# ON THE INTERRELATION OF MATHEMATICS, PHYSICS AND PHILOSOPHY

**Ikhlov Boris**
**Perm State National Research University**

**Abstract.** The key points of the teachings of the Pythagorean school are considered. Using concrete examples from the theory of oscillations and celestial mechanics, a radical difference in research methods in both mathematics and physics is shown. An assumption is made about the pos- sibility of the existence of new world constants that do not have dimen- sions, associated with time and with a number of fundamental interactions.

**Keywords:** World constants, methodology, frequency, planets

## Introduction

The fact that mathematics was created in view of the urgent problems that stood in ancient times, is indicated by Gaidenko [1]. Using geome- try, we calculated areas and volumes, using arithmetic we calculated the price of bread, wages, and mathematics was needed during construction. Among the Egyptians and Babylonians, mathematics acted as a means, the Pythagorean school turned mathematics into a separate subject of re- search, Gaidenko notes.

Such a transformation is an objective process of ascent from the con- crete to the abstract. Physics is similar with the introduction of integro-dif- ferential notation, completed by Leibniz and Newton, with the discovery of Kepler's laws and further the Hook-Newton law of universal gravita- tion, etc. divided into experimental and theoretical. "Theoretical physics," Landau remarked to experimenter Joffe when discussing the quantum tunnel effect, "is a complex subject, not everyone can understand it." Nevertheless, the priority remains for experimental physics. So, Peierls and Landau theoretically proved the instability of two-dimensional lat- tices, the impossibility of graphene, but graphene was obtained. For in the dialectic pair "practice - theory" practice is primary, determining. Yet Holmes's question to Dr. Watson, why astronomy is needed in everyday life, is not trivial.

It would seem that cosmology, astrophysics, the detection of gravita- tional waves, for which more than $ 200 million were spent only in the last project, are of purely cognitive value. However, all these disciplines are connected with the rest of physics; their methods are used both in hydrodynamics and in solid state physics. Thanks to celestial mechanics, tidal power plants were built, cosmology and astrophysics give answers to questions about the already close relocation from the Earth, if in the next centuries the rate of expenditure of Earth's resources does not slow down, after 200 years the world's population will be without resources. The Moss- bauer effect has long been presented as a purely academic study. Today, this effect is used even in agriculture.

As Marx said, in science there is nothing but its practical application. On the other hand, Marx is right conceptually, but not situationally. Otherwise, the world would not have known astronomy. It would not have occurred to Aris- tarchus of Samos to propose a heliocentric system of the world and to deter- mine the distances to the Sun and the Moon and their sizes. And the point is not only that cognition cannot be limited by the economy. In order for Galileo to renounce his claim that the Earth rotates around its axis, they tortured him so that they carried him to a place of renunciation on a stretcher, Giordano Bruno was burned at the stake. Science, the process of cognition require rejection of dogma, they reflect not only a utilitarian, but also a worldview aspect. No tricks and twists can obscure the fact that scientific data on the origin of the Universe and the origin of life on Earth, Darwin's theory and the synthetic theory of evolution built on its basis directly refute religious writings. Today, unsolved problems in number theory, the hypotheses of van der Waerden, Collatz, Erdös, the problems of Warring, Goldbach, etc., seem- ingly, are separated from the immediate needs of mankind. Nevertheless, substantial funds are being invested in solving these problems.

But Pythagoras and his students did not simply ascend from the con- crete to the abstract, they unilaterally, exaggeratedly raised one of the fea- tures, sides, faces of knowledge into absolute, they wanted to explain from the nature of everything that exists. Mathematics is methodologically sepa- rated from nature, in the mind of the Pythagorean - it loses touch with it. Then mathematical abstractions are put in the basis of matter as primary. Engels argued, for example: "Mathematical infinity is borrowed from reality

... and therefore it can be explained only from reality, and not from itself, not from mathematical abstraction. [2].

This article is not so much a criticism of mysticism in the spirit of Nordau as an attempt to present the reverse process: the ascent from the abstract to the concrete.

**Scientific laws and mysticism**

The laws of physics are not applicable in history, the laws of biology in chemistry. On the other hand, physical laws in the field of quantum chemistry explain some chemical processes, if experimental data are used, other physi- cal laws are used in biology (biophysics, bionics). In the last century, it was discovered that the same differential equations (Belousov-Zhabotinsky, An- dronov) describe hydrodynamic processes, chemical reactions, and even bio- logical systems. Synergetics encompasses all of nature; catastrophe theory is able to predict the situation on commodity and financial exchanges. Similarly, the theory of probability that arose in the 17th and 18th centuries describes physical, chemical, biological, and social processes. And, although the higher forms of motion of matter are not reducible to the lower ones, mathematics is a reflection ofall nature, its laws, and general necessary connections.

The only thing that mathematics cannot describe is the individuality of a person. For the reason that physics, chemistry, biology deal only with repeatable phenomena. In view of this, Aristotle did not see (in theory) a significant difference between Callius and Socrates [3]. The doctor does not treat Callia and Socrates, he treats the general in their organs, not with a specific disease, but something averaged.

The number is not contained in the substance. At the same time, it is common to various substances, manifests through them, does not ex- ist separately from them. Substances are not identical to each other, two metal balls are identical, as if it is impossible to summarize in view of their incomplete identity. Mathematical abstraction is distracted from insignifi- cant differences, highlighting the general. Aristotle, one of the founders of dialectics, did not yet understand the dialectics of the singular and the general, that the essence is not separate from things, because he believed that the individual cannot be the subject of knowledge. But precisely for this reason, the basic social laws cannot be described mathematically. For example, the value of the goods is tangible (see [4]), i.e. exists objectively, regardless of the consciousness of the individual, but is not immanent to the product, like mass or charge, it exists only in the heads of people. Therefore, social laws are manifested only as trends, potential opportuni- ties that may not be realized [5].

For example, there is a tendency to centralize capital, expressed in globalization, but it runs into the opposite centrifugal tendency, expressed in the growth of nationalism. Another example - the war of the poor South with the rich North predicted in [6] was expressed not in a clash of armies, but in the ugly form of Islamic fundamentalism. At the same time, the typi- cality, identity of “uniqueness” is expressed not only in ethnic, national,

state forms or in forms corresponding to the manipulations of the mass consciousness, but even in identical fragments of verses that are not cita- tion. If the former is expressed in the formulation of Marx tied to the existing mode of production, that personality is a concrete totality of social rela- tions, the latter is an independent phenomenon.

The distinction between the Pythagorean half-pass and Aristotle's ap- proach to mathematics is not reduced to worldviews, it concerns the way of thinking, methodology.

One of the justifications of the materialistic method in mathematics is the history of its origin. The history of numbers begins 5 thousand years ago in Egypt and Mesopotamia, when animal husbandry and agriculture are developing. The founders of the special designations of numbers are considered the Sumerians, I - II millennium BC. The Indian positional num- ber system, which Europe became acquainted with thanks to the Arabs, made it possible to record numbers using ten digits. In the Persian era, which began with the reign of Cyrus, a special symbol appears for zero, until this time the smallest number was one, and for Pythagoras too. In the III century BC Archimedes and Pythagoras substantiated the concept of infinity of a natural number. Pythagoras was one of the first to give the number an independent existence separate from matter. He created the philosophy of numbers, turned upside down the history of the emergence of numbers. The Pythagoreans “recognized the mathematical principles for the beginnings of everything that exists,” Aristotle noted [7]. Pythagoras believed that “all things are numbers,” numbers are ultimate, the primary basis of the world, because they are present in the living, and inanimate, and in the earth, and in the sea, and in heaven. This discourse in its un- changed form has survived to the present day, a variety of authors argue that, since the number is invariably present in completely different chang- ing things, being a single basis, the number can be considered the begin- ning of the world. Among the adherents of this direction of the Pythagorean school, it comes to funny things, they believe that the interaction of inde- pendent numbers among themselves leads to a variety of things, the whole natural world is built of numbers, the world of spirit is reduced to number: love and friendship are identified with the figure eight, justice with multiple numbers. Thus, the whole world is a consistent deployment of an ideal en- tity - numbers. That is, various specific numbers endow with supernatural, magical properties, both in the era of Pythagoras and to this day: 5 - the number of happy marriage, in Judaism 7 - the number of luck, prosperity, 666 - the number of the devil, etc., the sum of the numbers date of birth supposedly determines fate.

The logical conclusion of the discourse - at the curiosity level, they say that the positive nucleus of an atom has a negative nucleus inside, a nu- cleus in the nucleus, in the form of a complement to the whole, to unity, the numerical axis in the sum and in the product of all members is equal to one, since it was born like a world from one, etc.

Moreover, the philosophy of Pythagoras was not something abstract, a certain game of the mind. His doctrine of harmony had a clear political goal
- to put the demos in complete submission to the power of the aristocracy. The worldview, morality of Pythagoras is the worldview and morality of an aristocrat. Each member of the Pythagorean Union was required to follow virtue, and among virtues - the virtue of obedience. In one of his Golden Poems, Pythagoras writes: "First of all, honor and love gods, heroes, crea- tures, between gods and heroes, but don't ask them for anything in your prayers, you yourself don't know what is good for you, it's but only they know".

For Pythagoras, the number 7 connects a person with a deity, since 3 is a deity, and 4 is a person.

We owe the Pythagorean teaching a theorem on the connection of the sum of squares of legs with the square of the hypotenuse in a right-angled triangle, the theorem on the sum of the angles of a triangle, distinguishing even, odd and even-odd numbers, studying the motion of celestial bod- ies. But, as we see, the significance of the Pythagorean school is far from exhausted. Quantitative abstraction was opposed to nature, arose as a system of mysticism of numbers. Instead of a moving, diverse, developing nature, the Pythagoreans have empty, devoid of movement abstractions. According to Pythagoras, the body for the soul is something random [8]. The teachings of Pythagoras, Architus, Eudoxus, Philolaus, as an attempt to idealistically comprehend the quantitative side of nature, became the basis of the Plato system.

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The teachings of Pythagoras, Architus, Eudoxus, Philolaus, as an attempt to idealistically comprehend the quantitative side of nature, became the basis of the Plato system. Mathematical symbols do not exist either in objects or outside them, they do not precede being. Symbols are the re- sult of abstraction, highlighting in the subject of its certain side, the rest is discarded.

But does the common exist only in the form of similarities of many in- dividual objects, only as one of the parties, separately only in the human head, in the form of a symbol? - asks a question Ilyenkov. And he answers: in fact, such a formulation of the question does not abstract the side, but the whole thing, pulls it out of its physics, its history. General - is a clan relationship in the objective world.

Is the singular in the sense of development as an ascent from the sim- ple to the complex and from the lowest to the highest? Yes, if it itself is a minimum is a special variety.

The "Pythagorean" type of thinking is seen in Eckhart, Boehme, Jung, Aurobindo, James. Physicists are engaged by no less than journalists, along with interpretations within the framework of various expositions of the Copenhagen concept, there is also a mystical version of the quantum mechanics of Eddington - Jeans - Schrödinger - von Neumann in the spirit of primitive subjective idealism of Hume - Berkeley. In attempts to create a unified field theory, in the theory of gravity, a whole direction, represented, for example, by J. Wyndham, J. Wheeler, etc., is associated with an at- tempt to put geometric symbols at the basis of the world, replace dynam- ics with geometrodynamics, quantum fluctuations of matter with quantum fluctuations of the metric space.

Space-time is eternal and unchanging, Plato believed. The concept of empty space having its own being goes back to Thales, Anaximander, Leucippus, Democritus, Epicurus, Lucretius Carus. Galileo, Descartes, Hobbes, Newton affirmed the concept of substantial, absolute, indepen- dent of the subject of time. Hume, Mach considered space-time phe- nomena of consciousness, Augustine - time. The connection between the material world and the space-time form appears in Einstein's theory: the greater the mass, the greater the curvature of space and the slow- ing down of time. The empty Minkowski space is formed by the material Higgs vacuum [10].

In Einstein's theory, the energy-momentum tensor defines the structure of space-time. However, in many scientific articles the opposite is true: material filling is adjusted to the chosen metric. As a rule, such articles contradict new discoveries in cosmology.

Similarly, the physical characteristics of motion are endowed with a mys- tical meaning: mass, speed, energy. Energy is separated from the carrier, “energy particles”, “energy fields”, and “pure energy” that do not exist in na- ture are used, just as information is separated from the carrier, the “infor- mation field of the universe" is created, information is recorded on some carriers up to the state of a healthy organism. Finally, quantum mechanics is used to justify the supernatural, which is why the EPR paradox and quantum entanglement are very useful. Although it is well known that the laws of mac- roscopic physics do not work at the quantum level, it is pointless to discuss the excess of the speed of light in the stretched wave packet of a system of quantum particles, to detect the influence of the future on the past, to state that information is transmitted not in matter with quantum entanglement, etc. Obviously, the connection between entangled objects exists, but cannot be understood within the framework of classical determinism. As Lenin said, causal communication, which we usually understand, is only a part of global communication. “Every movement includes a mechanical movement and the movement of large or smallest parts of matter ... But this mechanical movement itself does not at all exhaust movement” [11]. The quantum world does not have to be microscopic, but can extend a thousand kilometers.

If the origins of the mysticism of the Pythagorean school, first of all, are epistemological and only in the second, as we saw - social, now the decrease in the level of generalization to animism, fetishism, totemism is generated primarily by the collapse of the economy and only in the second, as a result - by a decrease in the level of educational qualification. These processes gave rise to an idea (e.g., A.P. Gurevich) of mysticism, i.e. about crowning, etc., as part of a spiritual culture.

**World constants**

The number of world constants with dimension includes the electron charge, Planck’s constant,

Boltzmann constant, speed of light in vacuum, electric constant (deter- mines the value of the peak of the process of emitting a virtual photon) and gravitational interactions.

In gauge theory, the coupling parameter g has the dimension $\sqrt{hc}$. The strong interaction constant has the same dimension. Finally, the weak in- teraction constant (Fermi constant) determines the value of the peak of the muon decay process. The cosmological constant and the Hubble constant are also referred to world constants, although the latter change during the evolution of the Universe. There are no restrictions to consider other di- mensional world constants changing with time. This hypothesis was first put forward by Henri Poincare in the early twentieth century.

For example, Australian physicists, led by theorist Paul Davis of Mc- Quare University in Sydney, suggested that when billions of light-years pass, the speed of light in a vacuum decreases. Astronomical observations showed that for the light from the selected quasar to reach the Earth, it will take about 10 billion years. In this case, the key constant characterizing the ratio of light photons and electrons on the quasar has changed, i.e. after 12 billion years of travel, the characteristics of light traveling from a quasar to the Earth do not correspond to those predicted by SRT This discrepancy can be explained either by a change in the charge of the electron, or by a change in the speed of light. It may turn out that 6-10 billion years ago the speed of light could be higher than now. From dimensional world constants such relations are obtained, for example, Planck radius or Planck time.

World constants that do not have dimensions include $\pi$ - the Archime- des number, the base of the natural logarithm of *e* (Euler or Napier num- ber), the Phidias number (golden ratio), and the Feigenbaum constants. Another world constant, a fine structure constant, does not have dimen- sionality, but it can be represented as a ratio of other world constants hav- ing a dimension.

Feigenbaum numbers are clearly associated with processes occurring in nature. These are universal constants characterizing an infinite cas- cade of period doubling bifurcations during the transition to deterministic chaos. First constant $\delta = 4,66920016...,$ characterizing chaos, sets the form of fractals associated with chaos. The second Feigenbaum constant $\alpha = 2,502907...$ is defined as the limit of the relationship between the width of the branches in the bifurcation diagram. This constant also arises in the description of many dynamical systems.

The Napier number stands out from the other bases of the logarithms in that $(e^x)' = e^x$.

The first to pay attention to the "harmonic" "division of the segments was Pythagoras. In 1509. Fra Luca Pacioli called this division the "Golden Section". The Phidias number corresponds to the homogeneity of space, the Archimedes number - to the isotropy of space in non-Euclidean geom- etry, they are transformed. So, by the Gauss-Bonnet theorem, the integral of the Gaussian curvature on a compact 2-dimensional Riemannian mani- fold is equal to $2\pi\chi(M)$, where $\chi(M)$ - is the Euler characteristic of the manifold. As Engels wrote, “a unit, no matter how it appears identical to itself, contains infinite diversity” [12].

Number theory is occupied by various numerical sequences, for ex- ample, Fibonacci numbers, curly numbers, Fermat or Mersenne primes, etc. The extension of the field of real numbers is complex, hypercomplex

numbers (quaternions, Cayley numbers or octaves), vector spaces. *p*-adic theory (expanding the field of rational numbers Q with the abandonment of the Archimedes axiom), which is used in quantum mechanics, as well as fractal geometry, with fractional dimensions and corresponding differentia- tion and integration, opens up wide possibilities for introducing additional world dimensionless constants. Fractional dimensions are expressed in probability theory.

The Euler number is related to such contradictory concepts as infinity and continuity; these very concepts connect it with the Archimedes number

via the Gaussian integral: $\int_{-\infty}^{+\infty} e^{-x^2} = \sqrt{\pi}$ - since the Archimedes number

can also be represented as the sum of the members of a numerical se- quence. The first Feigenbaum constant is elementarily expressed in terms

of the Phidium number $d = \Phi^{3/2}(1+\sqrt{\Phi})$. Thus, the first Feigenbaum

constant is not fundamental, and the Phidias number is also involved in the theory of fractals and the dynamics of chaos.

**Distinction methodologies**

Unfortunately, one has to pay attention not so much to criticizing sci- entific errors as to explicit engagement that is not related to science. For example, in the literature on the golden section, Butusov's article [13] is widely used. Butusov tried to explain from the numbers the trajectories and masses of the planets of the solar system. It is claimed that Butusov discovered the laws associated with the number of Phidias, and even quantum effects in the structure of the solar system, on the basis of which he predicted the parameters of the three supposed planets beyond Pluto. Butusov calculated that in the Earth's orbit at the libration point beyond the Sun there is another planet similar to the Earth. However, the STEREO satellites launched in 2007 observed the area of the Lagrange point and did not find objects there.

Butusov is also credited with the prediction of 10 unknown satellites of Uranus, they say that in 1974 he predicted the discovery of Sedna. In fact, the prediction of 6 new satellites of Uranus was made by two Soviet scientists who received a state prize for this. The orbits of the satellites are calculated according to their resonance model. And in 1973 no one predicted the existence of Sedna.

Let us give an example of a scientific methodology.

In a problem with two identical weights suspended on springs and oscillating synchronously, their frequencies $w_1 = \pm w_0\sqrt{1+\Phi}; w_2 = \pm w_0\sqrt{2-\Phi}$ are determined through the "partial" frequency of individual weights w02

= k/m … Thus, the eigenfrequencies of synchronous oscillations of the system of two weights are not one, but four, and all are proportional to the "partial" eigenfrequency of individual weights, some lower than it, others higher. The proportionality coefficient is expressed in terms of the Phidias number. A particular solution to the problem with three weights of different weights is given in [14].

A general solution with many identical weights connected by springs is given in [15]. A particular solution with many different weights (oligosomes in DNA) for the frequency of synchronous vibrations is given in [16]; the frequency of a spring pendulum in the form of a DNA helix is inversely pro- portional to the square root of the average harmonic mass of oligosomes. Now we give an example of a reverse, upside down, mystical methodol- ogy. It is presented in [17], where an abstract system of two equations is considered. According to the author himself, he allowed himself to "move away from any physical reality", however, he writes about oscillations with a set of frequencies. In fact, the equations under consideration correspond to oscillations of a system of two weights with different masses on springs. However, instead of its general solution, a solution is sought that would lead to the number of Phidias. With the same success, one could look for a solution leading to the Archimedes number or to the Euler number.

Similarly, in numerous publications, including in [ibid., P. 441], attempts are being made to detect certain resonances in celestial mechanics. And it's not just about trying to derive a formula similar to the Titius-Bode rule of thumb, according to which the radii of the orbits of all the plan- ets of the solar system except Neptune, the planets lie on the sequence $R_n = 0,4 + 0,3 \cdot 2^n$, where $R$ – the radius of the planet, $n$ – its number starting from Mercury. Researchers, not understanding the essence of the resonance model, are trying to attract the constructed empirical for- mula precisely to the Phidias number. Moreover, they are not confused that some planets fall out of the resulting structures, in which case it is claimed that they are "approaching" the resonance. Approximate non-integers are identified with Fibonacci numbers only by the coincidence of their integer parts, the resonance model itself is perverted, it is argued that for reso- nance it is enough that the rotation periods of the planets relate to each other as integers, even with decimal additions.

"Orbital resonance in celestial mechanics is a situation in which the pe- riods of revolution of two (or more) celestial bodies" are correlated as small natural numbers. As a result, these bodies periodically come together, being at certain points of their orbits. The resulting regular changes in the force of gravitational interaction of these bodies can stabilize their orbits. In some

cases, resonant phenomena cause instability of some orbits "(Wikipedia). Those. resonances either stabilize the upholstery or cause their instability.

In fact, the meaning of the resonance model is as follows.

If a particle rotates around the planet in 10 hours, and a satellite in 20 hours, this ratio is called a 1: 2 resonance. Every second passage, the particle meets the satellite, the influence of resonance accumulates, un- der the influence of the resonance satellite, the particle's orbit stretches, increasing ellipticity. For example, if the circulation period of one ring of Uranus is 6 hours, and the other 8 hours, these two rings have a common resonant orbit with a period of 12 hours, which with a ring has a resonance of 6:12 = 1: 2, and with a second of 8:12 = 2: 3. The Phidia number, Fibo- nacci numbers, as we see, are nothing to do with.

The Phidia number in the mechanics of the planets of the solar system appears only in the connection between the functions of the potential and rotational energies of the Earth's group of planets and giant planets, as a proportionality coefficient. And not the coefficient, but the connection itself indicates the features of their origin.

**Conclusion**

By Noether's theorem, the law of conservation corresponds to each continuous symmetry. The homogeneity of space corresponds to the law of conservation of momentum, conservation of angular momentum corre- sponds to the isotropy of space. From the homogeneity of time follows the law of conservation of energy, from the isotropy of time - the conservation of parity. Lorentz covariance implies the invariance of the convolution of the 4-momentum, gauge invariance corresponds to the conservation of charge.

It is possible that each symmetry corresponds to a world constant that does not have a dimension.

The group of time shifts corresponds to the Pauli matrices, which, in turn, are generators of infinitesimal rotations for nonrelativistic particles with a spin of ½.

At the same time, neither time nor gauge transformations or strong interactions have a dimensionless fundamental number. For time, even with some tension, the dimensional constant cannot be taken equal to $H^{-1}$, because other constants are tied to the classical world and are not funda- mental in non-Euclidean geometry. Perhaps the fact is that time, as a form of the existence of matter, already in SRT is "confused" with space through a fundamental constant, the speed of light. However, it is also possible that these constants are still awaiting discovery. Accordingly, by analogy with the second constant of Feigenbaum - new mathematics and a new under- standing of determinism.

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