*, the teaching of paramania ((Sank., anu, paramania – the thinnest, smallest, the idea of a unitary atom) in Jainism according to which in one point in space there can be a large number of “paramania”, light rays, and that an impenetrable

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26 Jonbobobev S. Abu Reyhan Biruni – the founder of the scientific revolution in Central Asia and Iran // Materials of the international scientific and theoretical conference “Abu Reykhan Biruni – the great thinker of the East.” National Museum of Tajikistan and UNESCO. Time of circulation: 02/10/22. Dushanbe. 2022. – S. 105–108. (in Tajik) // Джонбобоев С. Абу Рейхан Беруни – основатель научной революции в Центральной Азии и Иране // Материалы международной научно-теоретической конференции “Абу Рейхан Беруни – великий мыслитель Востока”. Душанбе. 2022. – С. 105–108. (на тадж. языке.).

27 Bruno D. On Infinity, the Universe, and Worlds. (in Russian), Translated from Italian. M., 1936 259 p. // Бруно Д. О бесконечности, вселенной и мирах. Пер. с итал. – М., 1936. – 259 с.

28 See: Plurality of Worlds ([www.iphib.ru](http://www.iphib.ru)). Time of reference: 02/10/23 // См.: Множественность миров ([iphib.ru](http://iphib.ru)). Время обращения: 10.02.23.

paramania is able to cross the universe up and down in an instant<sup>29</sup> or was based on the discussions of Democritus and Leucippus.

Some researchers of the scientific and philosophical thought of the Muslim East, for example, the famous Russian philosopher A.V. Smirnov, are of the opinion that since we do not yet have direct evidence that Muslim thinkers borrowed atomism from the ancient Greeks, we must agree with the fact that atomistic teaching in the form that they propose to be the invention of the Muslims themselves in the Middle Ages. Based on the critical attitude of Muslims (especially representatives of Kalam) to ancient teachings, including the ancient Greek philosophical heritage, this is to some extent possible. But, on the other hand, it is difficult to disagree with G.O. Wolfson, with the fact that he writes that the “*al-javhar*,” used in Arabic, expresses the essence, i.e. atoms, from which all things arise, this is what Aristotle writes when discussing the atomistics of Democritus.<sup>30</sup> And Aristotle was the most popular author among Muslim intellectuals. True, the Arabic word “*javkhar*” “was originally borrowed from the Middle Persian (Pahlavi) as “*gawhar*” that is, the basis or foundation. It is also difficult to agree with the statement about the non-Greek origin of atomism because such concepts as “*la yatajazza*” (...) and “*la yankasim*” (...) seem to be a direct Arabic translation of the idea of indivisible particles (Greek “*atom*”)<sup>31</sup>. Especially if Muslim thinkers such as Ibn Hazm, al-Shahristani, Fakhruddin Razi, and the Jewish scholar Musa Maimonides testify to this.<sup>32</sup>

Yes, indeed, such a teaching also existed in India, and the Muslims were in close interaction with the Hindus (numbers, algorithm, mathematics of Al-Khwarizmi for example). Even Muslim theologians became interested in atomism, moreover, if this doctrine was rejected by the Greeks (Plato, Aristotle), it was accepted by all early Mutakallimuns, except for some Mutazilites (for example, an-Nizam, etc.). The necessity of this doctrine for Muslim philosophers, in particular, Mutakallims, was to refute or prove the idea of the eternity of the world, the assertion that the basis of the world is some kind of eternal material, indestructible substance (*javhar*). They concluded that those who believed in atoms denied causation, while those who admitted the infinite divisibility of matter (divisible particles) led to the recognition of causality. God is considered by the Mutakallims as the direct cause of everything that happens in the world, which means the denial of causality. As Wolf, V.M., the scholar of Arab-Muslim medieval philosophy, notes Mutakallims did not consider atoms to be extended, this was characteristic of the Baghdad school of thought, however, the Basri school considered atoms to be extended. True, some Mu'tazilites did not recognize the atomistic approach at all.<sup>33</sup>

According to the teachings of the Mu'tazilites, a particle is indivisible when “division” destroys all the “connectedness” of particles. We should note that regarding “indivisible particles”, there were several points of view: some believed that atoms, as something existing in itself (*infradi*), could be identified with the body (*Jism*) and with substance (*Jawhar*), others recognized the single existence of the atom, but denied it the presence of three dimensions, sensual qualities of life, the ability to act and knowledge. They allowed the ability of this particle to combine into an aggregate of such

29 New Philosophical Encyclopedia, in 4 volumes. T. 1. Moscow, 2010 // Новая философская энциклопедия, в 4-х т. Т. 1. Москва, “Мысль”, 2010. – С. 198-199. Sikdar, J.C. Indian Atomism, – “Indian Philosophy and Culture”, 1974, v. 19, #2.

30 Wolfson G. O. The Philosophy of Kalam. London. 1976. <https://www.academia.edu/7475380/%D0%93...>  
Russian translation. Ch. 6–8 // Вольфсон Г. О. Философия калама. Лондон. 1976. Русский перевод. Гл. 6–8. (интернет). Атомизм. Происхождение атомизма в каламе. – С. 1. Пер. Марина Вольф. Философия калама. Гл. 6–8.

31 Wolf M. N. Medieval Arab Philosophy: The Mu'tazilite Kalam. Novosibirsk. // Вольф М. Н. Средневековая арабская философия: мутазилитский калам. Новосибирск. 2005. См.: <https://classics.nsu.ru/Wolf/kalam.htm>. Время обращения: 23.06.22.

32 Wolfson G. O. The Philosophy of Kalam. London. 1976 // Вольфсон Г. О. Философия калама... – С. 1.

33 Ibid, p. 2.

particles in a certain combination (pillar – arm- (столп – рука)), in contact with six others; such a particle could, by combining, create a material body (*jism*). Another group allowed the possibility of contact to create a body with only one such atom (particle). Another group denied the possibility of a solitary existence of particles<sup>34</sup> because, according to them, in solitude such a particle would be deprived of all spatial dimensions and would be inaccessible to perception. That is, it is something like an atom with the smallest single combination of particles, so that they can create one body, a compound of six or eight particles should be considered. Some believed that such a particle is deprived of all the qualities of a spatial dimension, the ability of independent existence, and remains only as a mental construct.

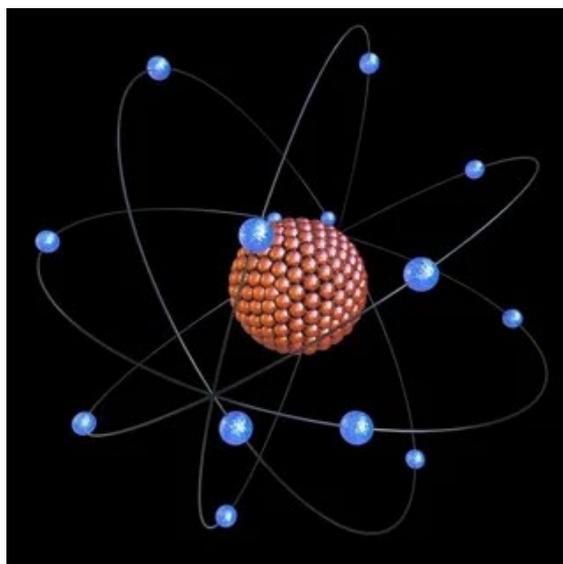


Image of Atoms.<sup>35</sup>

And how exactly do the Mutazalites characterize time and space according to their theory of atoms: “Space in atomistics is presented as a function of the “being” (essence) (its smallest unit) or as a property of atoms. And the carrier of the smallest spatial dimension is the atom. Time is represented as a sequence of indivisible atomic moments (*zamani fard, vakti fard*). In them, the simultaneous destruction of a given body and its reappearance take place.”<sup>36</sup> This reflects the dialectical interpretation of the teachings of atomism regarding the understanding of time and space: the emergence and destruction occur simultaneously! It should be noted that many of the Mutakallims were motivated to use this theory not only to study the natural foundations of the world, but to prove the continuous creation of the world by God: God creates the world (at the atomic level) every moment of time!

The arguments of the Mutakallims in favor of atomism were not just scientific only, but with more religious connotation, and proceeded from the agreement of the power of God. But even in this form, they pointed to the inconsistency of this concept. Ibn Hazm gives an argument from the power of God in the following form: “The supporters of atoms say: Does not God connect the parts of the body? Inevitable answer: Yes. Then they say: Does God have the power to separate these parts of the body so that nothing of the union and nothing of the parts remains in them, or does God not have the power to do this? And if you say that He has no power, then your God is powerless. And if you say that He has power, then you allowed the existence of the atom”<sup>37</sup>

It is known that changes and scientific revolutions are tried by the mental juices of the past, and the intellectual soil is usually prepared long before these scientific revolutions themselves take place. We know now that modern science proves divisibility of atoms. Avicenna does not accept the popular ancient Greek concept of atoms, i.e., the theory of the indivisibility of the smallest particles of bodies, proposed by both the ancients and his contemporaries. In his criticism he follows Aristotle.

34 In Russian: “одионочного существования частиц”.

35 The picture taken from Internet.

36 Wolf M.N. The Middle Ages Arabic philosophy: The Mutazilli Kalam. // Вольф М.Н. Средневековая арабская философия: мутазилитский калам. Там же. Время обращения: 23.06.22.

37 Ibid, p. 3.

Abu Raihan Beruni clearly understood the inconsistency of the Muslim approach to the doctrine of atomism. To Beruni's question about "why Aristotle considers the doctrine of an indivisible particle to be vicious, while the statement about the divisibility of bodies to infinity is even more vicious," he, Avicenna, then still a young scientist, boldly answers:

"It is impossible that anything continuous, be it a body, a surface, a length, a movement, or time, should be composed of indivisible particles, that is, those that would not have two ends and a middle, dividing them in half. Aristotle showed this in the sixth book of Physics and confirmed it with such convincing logical proofs that they cannot be doubted. As for the objection, Aristotle himself explains it and gives an answer to it. However, one must know that, when speaking about the fact that bodies are divisible to infinity, Aristotle did not want to assert by this that division always in actuality (i.e. in reality) happens.<sup>38</sup>

In his tractates of "Readings on Nature" (*Samo'i Tabii*), (part of the "Physics" of the encyclopedic "Book of Healing"), Abu Ali ibn Sina devotes chapters to this problem, where, along with the refutation of the views of Democritus and his supporters, as well as the opinions of Muslim followers of atomism from among the Mutakallims (Muslim scholastics, who proved the religious truth, the faith with the help of philosophy and logic), puts forward his arguments, proving the infinite divisibility of the smallest particles of the microcosm.<sup>39</sup> He gives evidence ("*Dar isboti rayi xaqx va ibtoli botil az rayhoi mazkur*") and argues the position that bodies can consist of indivisible incorporeal particles (*mazhab al muallifin lil aySom min ghair il ajsam*). Thus, there he refutes the opinion of the indivisibility of matter (bodies), including the views of Islamic religious scientists, i.e. Mutakallims, that atoms do not have bodily material properties and characteristics.

"To assume such bodies (indivisible atoms) that have no constituent parts, which are not bodies, means that they cannot produce (physical) bodies. For example, let's take the following row of atoms – X, Y, Z. How can an atom Y, located in the middle, between two others (i.e., between X and Z) prevent the contact of two other atoms that are located at the edges of this row? It must be that each of these two atoms (which are at the edges) in contact with the middle atom (Y) has something extra that the one in the middle does not have. All this suggests that the average atom is conceptually divided (i.e., it encounters others – S.J.). This means that it (the atom) is not indivisible."<sup>40</sup>

The arguments of Abu Ali ibn Sina in support of the divisibility of the indivisible (atom) are philosophical, i.e., arguments from knowledge, and not religious, which happened among the Mutakallims (i.e., arguments from the power of God). The infinite divisibility of the body implies a refutation of atomism (indivisibility). The Epicureans spoke of the free deflection, free fall and adhesion of atoms, this idea was borrowed by the philosophy of Kalam and applied to assert the concept of the creation of the world: just as atoms move freely and constantly, God creates the world continuously! Avicenna disagreed with this thesis proposed by the Mutakalim (Muslim scholastics).

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38 Correspondence of Biruni and Ibn Sina // Abu Ali ibn Sina. Works. T. 1. Dushanbe "Donish" Publishing House, 1995. // Переписка Бируни и Ибн Сины. // Абу Али ибн Сина. Сочинения. Т. 1. Душанбе "Дониш", 1995. – С. 188-189.

39 Abu Ali ibn Sina. Selected Works, Third Article (on the issues which has origin in nature and some its quantitative aspects), Third, Fourth and Fifth Sections, Vol. 3. Dushanbe. 1985. – S. 163–169. // Абуали ибн Сино. Осори мунтахаб, Мақолаи саввум (Дар умуре, ки оризи табиёт аст ва чиёати он), Фасли саввум, чаъорум ва панҷум, қ. 3. Душанбе. 1985. – С. 163–169.

40 Alnoor Dhanani, The Impact of IBN SINA's critique of Atomism on subsequent KALAM's discussions of Atomism // Arabic Sciences and Philosophy, vol. 26 (2995), pp. 79–194. P. 82-83.

Denying this theory, however, he indirectly advocated the recognition of causality and for the freedom of the human will. This was the answer of Ibn Sina to Abu Raihan Beruni – there are no indivisible parts, the atom is not indivisible.

In the 16th century Fr. Bacon returned to Democritus' idea of the indestructibility of matter and its infinite divisibility and, like Avicenna, concluded that there are no last “building blocks” of matter, and its divisibility is infinite. The theory of atomic divisibility is also supported by modern science. Niels Bohr (1913) proposed that the structure of the atom is like the planetary model. At the beginning of the 20th century, the planetary model was replaced by the wave model.<sup>41</sup>

#### 4. The Problems of Movement (What it is?)

The whole physical world, according to the teachings of the Eastern Peripatetics, from the smallest particles to the celestial bodies, is in constant motion. Aristotle's philosophy of nature, especially the problems of motion, space, and time, are widely discussed in his “Metaphysics” and “Physics”. It should be noted that the works of this thinker were considered the best example of the philosophy of nature, including during the Muslim Middle Ages, since it was on the topic that Muslim intellectuals relied in their ideological struggle with their opponents (theologians). Abu Nasr al-Farabi also devoted a significant part of his works to this topic, but after the intellectual crisis of the Baghdad school, the word of Abu Ali ibn Sina (representative of the scientific school of Eastern parts of Islamic world, like Bukhara, Ray and Khwarazm) for the medieval East and Europe in this area was stronger and weightier. Thus, the problems of movement, space and time are discussed in more detail in the section “Physics” (Tabiyat) of Ibn Sina and in his other works, such as “An-Najat” (the “Book of salvation”), “Danish-name”. But now we are here to concentrate our attention just on “Physics” of Avicenna to decipher his philosophy of nature.



Image of Movement.<sup>42</sup>

41 See: [https://platona.net/board/novaja\\_filosofskaja\\_ehnciklopedija/atomizm/3-1-0-805](https://platona.net/board/novaja_filosofskaja_ehnciklopedija/atomizm/3-1-0-805)

42 Movement, the image from Internet.

According to the teachings of Abu Ali ibn Sina, there is a universal law according to which all things have two states: potential and actual, and all potential has the ability to be actualized, i.e. to be realized (*har chise, ki quvvaе dorad, metavonad az quvva ba fe 'le, ki barobari on ast, daroyad*). An example of this would be all existing phenomena falling under these categories: in substance, the appearance of a person after being in a potential state. In quantity – the appearance of the plant world. In quality – the appearance of blackness from the state of potency (when it was not existed), etc. The transition from a potential state to an actual one can be gradual, or instantaneous (in momentum). According to Avicenna, his teacher Aristotle, considers movement moving by itself, and shows it as a form of being in which movement occurs by itself. He concludes that movement itself is perfection and action, and action is something in which the potential passes into the actual.<sup>43</sup>

However, Ibn Sina believes that the definition of movement (*mayl, shavq*) cannot be entirely reduced to the transition from the potential to the actual state. Ibn Sina refutes such definitions of motion as the appearance of “*something different*” or “*limitless*” (such characteristics are also inherent in time and infinity). Some scientists defined movement as a way out of a state of uniqueness (*identity*), this definition also does not correspond to the essence of movement, because the one who moves at every moment of time (*har “one”*, i.e., an instant of time) and space manifests itself differently, respectively, its parts are different.

**On the forms of movement.** Avicenna anticipated many ideas that arose in subsequent centuries of history, for example, in his teachings one can find in the embryo the idea of the Earth’s motion proposed by Galileo, and he also predicted the foundations of evolutionary theory.<sup>44</sup> The well-known Tajik historian of science, academician M. Asimi in his preface to the first partial publication of selected works of Abu Ali ibn Sina (in the Tajik, in 1985, prepared for the 1000th anniversary of the thinker)<sup>45</sup>, analyzing his work “*Samai Tabii*” – “*Readings on Nature*”) emphasizes that according to Avicenna, the world, the Universe is in constant motion, and accordingly there are different forms of motion, for example, natural, forced nonnatural, circular, volitional, etc. (in Avicenna’s words there are: - *harakati davri (mustadir), kasri, mustaqimi, tabi, irodi etc.*).<sup>46</sup> Prof. Abid Sadykov, former President of the Academy of Sciences of Soviet Uzbekistan, writes in his article “*Forerunner of Modern Science*” that Avicenna is undoubtedly the father of modern medicine, and to a greater extent, with his works “*Kitab-ush-shifa*” (Book of Healing) and “*Danishname*” (Book of Knowledge, written in Farsi) is the greatest thinker (physicist, geometer, astronomer, biologist and philosopher) of all times and eras. He touched on all aspects of contemporary physics, including questions of motion, time, space, the speed of sound and light (using the example of light and sound emanating from thunder), the relationship between the speed of movement and mass, etc., questions that have many parallels with modern science. The problem of measuring motion, the continuity of space and time, etc., were developed by him long before Descartes and Leibniz.<sup>47</sup>

43 Abu Ali ibn Sina. The Science of the Nature // Abu Ali ibn Sina. Selected works. – V. 3. // Абуали ибни Сино. Фанни Самои табиӣ // Абуали ибни Сино. Осори мунтахаб. – Ҷ. 3, Душанбе, 1985. – С. 78.

44 Avicenna, Ibn Sina. By M.S. Asimi // The UNESCOs Courier. October 1980. P.8. See: Avicenna – UNESCO Digital Library (доступно в интернете).

45 After that, the Project of publishing a ten-volume work of Abu Ali ibn Sina (in Russian and Tajik) was curtailed due to the collapse of the Soviet Union. This project was revived only after Tajikistan gained national independence, specifically in 2005, during the celebration of the 1025th anniversary of Ibn Sina, when it was approved by the President of the country.

46 Asimi M. Kitob-ush-shifo-i Abuali Sino “The Book of Healing” // Асими М. Китоб-уш-шифо-и Абуали Сино. // Абуали ибн Сино. Осори мунтахаб. (Иборат аз даъ чилд). Ҷилди 3. Душанбе. «Ирфон», 1985. – С. 9.

47 Sadykov, A. S. A Forerunner of Modern Sciences. The UNESCOs Courier. October 1980. P. 8. See: Avicenna – UNESCO Digital Library. (доступно в интернете). P. 41–43.

We will try to deal with the forms of movement proposed by Avicenna, analyzing them in a more detailed form. In the treatise “*Samoi tabii*” (The Science of Nature), he writes: “Natural aspiration (*shavk*) and, accordingly, also natural movement is the result of the action of gravity, and it is expressed in the form of falling bodies, in their natural state. Along with elementary forms of movement (moving from one distance to other in space), there are also complex forms of movement. Thus, the movement characteristic of higher forms of existence (for example, in plants, animals and people) differs from the movement inherent in simple natural constituents (elementary bodies and material particles). He gives a description of the forms of movement that indirectly contain elements of the evolutionary system in the embryo, that is, the movement from simple to complex: the chain “inanimate bodies (lifeless) – plants – animal-humans”; a theory developed in a more complete form, presented later in the theory of evolution by C. Darwin and in the book “Dialectics of Nature” by F. Engels in the form of a classification of forms of movement and a classification of sciences in general. Contrary to many scientific arguments, including those expressed by W. Montgomery, J. Sarton, M. S. Asimi, A. Sadykov, and others, it may seem incorrect to some to compare medieval concepts related to the interpretation of time with those that historically arose later, after scientific revolution in Europe. However, it seems to us that this example can show a unified course of universal scientific thought in a historical perspective. Moreover, the sources of both teachings are approximately the same – the Near Eastern global science systematized by the ancient Greeks, being available in translations and in interpretation for Arabic-speaking scientists. It is because we believe that Mediterranean civilizations have much in common.

Regarding this issue of forms of the movement Abu Ali ibn Sina writes, “elementary bodies are characterized by direct movement. Bodies are divided into inanimate and animate species. Animated bodies, such as plants and animals, are mobile from the inside, they are moved by plant and animal souls. But there are some other types of animate bodies, besides humans and animals, which also have voluntary movement.”<sup>48</sup> Let’s see what F. Engels writes about this issue. F. Engels, generalizing all existing forms of movement in the world, classifies the evolution of the following main forms of movement: mechanical, physical, chemical, biological, social, and spiritual. For greater persuasiveness, one can show an episode from an article by F. Engels, which he called “Basic Forms of Movement” in the book “*Dialectics of Nature*”:

“Movement, considered in the most general sense of the word, i.e., understood as a form of existence of matter, as an attribute inherent in matter, embraces all changes and processes occurring in the universe, starting from simple movement, and ending with thinking. It goes without saying that the study of the nature of motion had to proceed from its lower, simplest forms and had to be understood before giving anything to explain its higher and more complex forms».

Further, F. Engels analyzes the existing history of natural science, and shows how it develops evolutionarily:

“And indeed, we see that in the historical development of natural science, the theory of simple displacement, the mechanics of celestial bodies and terrestrial masses, is developed first of all; it is followed by the theory of molecular motion, physics, and immediately after the latter, almost along with it, and sometimes even before it, the science of the

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48 Abu Ali ibn Sina. The Science of Nature // Fanni Samoi Tabii, in Абуали ибни Сино. Фанни Самои табиӣ... // Abu Ali ibn Sina. Asarhoi muntakhav. Ibid.

motion of atoms, chemistry. Only after these various branches of the knowledge of the forms of motion that prevail in the field of inanimate nature reached a high degree of development, it was possible to successfully begin to explain the phenomena of motion, representing the process of life ...”.

Further, F. Engels writes about the prospects for discovering the phenomenon of movement in the animal world:

“Thus, while mechanics has long been able to satisfactorily explain the actions of bone levers occurring in the animal body, set in motion by muscle contraction, reducing these actions to their own laws which is also valid in inanimate nature, the physicochemical substantiation of other phenomena of life is still almost at the very initial stage of its development.”<sup>49</sup>

In the specified work, Abu Ali ibn Sina writes about the same forms of movement (mechanical, physical, chemical, biological, and human (social) movement), almost a thousand years ago, but with a slight difference in terminology (for example, the movement of the soul, volitional movement etc.), reflecting the originality of their era. He writes: “Elementary bodies are characterized by direct motion. Bodies are divided into inanimate and animate. Animated bodies, such as plants and animals, are mobile from the inside, they are moved by plant and animal souls. But there are still some types of animate bodies, besides people and animals, which are also characterized by voluntary movement. Next, let’s look at the types of movement presented by Ibn Sina.

**The theory of natural (native) place.** It is important to note in the beginning that the concept of natural place was a predecessor of the theory of gravity. So, what is natural movement? We note right away that, according to Avicenna, this is not only a simple fall of bodies (for example, the fall of the rocks from mountains). Ibn Sina thinks that the movement of bodies that do not have a soul is natural, and it has a chaotic character. For example, it is generally accepted that the movement of earth, water, and bodies inherent in water and earth is directed downwards, while the movement of wind and fire is directed upwards. It is obvious that the thinker, referring to the heritage of his ancient predecessors, concludes that all bodies have a place in nature (in the land or in the sky), tend to the center and having taken their place, stop and are there at rest. If for the earth, Abu Ali ibn Sina reflects, such a center is the earth itself, then for water it is the surface of the earth, for wind it is the surface of water, for fire it is the surface of the wind. Therefore, within each of these elements there is a force by which they tend to their natural location. This force is a natural force and, accordingly, the movement that occurs due to such a force is a natural movement. This natural-philosophical theory was not supported by everyone in the Middle Ages since it was one-sided. Thus, this concept of a natural place was sharply criticized by another encyclopedist, a contemporary of Ibn Sina – Abu Reihan al-Beruni, during the lifetime of Avicenna, in his famous “Correspondence of the Century”.<sup>50</sup>

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49 F. Engels. *Dialectic of Nature* // Ф. Энгельс. *Диалектика природы*. ОГИЗ. Госполитиздат. – М.: 1941, 338 с. – С. 46. (in Russian).

50 Jonboboev S. Abu Reihan Beruni – the founder of the scientific revolution in Central Asia and Iran // *Proceedings of the international scientific and theoretical conference “Abu Reykhan Beruni – the great thinker of the East.”* National Museum of Tajikistan and UNESCO. 02/10/22. Dushanbe. 2022. – S. 101–104. (in Tajik). See also: S. Kh. Nasr. *Correspondence of the Century: Giants of the Thought of the East*. In the *Unesco Courier* magazine. October. 1980 // Джонбобоев С. Абу Рейхан Беруни – основатель научной революции в Центральной Азии и Иране // *Материалы международной научно-теоретической конференции “Абу Рейхан Беруни – великий мыслитель Востока”*. Национальный музей Таджикистана и ЮНЕСКО. 10.02.22. Душанбе. 2022. – С. 101–104. (на тадж. яз.). Также см.: С. Х. Наср. *Переписка века: гигантов мысли Востока*. В журнале “Курьер Юнеско”. Октябрь. 1980

Abu Rayhan Beruni believed that there is no natural place for the things of nature, according to him everything is drawn to the center of the world.

Modern science and philosophy of natural science also, of course, cannot support the concept of “natural place” proposed by Avicenna, which was accepted under the influence of Aristotle. But it must be borne in mind that it was a harbinger of another physics, since human thought, just like nature, does not move in a straight line, but in a zigzag, dialectically. Today, these problems are solved through more complex theories, such as the theory of universal gravity (or the force of gravity). Since modern physical science and astronomy are based on other theoretical foundations than in the Middle Ages, they cannot agree with the recognition of the Earth as the center of the Universe, where all bodies stretch (in reality, everyone already recognizes that the Universe (universes) are infinite!). Today, not only such a geocentric (based on the Ptolemaic theory), but even the heliocentric (Copernican) theory does not withstand strict scientific criticism. The fact is that it is proved that the Universe has no center, it (or they) is infinite. Therefore, it seems to us that the answer of Nasriddin Afandi, a humorous character of the Persian-Tajik medieval literature, to the question of where the center of the world is located is correct, we may say – absolutely! He believed that this center is “under the right leg of his donkey.” That is, one can assume the existence of such a center everywhere, anywhere in the Universe, since there is no special center anywhere! This theory also leads to the already discussed recognition of the plurality of worlds. For example, Hugh Everett<sup>51</sup> believes that there is not one, but an infinite number of universes, each of which is connected to the others by a whole network of “road forks” and it is expanding. According to the multiple or “many-world theory”, there are many quantum worlds, some of them have planets with life, some do not.

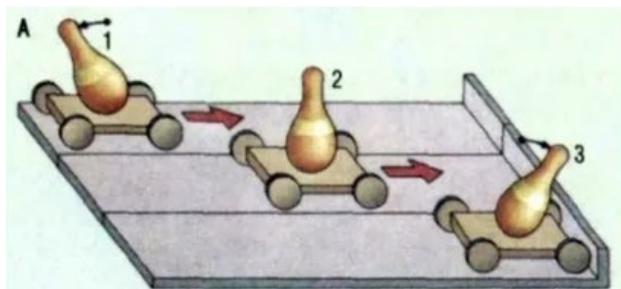
**On the theory of the first shock or impetus.** The intellectual heritage of Avicenna and his contemporaries is rich. So, in the works of our thinkers one can find many other important and valuable, productive ideas, one way or another, connected with the understanding of the modern, scientific picture of the world. Avicenna says in his book “*On the Heaven and the Universe*” that heat arises from motion in external things.<sup>52</sup> Similar ideas were undoubtedly developed and used by Europeans in subsequent centuries. The works and discussions of Avicenna reflected his view of the nature and types of motion (now one can equally say “energy”), a theory proposed by Aristotle and Avicenna, and called in modern times “inertia”, then developed by Galileo, Newton, and in the 20th century Einstein. As already noted, the mentioned works of Abu Ali ibn Sina discuss what we observe in the history of science – the theory of impetus (or in modern terms – inertia), which was supported and developed by Jean Buridan (1300–1358), a famous French philosopher, theologian, and naturalist.

For persuasiveness, we present exact thoughts on this issue. Ibn Sina writes that the mover or “motor” (moharric, «двигатель»), i.e., the human hand, bowstring, sling, etc., informs the moving body – stone, arrow – some “striving” (*shavq*), just as fire transfers heat to water. Sometimes gravity can also act as an engine. Violent movement is communicated to the throw body by an engine located outside. That is, the cause of the movement of the dropped body is an external force. During the movement, the force of “violent aspiration” decreases due to the resistance of the environment, and as a result, the speed of the body also tends to zero. Violent aspiration (movement) would not change in emptiness, and the body could perform perpetual motion, but this is impossible according to the teachings of Avicenna due to the absence of emptiness. Since he denied the existence of the void (vacuum).

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51 Hugh Everett (1930–1982), American physicist who proposed the many-worlds interpretation of quantum mechanics. About the theory of multiple universes of Hugh Everett, see: <https://www.scientificamerican.com/article/hugh-everett-biography/>; 18.05.2023.

52 Abu Ali ibn Sina. About Heaven and the Universe // Абу Али ибн Сина. О Небе и Вселенной; Gutman, Oliver (1997). On the Fringes of the Corpus Aristoteles: The Pseudo-Avicenna. Early Science and Medicine. 2 (2): 109–128 p.

Theory of impetus.<sup>53</sup>

The theory of **impetus** is known in the history of modern science according to the well-known scientific chain: “Aristotle-Avicenna-Jean Buridan”. As noted, the concept of “inertia” was not yet known to medieval physics. Avicenna, like Buridan, criticizes Aristotle’s theory that moving bodies move in space not due to some external environment (for example, vortices and vibrations in the air), which allegedly contributes to this, and in the absence of which the body

would stop. They themselves claim that this happens due to the initially communicated bodies to the push (impetus). Buridan called this force “impulse”. He believed that the speed of the body increases depending on the momentum (push) and the amount of its matter. It is not surprising that this was recognized by historians of science as an anticipation of Isaac Newton’s well-known theory of motion. This is reflected in the following statement by Jean Buridan, where he reveals the essence of this theory regarding the movement of projectiles, i.e., based on its practical application (in military sciences):

“... after leaving the thrower’s hand, the projectile will be moved by the impulse given to it by the thrower and will continue to move until the impulse remains stronger than the resistance. And it will have an infinite duration, unless it is reduced and damaged by an opposite force resisting it, or by a force resisting it, something inclining it to the opposite movement (Questions to the Metaphysics of Aristotle XII.9).<sup>54</sup>”

Ibn Sina writes about the “striving” (*shawq*) as follows: just as fire transfers heat to water. Here it can be seen that this discussion had a continuation in the Western Middle Ages. There really exists an intellectual chain between Abu Ali ibn Sina and Jean Buridan that is confirmed by the latest research of the historian of science, for example, A. Sayili.<sup>55</sup> But along with this, such an idea is put forward that this concept was developed by Avicenna under the influence of Yahya al-Nakhvi of Alexandria, a thinker of the Alexandrian school who studied in Egypt with Ammonius and Proclus.<sup>56</sup> We are talking about John Flipponus, who was from Byzantium. Like Buridan, in these parts of Avicenna’s discussion of nature, one can find his view of the nature of inertia, boldly proposed by him, and then developed as a separate mechanical theory by Galileo, Newton and Einstein [9:87]. Of course, the form and content of the perception of the physical world and the discussion around it are changing. Modern scientists discuss this topic in a different way, namely from the perspective of “Movement – Energy”: here is what, for example, V. Tsvin writes about this.

“... if the energy is weighty, then the potential energy (gravity) depends on the kinetic energy (inertia), because the magnitude of the speed depends on the energy. Therefore,

53 Impetus, the image from Internet. The Inertia is a physical phenomenon in which a body keeps its speed constant or at rest if no other bodies act on it. One of main principles of theory of movement of I. Newton.

54 J. Buridan. Why don't we study Buridan's laws of motion? Jean Buridan. Questions to the metaphysics of Aristotle. XII. 9). // Ж. Буридан. Почему мы не изучаем законы движения Буридана? Жан Буридан. Вопросы к метафизике Аристотеля. XII. 9). См.: Интернет ресурс. [https://translated.turbopages.org/proxy\\_u/en-ru.ru.a59a3735-62a17af3-fc0fbd68-4722d776562/https/hsm.stackexchange.com/questions/2135/](https://translated.turbopages.org/proxy_u/en-ru.ru.a59a3735-62a17af3-fc0fbd68-4722d776562/https/hsm.stackexchange.com/questions/2135/)

55 Sayili, A. Ibn Sina and Buridan on the Motion of the Projectile // Annals of the New York Academy of Sciences. – 1987. – Vol. 500. – P. 477–482.

56 Zupko, (1997), what is the Science of the Soul? A case Study in the Evolution of Late Medieval Natural Philosophy, Syntheses, 110 (2): 297–334.

although the kinetic energy of a given body depends on the speed, and the potential energy on the position, but the speed and position can only be determined relative to another body.”<sup>57</sup>

**On the relation between motion and rest.** The other most interesting problem in Avicenna’s concept of motion lies in his understanding of the relationship between motion and rest. What is motion and how does it relate to rest? In the history of science and philosophy, Zeno’s “Aporias” are known regarding this issue: to go halfway, you must go halfway of halfway and so on to the point of absurdity .... From which some thinkers of antiquity and the Middle Ages concluded that there is no movement in the world. So, there were constant dichotomous discussions about movement and rest, some argued that there was no movement, others that there was no rest. In this regard, we can cite this episode in the transfer of A. S. Pushkin, the Russian poet:

“There is no movement,” said the bearded sage,  
The other was silent and began to walk in front of him.  
He couldn’t have argued more strongly...!”  
Everyone praised: the answer is intricate.  
But, gentlemen, this is a funny case.  
Another example comes to mind:  
After all, every day the Sun walks before us,  
However, the stubborn Galileo is right.

It is noteworthy that the remarkable Russian poet A. S. Pushkin, showing his erudition, simply and artistically beautifully illustrates the ancient discussion (that the Sun and the Earth move, as it according to Galileo, although we see only the movement of the Sun). However, back to Avicenna. It is important to see how this dispute stood in the Middle Ages, and how did Avicenna react to it? Based on the proposed texts in “Physics”, Abu Ali ibn Sina believed that what relates to movement exists simultaneously in time and space. But if an object is at times found in a certain place, then they say that it is at rest.<sup>58</sup> The *definition of rest* can be given as follows, i.e., according to Abu Ali ibn Sina, this is the *stay of something at a certain place in time*, so that it is also in the same place earlier and later.

Ibn Sina wrote: “Rest (i.e. stillness) consists of the presence of an object in a single place at a time, while before and after that object was also at that time.” (“*Суқун иборат аст аз будани чизе дар макони воҳид дар замоне, дар ҳоле, ки пеш аз он ва баъд аз он ҳам он чиз дар он замон буда бошад*”). Similarly was noted by Gulam Husayn Rahimi, and Abdol Rasul Imadi, “Ibn Sina thinks that the movement and the rest are not possible in vacuum, that’s why it is impossible to exist.”<sup>59</sup>

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57 Vladimir Tsivin. Potential, kinetic, dynamic. The Physical Beginnings of the Historical, Part II. Logical principles of the physical. Chapter 4. Physics of interaction, motion, force, interaction. See: <http://ruspioner.ru/profile/blogpost/9342/view/20196/>. (in Russian). – P. 21. // Владимир Цивин. Потенциальное, кинетическое, динамическое. Физические начала исторического, Часть II. Логические начала физического. Глава 4. Физика взаимодействия, движения, силы, взаимодействия. См.: <http://ruspioner.ru/profile/blogpost/9342/view/20196/>. – С. 21.

58 In Russian translation: “Но если нечто находится временами на определенном месте, то говорят, что оно покоится.”

59 Abu Ali ibn Sina. Selected works. – V. 3. Monday. – Publishing house “Irfan”. 1985. – P. 100. //Абуалӣ ибни Сино. Осори мунтахаб. See also: Gulim Husayn Rahimi, Abdol Rasul Imadi. The Place and Vacuum from the point of view Avicenna and Abulbarakot Baghdadi, Research Journal of Islamic Philosophy and Theology of Shahed Beheshti University, (In Farsi [https://jipt.sbu.ac.ir/article\\_95133\\_e558d0bb0967c9e10dfc46869aa81ccc.pdf](https://jipt.sbu.ac.ir/article_95133_e558d0bb0967c9e10dfc46869aa81ccc.pdf)), viewed in 20.05.2023.

Ibn Sina's understanding of the rest is that if movement is the presence of an object in a certain place, so that the object was neither earlier nor later in this place. But this definition of rest seems to be imperfect. It would be more correct if we say it in this way: "rest is a state when something is in time in a certain place, and movement is if something was in a certain place and in time." But according to Avicenna, even such a definition of rest is not entirely correct. The main aspect in the definition of rest is the absence of movement (*sukun adami harakat ast*).

The point is that each class of motion has its own form of rest. For example, there is development, but there is also rest inherent in development (as part of it), there is even rest inherent in the process of transformation, etc. Therefore, according to Avicenna, it is impossible to imagine rest (i.e., the absence of movement) as something opposite to movement (in the absolute sense). Consequently, the relationship between movement and rest is based on the rules of dialectics: Rest is one of the states of motion (movement), i.e., the first is characteristic of the second as a transitional stage.

Ibn Sina considers and analyzes the philosophical understanding of movement based on the analysis of the interaction "movement – change and rest", the interaction also points to the role of the Necessarily Existing (*Wajib-al-wujud*), i.e., an example of the absolute unity of movement and rest in the world. Based on the clarification of the essence of the philosophy of nature, Ibn Sina reveals the objective nature of the movement (that is, he firmly stands on the position of recognizing the objectivity of the existence of movement as a condition of the being, matter and the Universe). As already noted, the problems of space and time are discussed in the section "Physics" (in the treatise of "*Samoi tabii*"), but these problems can also be found in his "*Book of Knowledge*" ("*Danish-name*") (a book in Ibn Sina's native Persian-Tajik language), as well as in "*Kitab-un-Najat*" ("*The Book of Salvation*") and in other works. To supplement information and acquire a more general picture, you can go directly to these sources.

## 5. The Problems of the Space

Space, according to Avicenna, is nothing but the boundary (*nihaya*) of the enclosing body, therefore it is an objective characteristic of the body (and not something separate from them and independently existing). The concept of space, in Abu Ali ibn Sina, is expressed by the term "*makan*", which literary indicates the meaning of "place". The most important point in considering the issue of Avicenna's view of space is that he discusses the problem of space in connection with the concept of movement, i.e., in accordance with the theory that space does not have any kind of independent (substantial) existence, but it is a process of transition, movement and transformation of bodies and objects themselves. That is, space indicates the border and the unity of the proximity / distance of the distance between bodies, objects, processes. Each shift (object / surface) must have, 1-first) its own space (place); 2-second) this own space should (by volume) coincide with the body (/thing/process), because it should be so that nothing but it could fit or move in this space (place). In other words, the location of point "A" will be point "A" itself, not something else. Avicenna follows Aristotle in the process of analyzing these problems, but he deliberately smooths out many shortcomings of this ancient Greek thinker, his teacher, based on Muslim morality, where the teacher was treated with reverence, not pointing out, but imperceptibly correcting his obvious mistakes.



Image of Universe, the “Celestial sphere”.<sup>60</sup>

Delving deeper into this issue, we note that the space (Arabic “*makan*”), according to Ibn Sina, is equal and even equivalent to the body itself (*makan bo jism musovi ast*), it is updated every time, the body is not separated from it, but at the same time other bodies move there, and they come and go (with space). At the same time, it is also important to understand that Space is also not a (separate) body. Moreover, it is equal to the covered object, even equal to its borders, redistribution and is intended for it (*makan musovi bo mutamakkin ast, balki musovi bo nihoyati ust va mukhtas be yst*), space is equal to what is in it, equal to its boundaries and belongs to what occupies it. As this moment noted by Ghulam Husayn Rahimi and Abdul Rasul Imadi “...Place (*makan*) is the space where body is located. Two things cannot be in the same space at the same time. Aristotle considered the place as the internal surface of the containing object or the external surface of the obliterated object. Ibn Sina is trying to prove the opinion that the place of the matter is not the dimension or the void; Therefore, “*makan*” defined by Avicenna as the border of the volume. To establish this concept, he rejects the vacuum for various reasons. Abul Barakat Baghdadadi says that for the same reasons that place can be a surface, it can also be a volume, so the place is all the volume in which the object is located.”<sup>61</sup>

Nevertheless, contrary to many views, Avicenna declares, space is not reduced to matter, to form, to angles, it is also not reduced to a field (point, space) of meetings of different things. Space is also not an empty field for content (things), and moreover, it also does not contain a surface (*sathi hovi*). From here it becomes clear that there is no space, that’s why one must proceed from the contrary. So, what is it? To put it briefly, space is the boundary of things. Thus, space is nothing but the boundary of the enclosing body (*nihoyati jismi hovi*). It is something that contains a body in motion, is equal

<sup>60</sup> The image taken from Internet.

<sup>61</sup> Abu Ali ibn Sina. Selected Works. – V. 3. Dushanbe, “Irfan” Publishing house. 1985. – S. 132, 135 (in Tajik); Also see: Ghulam Husayn Rahimi, Abdul Rasul Imadi. The Place and Vacuum from the point of view Avicenna and Abulbarakot Baghdadadi.

“مکان” و “خلاء” از دیدگاه ابوعلی سینا و ابوالبرکات بغدادی

Research Journal of Islamic Philosophy and Theology of Shahed Beheshti University, In Farsi, viewed in 20.05.2023.

[https://jipt.sbu.ac.ir/article\\_95133\\_e558d0bb0967c9e10dfc46869aa81ccc.pdf](https://jipt.sbu.ac.ir/article_95133_e558d0bb0967c9e10dfc46869aa81ccc.pdf)

to itself, and for moving things it is a stable receptacle. These moving bodies fill it, or by movement are separated from it, but can rejoin it. Space is nothing but the limit for the body. It is impossible for space to have two things at the same time or be contained in it (“within”). (Compare the Persian translation of the original: “Makan juz nihoyati jismi hovi chize nest... Wa mumkin nest, ki du jism bo ham dar on voqe’ shavand”-which means place is nothing but the boundary of particular thing, that two bodies can’t exist at one place at the same time (3:125)).<sup>62</sup>We also note that space, according to Abu Ali ibn Sina is not a void (i.e., is not a vessel). All these points are important for understanding Avicenna’s teachings about space.

Consequently, space (*makan*) is a boundary formed by bodies and things, without which it cannot exist independently. The conclusion is that, as it was stated at the beginning, space is an attribute, and not something substantial (separate), or existing without objects and bodies. Space in fact is the boundary of material bodies.

## 6. Problems of Time

Before discussing the concept of Time in the writing of Ibn Sina it is important to provide general picture of Time in the history of world philosophy. So, the philosophical approach to time has its own history, in the past and present time. Briefly, it can be explained as follows. Plato defined time as “a moving likeness of eternity”, in contrast to eternity, time he defines it as an imperfect dynamic world. Aristotle defines time as a “*measure of movement*”, which becomes the basis of natural science philosophy. Newton proposes the concept of “*absolute time*”, which flows perfectly evenly and has no beginning or end. Another approach is offered by Kant, who defines time as “*a priori form of contemplation of phenomena*”. In modern times, Heidegger defines time as “*being*” and contrasts it with “*non-being*.” For him, time becomes a human existential phenomenon. So, it is necessary to show what is the place of Avicenna in this discourse.

According to the teachings of Avicenna, time is inseparable from movement, and, in short, it is a measure or amount of movement. Time does not exist without movement. When we do not feel movement, we cannot feel time either. All bodies, their changes and movements have antecedent and subsequent moments. Time is the quantity and measure of these movements. All change and movement occurs in time. Recognition of the objectivity and inseparability of time from the movement of material bodies is an important aspect of the teachings of Avicenna. And this corresponds to the modern ideas of physics about time.<sup>63</sup>

62 Abu Ali ibn Sina. Selected works... Vol. 3. – P. 125. (in Tajik). The body contains both the volume and boundary. See also: Also see: Gulam Husayn Rahimi, Abdul Rasul Imadi. The Place and Vacuum from the point of view Avicenna and Abulbarakot Baghdadi.

مکان و "خلأ" از دیدگاه ابوعلی سینا و ابوالبرکات بغدادی]

Research Journal of Islamic Philosophy and Theology of Shahed Beheshti University, #26, p.112. In Farsi, viewed in 20.05.2023.

[https://jipt.sbu.ac.ir/article\\_95133\\_e558d0bb0967c9e10dfc46869aa81ccc.pdf](https://jipt.sbu.ac.ir/article_95133_e558d0bb0967c9e10dfc46869aa81ccc.pdf)

63 Dinorshoev M. Naturphilosophy of Ibn Sina. Dushanbe, “Donish”, 1985. 200 p.; A. Komili. See: On Some Physical Views of Abu Ali Ibn Sina (Avicenna) (cyberleninka.ru). // Диноршоев М. Натурфилософия Ибн Сины. Душанбе, “Дониш”, 1985. 200 с.; А. Комили. О некоторых физических взглядах Абу Али Ибн Сины (Авиценны) См.: (cyberleninka.ru); Behrozpur Jabbori Jahid. The view of Avicenna on the Time (zaman). [Бехрузпур Чаббори Чохид. Назарияи замон дар фалсафаи Ибн Сино (نظریه زمان در فلسفه ابن سینا)]

نظریه زمان در فلسفه ابن سینا  
چهارچوب ادیب روزنپور ( Source: <https://alefbalib.com/Metadata/112636/>);

Mahdii Najafi, Zaman dar padidorshinosii vujudii Haydegger va ontologii Mullo Sadra. Journal Ontological Research, vol. 4, #7, Spring & Summer 2015, P. 41–57.

Thus, we note that the problem of Time (*zaman*), as well as space, is solved in connection with movement, and it is a phenomenon that accompanies any movement (“*on bo har harakate hamroh ast*”).<sup>64</sup> The treatise “*Samoi tabii*” (part of physics) by Ibn Sina gives a palette of opinions regarding time, among which there is both a complete denial of the phenomenon of time, and the recognition of it only as a subjective mental category (“*na dar khorij az zehn*” -means that it does not exist outside of mind), not as something objectively existing. Some scholars recognized its relative nature, arguing that it exists incidentally; for example, as the appearance of someone before sunrise (or just as the appearance of something somewhere by chance), etc. Other scholars, on the contrary, are insisting and recognized it as an independently existing substance.<sup>65</sup> These four opinions regarding Avicenna’s view on existence of time are reflected on the already mentioned Behrozpур Jabbori Jahid’s paper as well. So, this shows the coincidence of our views on the main object of our discussion.

Accordingly, the question of the nature of time is considered by Ibn Sina within the framework of the natural philosophical ideas of both antiquity and Aristotle himself and was also based on the realities of the Muslim Middle Ages which was in rise. Aristotle was one of the first scientists in the history of science and philosophy who systematically developed a theory of motion/ movement, directly relating it to the study of time, the flow of time and the way motion is measured. What particularly attracts our attention is that Aristotle and Ibn Sina solved the problem of time not only instrumentally from the point of view of the task of measuring the number and types of movements (based on problems of an applied nature for practical matters (building, navigation, etc. in their societies)), but also based on philosophical-ontological aspects, from the point of view of its essence (i.e., clarifying the question of what time is in a philosophical, theoretical aspect). The second aspect is of particular importance, because it shows that knowledge and science in Medieval Muslim culture had a value in itself, that is, knowledge for knowledge, ultimately for knowledge of the world and to find how it operates.



Image of the Time.<sup>66</sup>

64 Abu Ali ibn Sina. Selected works, Vol. 3, p. 135, (in Tajik). Dushanbe, 1985. – P. 135.

65 Ibn Sina. Selected works. Vol. 3. Ibid. P. 135; Behrozpур Jabbori Jahid. The view of Avicenna on the Time (*zaman*).

[Бехрузпур Чаббори Чохид. Назарияи замон дар фалсафаи Ибн Сино (ابن سینا) فلسفه ابن سینا) <https://alefbalib.com/Metadata/112636>]

66 The image of the Time, from Internet.

In the works of Avicenna, the concept of “time” is described by the term “*vaqt*” or “*zaman*” (in the sense of time, era, period of life, etc.). In Persian dictionaries, time is conveyed in different forms and is expressed in lexemes *goh* (moment), *zaman* (period), *fursat* (chance, opportunity), *soat* (hour, moment), according to Dekhudo in sum it is the number of moments of life and death<sup>67</sup>. As it noted before, at the same time for some modern philosophers time becomes a human existential phenomenon. But as it concerns Avicenna, “time is a way of measuring movement (*vakt (zamon) hamchun tarzi chen kardani harakat*)”]. By this, he synthesized the positions of metaphysical and physical research and the definition of time. Aristotle in his “Physics” raised two important ontological questions around which he sought to build his doctrine of time: is the immediate (objective) existence of time permissible or not?

If yes, what is its nature? He explains this problem as follows: “either the fact that time (objectively) does not exist at all, or it is something incomprehensible and barely existing.” In contrast, Abu Ali ibn Sina believes that time is the amount of movement, whether it is the movement of an object from one place to another, or from one position to another, when there is a gap between them, and situational movement occurs at a distance between them. This is what is called time (*zaman*)<sup>68</sup>. About this he writes:

“Consequently, the movement fixes the antecedent and the subsequent by means of its parts, and insofar as the movement has an antecedent and subsequent in the dimension of distance, there is a quantity in it. And the amount of distance also has a dimension. Time is that unit or that amount of motion. And when a movement is divided into anterior and posterior, it is due to distance, not due to time.”

For better persuasiveness, we present this idea in the Persian-Tajik language, where this provision is given as follows:

[“*Pas harakat ba vositai ajzoyash mutaqaddimu mutaakhhirro shumora mekunad va harakat az haisi in ki dar masofat taqaddumu taakhhur dorad, shumor dorad. Va boz in miqdori masofat ham miqdor dorad. Va zamon on adad, va on miqdor ast. Pas zamon – shumorai harakat ast. Dar surate, ki harakat munqasim ba mutaqaddimu mutaakhhir shavad, ammo ba sababi masofat, na ba sababi zamon.*”]<sup>69</sup>

The implication of this relatively short passage is that the essence of time is that it is a *quantity (measurement) of motion*. Ibn Sina states that along with this time can be understood as amount of possibilities (Persian translation of the original: – “*vaqt miqdori imkone ast*”) and reveals another aspect of this phenomenon. The next point, important for understanding time according to Avicenna: the past and the future are integral parts of the phenomenon of time. There are, however, other important points in understanding the phenomenon of time, which must be emphasized here again. One of them, as noted earlier, is related to the clarification of the nature of time – this is the question of whether it is an independent entity (objective substance) as previously stated, or whether it has an accidental form of existence.

67 Hour, moment, period. Time is part of the deception given to something. Zaman is the amount of life of something. Zaman is an era, a period of life and death. (Soat, fursat, гоъ. Миъдоре аст аз рӯзгор, beshtar dar zamoni guzashta ba koravad, hamyi he avkot ast. Vaqt miqdore az zamoneki baroi amre farz shuda). Lughatnomai Dehhuda (Encyclopedia of Dehhuda). See: <https://vajehyab.com/dehhoda/%D8%B2%D9%85%D8%A7%D9%86>. Time 06/22/22. P. 30.

68 Abu Ali ibn Sina. Selected works... – P. 141.. // Абуали ибни Сино. Осори мунтахаб.... – С. 141.

69 Ibid. P. 142.

Avicenna believes that time, being a characteristic of moving bodies, is not a self-sufficient entity (he writes about this directly: “*zaman goim ba khud nest*”), it arises and disappears. And the existence of everything that is such is associated with matter, (“*vujudash basta ba modda ast*”). Therefore, time is something that characterizes the material things, and the existence of every material thing is realized due to movement<sup>70</sup> If change and movement do not occur, the existence of time intervals, such as past and future, will also be impossible, then there will be no time. If the previous does not disappear, the next cannot appear either. Therefore, as Avicenna notes, time is a transformation of any state (literally: “*waqt tajaddudi hole boshad*”), it is an important contribution to understanding the phenomenon of time!

The next important point in understanding the concept of time according to Avicenna is the question of the continuity of time. Time is woven from different moments (“on”, -“one vohid”- in Persian, which means “the particular moment”, or just “a moment of time, now, the blink of an eye”- in Russian “*mgnovenie oka*”), they are characterized not bodily by physical appearance, but by potential and not only through the mental existence (i.e., existing in our thought) . An instant (“he”) in time is comparable to the concept of “point” in the concept of space; it, consisting of elements, preceding and following, constitutes the essence of the continuity of time. Thus, time determines the measure of movement, and movement determines the measure of time, i.e. they are interconnected and interdependent.

Some nuances exist in other writings of Avicenna. In his noted article, Behrozpur Jabbori Jahid writes that if in the book of “*Shifa*”, Ibn Sina writes that time (*zaman*) is the *number of movements*, and the movement is divided into the previous and the next, however its division should be *based on distance, not time*. But in his later book “*al-Isharat*” Ibn Sina defines time as a *quantity that measures change*, and in a sense, *time is the amount of movement*, but not in terms of distance, but *in terms of duration and delay*, which is impossible for them to come together.<sup>71</sup>

And finally, another important point in the problem of time is the definition of the content of the following concepts, such as: “eternal” (*qadim*), “eternity” *dahr*, “infinity”(perpetuity), absolute time – “*sarmad*”, etc. Let’s start with the concept of “eternity” – *dahr*. *Dahr*, according to Avicenna, is something that exists along with time, but is not in (or inside) time. In other words, that, the existence of which is jointly or simultaneously with time, in general, is called “*dahr*”. Speaking in the language of Ibn Sina, this is “the constancy or duration of being” (“*davomoti vujud*”), that is, that in each fragment of time it remains itself (identical). Thus, *dahr* is a combination of constancy and variability. The analogue of such an association with “*dahr*” is the association of many other things with time.<sup>72</sup> In other words, *dahr* is something invariable compared to the course or passage of time. We think that *dahr* is a dialectical phenomenon of the “invariably-temporal”! This is the world (in fact, eternal), in which we are all people, as well as stars, planets, natural things, animals, but temporarily. This moment is recorded in poetic form in one of Ibn Sina’s rubaiyat, where he describes the strength of his faith in the world where he lives, in comparison with the faith of other people, orthodox (literal Zahirites) and people from the crowd. The word “*dahr*” is used twice in the mentioned rubaiyat. It is used in meanings emphasizing various points in time: “The World”, which surrounds the author and “the society where he lives”, as well as “Epoch” – the world in general, the universe.

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70 Abu Ali ibn Sina. Selected works... – P. 143. (существование всего материального в веществе реализуется благодаря движению).

71 Behrozpur Jabbori Jahid. The view of Avicenna on the Time (*zaman*). <https://alefbalib.com/Metadata/112636>

72 Ibid. P. 143, 154.

My disbelief is not a game, not empty decorations of words.  
I believe in one truth: here is the constancy of faith.  
Now there is only one like me, and if I am unfaithful,  
This means that there are no true believers, there is no Islam in the world.<sup>73</sup>

In Farsi:

Куфри чу мане газофу осон набувад,  
Маҳкамтар аз имони ман имон набувад.  
Дар даҳр чу ман якеву он ҳам кофир,  
Пас дар ҳама даҳр як мусулмон набувад.]

Commenting this poem, it is evident that according to Ibn Sina “*Dahr*” in the first case is the real time in the world of Islam, in the second case it is the eternal universe. Thus, Ibn Sina considers his religious and philosophical faith to be the most acceptable and convincing, since it is consistent with both science and faith, with time and eternity. The scientist is surprised at people who believe that 1) “*Dahr*” is a continuation of rest, or 2) is a time in which movement is not quantitatively fixed. In fact, as Abu Ali ibn Sina writes, such a position and statement cannot be accepted by Reason, that is, the reason does not perceive such time, the substance of which does not contain (moments) of antecedence and succession. But if it has these two elements (“on” as a moment, instant) of time (i.e., preceding and following), then, as noted earlier, it is a transformation of condition, or position (according to Avicenna: *taḥaddudi hol*) and, undoubtedly, is subjected to the factor of time. In his works, the scientist reminds more than once that even in rest there are moments of precedence and succession.<sup>74</sup> Thus, one can conclude that “*dahr*” is not a continuation of rest.

Now let’s turn to what philosophical means to determine a special phase of time: “*qadim*”. According to Avicenna, “*Qadim*” (eternal) is defined as absolute (“without beginning”) time, in which there is no point from where it follows, as something infinite in its origin (beginning). As for the clarification of what is connected with the definition of another category of time, i.e. the concept of “*sarmad*”, then according to Abu Ali ibn Sina, this is such an eternal change in time, as a form of manifestation of being, when taken without taking into account its variability and is considered outside the context of time in general. Precisely, such a state or dimension of time is called “*sarmad*”. This position of Avicenna and the philosophers of the Middle Ages is popularly stated and illustrated by Abu Hamid al-Ghazali. He writes: “Most modern and ancient thinkers were inclined to believe that the world is eternal and did not cease to exist together with Almighty Allah, that it is conditioned by His being, is consistent with Him, not lagging behind Him in time, and this is like harmony between the cause and effect or between light and the Sun. Most philosophers also believe that the Creator precedes the world, just as the Cause precedes the Effect. This precedence lies, in essence, in the degree of dominance, and not in time.”<sup>75</sup>

In fact, Ibn Sina does not equate the World with the Creator, they are different. The Creator, if understood in the terminology of Avicenna as “Necessarily Existing” or Being (*Wajib ul wujud*), it is One, it is Eternal, it exists by itself, it is Absolute being and Absolute existence. And everything else, if it is understood in the terminology of Avicenna as “Possibly existing” (*Mumkin ul wujud*), then it is

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73 Avicenna. Rubai. // Рубаи Авиценны (Абу Али Хусейн ибн Абдаллах ибн Сина). См.: <http://www.moudrost.ru/avtor/avicenna-6.html>

74 Abu Ali ibn Sina. Selected works//Абуали ибни Сино. Осори мунтахаб. – Ҷ. 3. Душанбе. – Нашриёти “Ирфон”, 1985. – С. 153.

75 Abu Khamid al-Gazali. Tahāfut al-Falāsifah //Абу Хамид аль-Газали. Крушение позиций философов. – М.: Изд. “Ансар”, 2007. – С. 44.

created, it exists for a reason, and its existence does not come from the thing itself, but from another thing. All causes go back to Necessarily Being. All things come from it, just as, for example, the Sun shines by itself, and the illumination of all things is an accident due to it. But Avicenna makes such a clarification that the image of the Sun in relation to the world does not need to be taken literally. “This example (with the Sun) would be true if the sun existed by itself and by its very nature was light, but this is not so, for the light of the Sun has a subject, but the being of the Necessarily Existent has no subject and exists by itself.”<sup>76</sup>

Theologians accused Avicenna of not believing in Allah, not understanding the depth of his faith. Because he considered the world to be possible, that is, a being that never loses the possibility of existence. It is not a being that has no possibility of being.

Thus, “Sarmad” can express such a timeless state of being of the world, where it is merged with God. But not in the physical, objective world. Another understanding of this term is “eternal” (like “abad”). In modern perception, the term conveys meaning as the most absolute form of time (where being comes to eternity). Thus, summing up, we can say that time is the quantity and measure of the movement of bodies (material).

Accusations of Abuhamid Ghazali, Ibn Sina and his fellow philosophers on dualism, according to Muso Dinorshoev, a modern researcher of Ibn Sina’s work, are based on ignoring or extremely inadequate interpretation of several of the most important points of the teachings of peripatetic philosophers, especially Ibn Sina’s teachings about the eternity of the world. The fact is that Ibn Sina distinguished three forms of eternity: 1) “Sarmad” or Sarmadian, 2) “Dahri” or Dahrian and 3) “Temporal (eternity)”. This concept of Avicenna was developed more broadly in the work of subsequent philosophers of Iran (Mir Domod and others in following centuries). So, according to this theory, “Sarmadian” eternity is the duration of the existence of a self-sufficient and self-identical Eternal Being (i.e. Allah), covering both the Dahri and temporal duration of existence, but not being reduced to them. “Dahri” eternity is the duration of the existence of immutable (absolute) and changeable beings. What concerns “Dahr” – is covered by Sarmad and covers time but is not reduced to time. Time is the duration of being of only changeable things, embraced by “Sarmad” and “Dahr”. Thus, “Sarmadian eternity” is an attribute of the Absolutely Eternal. He is super-eternity, Dahri eternity is the quality of immutable and changeable beings, and temporal eternity is relative eternity – it is the eternity of changeable things.<sup>77</sup>

So, according to this theory, the concept of time developed by Avicenna does not oppose the monotheistic approach of Islam, but at the same time opens up the door for study of nature, the world, without diminishing its importance.

So, in the teachings of Ali ibn Sina and his followers on the physical and philosophical characteristics of nature (about time and space, about their relative nature), one can find the philosophical/ideological prerequisites for the emergence of future physical and philosophical theories. Consequently, their theory of time and space is not reduced to subjectivist (for example, the philosophy of Kalam, Ghazali,

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76 Abu Ali ibn Sina (Avicenna). Danish-name // Abu Ali ibn Sina (Avicenna). Collections, Vol 1. 2005. Dushanbe. Donish. 2005. P. 329-330. // Абу Али ибн Сина (Авиценна). Данишнама // Абу Али ибн Сина (Авиценна). Сочинения. Том первый. 2005. Душанбе. Дониш. 2005. С. 329-330. [«Это пример (с Солнцем) был бы верен в том случае, если бы Солнце существовало само по себе и само по своей природе было светом, но это не так, ибо свет Солнца имеет субъект, а бытие Необходимосущего не имеет субъекта и существует само по себе»].

77 Dinorshoev M. Abu Hamid al-Gazzali and his “Refutation of Philosophers” // Диноршоев М. Абу Хамид Ал-Газзали и его “Опровержения философов”. В кн. Абу Хамид Мухаммад Ал-Газзали. Опровержение философов. Пер. с арабского, вступительная статья и комментарий М. Диноршоева и З. М. Диноршоевой. – Душанбе, 2008. – С. 62–64.

etc.) and substantial concepts that were widely used in antiquity, during the life of Ibn Sina, and are also not reduced to substantial theories of time and space, which arose later, theoretically formalized and supported by such scientists as Isaac Newton (in whom time and space are considered as vessels in which bodies and things are located). No matter how surprising it may seem, Avicenna's concept of time and space, expressing the objective properties of material bodies, is associated with the theory of relativity (time and space do not exist independently, they are only attributes of material bodies) and is conceptually close to Einstein's theory of relativity, the theory of time and space, offered in the 20th century.

## Conclusion

Thus, based on the analysis of the works of Abu Ali ibn Sina, one can be convinced that in his natural science works (dedicated to nature – “Taboe”-physics) Ibn Sina:

1. Does not support the theory of “indivisibility”, or indivisible particles (atoms), and of the subjective instruments of the “eternal creation of the world” from atoms, proposed by the Mutakallims;
2. Also, in a discussion with Abu Reyhan Beruni, Avicenna admits a plurality of worlds only if the nature and properties of these worlds are the same, as in the world that we observe.
3. Asserts that movement is a measure of time and an attribute of things. Time does not exist separately from things; it does not have an autonomous form of existence. According to his teachings, there are the following forms of movement, space, and time:

A) Avicenna gives a classification of the forms of movement. Forms of movement – quantitative, qualitative, potential, kinetical, circular (periodic), voluntary / involuntary, movement of the soul, movement and peace or advancement (“*junbish*”), random, volitional, natural, etc., spiritual (*nafsi*), the movement and the rest, (harakat wa oromi), harakati arazi, kasri, tabi);

B) For Avicenna, space, like movement, does not have a substantial status, so, it is just a characteristic of material bodies. Space, with all its types and differences, covers the surface (*macon-fazo*), varieties of places (*budhoi on-* the corners of it), but does not have an independent existence, but coincides with the boundaries of the objects themselves, their volume.

C) Avicenna defines and asserts that time has an objective character, it is inseparable from the movement of bodies. The definition of time is following – time is a measure or amount of movement. The classification of the category of time, such as moment, past, present, future, existing always (извечность (*azal*), eternity (вечность (*abad*), existing before the eternity (предвечность (*Sarmad*)-the forms of eternity (*azaliyat*, *abadiyat*, *sarmadiyat*) can provide food for future research. Sarmadi eternity is an absolute form of existence, it covers all forms, and has its form of eternity which based on condition of permanent and eternal possibility. Ibn Sina's position on the issues of movement, space and time, the eternity of the universe in time, his use of the terms “al-on”, “*dahr*” and “*sarmad*” in relation to the continuity of time, along with the Necessary Existent (*Wajib al-wujud*) – are an innovation in understanding the category and phenomenon of time in the philosophy of the Islamic world. So, time determines the measure of movement, and movement determines the measure of time, this is their interdependency, their difference and commonality.

From the proposed studies of the philosophical and natural scientific views of Avicenna, it becomes obvious that the philosophy of nature of Ibn Sina is continuing the concepts of Aristotle, but is not reduced to them, that it is original in terms of developing new theories, for example, movement as a theory of inertia, the strengthening of the concept of the relativity of time and space, the concept about the eternity of time and the eternity of God, the concept of sarmads, etc. They characterize his contribution, in contrast to Aristotle, and are of particular importance for Islamic culture. They touch upon the nature of infinity and testify that Ibn Sina, as a Muslim, could not ignore the concept of eternity and other Islamic values.

Historians of philosophy and religion often say and write that Ghazali's criticism of the philosophy of Avicenna and other Muslim philosophers was decisive and caused a crisis of philosophy in the Muslim world. In fact, this is not true. Philosophy, even in the form of Aristotelianism, was preserved and developed rapidly in Iran after Avicenna (Nasiruddin Tusi, Bahmanyar and others) and Ghazali. In addition, the fact is that Ghazali's arguments were mainly based on religion and theology, partly on formal logic, and not on a scientific and philosophical basis. Such accusations, for example, of *bidya* (innovation) or *kufr* (blasphemy), always accompanied philosophers and scientists in medieval society, where religion ideologically dominated. Yes, he also pointed out some of their logical inconsistencies. But the objections or refutations of philosophy, allegedly committed by Ghazali, in general, come down to the fact that "philosophers are in a deep internal split, that they refute each other, for example, Aristotle criticizes his teacher Plato; that allegedly "there is no central support pole in their school and therefore it is simply impossible to master their teachings masterfully ...", etc. But in fairness, is it possible to demand from all philosophers and scientists to be followers of the same teaching? Perhaps in a particular religion or school this is possible, but in philosophy in general it is not. But Ghazali's main objection is this: "They [philosophers] have not been able to fully master any of the Divine sciences," that "theological questions do not obey the method of logical evaluation of mathematical analogies."<sup>78</sup> Here he is right. But was it really the main motive of scientists and philosophers to "master the divine sciences and subordinate theological questions to mathematical analogies"? Of course, not. It seems to us that, even being sincerely believing Muslims, they were using theologian language engaged in the construction of an intellectual bridge, forcedly, otherwise they could not have engaged in science and philosophy in that era. Because then, in a society where religion dominated unilaterally, it was necessary to create an open field (at least as islands) for philosophy and science. In so doing, Ibn Sina made monotheism stronger, using his intellectual capacity. He and his followers created philosophical God, developing monotheism towards creating of philosophical monism (as in case of Spinoza and Hegel).

In Ibn Sina's theory on the philosophy of nature, in his concepts of atom, multiplicity of the world, the theory of space and time, it is important to mention that, using the arguments of the philosophy of his era, he sharply criticizes the ideas about the substantial nature of time and space. So, Ibn Sina advocates relativistic theory and concepts of space and time. All this makes it possible to use the works of Ibn Sina to create new discussions on specifics of new scientific theories, as well as to conduct modern scientific discussions on these complex issues of physics and philosophy. There is no doubt that Aristotle had a great influence on the medieval philosophical thought and science of Muslims. As we noted earlier in the period of the Western European Middle Ages and during the European Renaissance, the influence of Eastern thinkers, Muslim Peripatetics (like al-Farabi, Ibn

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78 Al-Ghazali. *Tahāfut al-Falāsifah* // Газали. Крушение позиций философов. Пер. с арабского. – М.: Изд. дом "Ансар", 2007. – С. 13–14.

Sina etc), Sufis and rationalist theologians (representatives of Kalam) on European culture, religion and philosophy had an effect as powerful, and perhaps even more powerful, than the influence of Aristotle's heritage on culture of the Muslim East. Our conclusion is that people and cultures often complement and give impetus to the further development of each other – the works of Abu Ali ibn Sina confirm this. But our main conclusion is that the peaceful interaction and cooperation of people is the source of any development, starting with the promotion of the quality of intelligence and ending with the rise of the economy and the well-being of mankind. Intellectual dialog of the cultures and civilizations is more important nowadays than ever in the history of humankind.

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