



# Intergeospheric Geochemistry and Metallogeny in the Context of Wave Geodynamics



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## Abstract

The history of science has accumulated many hypotheses and theories about the development of the Earth. The dominant part of them uses the reduction principle (reducing the complex to the simple and the higher to the lower), ignoring the effect of emergence. The end of the twentieth century coincided with the awareness of the physical limitations of Euclidean space, the beginning of a new rationality, a serious transformation of science from a discrete-atomic (traditional) Platonic to a holistic resonant-field Aristotle, where the form of systems is of fundamental importance. In search of a new paradigm, we turned to elliptical notions of space; as a result, we created a holographic model of matter (GMP). The article contains the rationale for the resonant field theory of global tectonics of planets and the geodynamics of the Earth based on the ideas of modern rationality, including the principle of wave-particle duality, homeomorphism in combination with the GMP.

**Keywords:** Elliptical geometry; Wave-particle duality; Spatially closed dynamic structures; Electrets; Underground thunderstorm; Geochemical evolution of the atmosphere; Minerals; Metallogeny

**Abbreviations:** GTR: General theory of Relativity; CDS: Closed Dynamic Structures; MZ: Metallogenic Zones; MOR: Mid-Ocean Ridges

## Introduction

The goal of theoretical geology at each level of scientific rationality is the scientific provision of the planet's resource potential and the formation of the most integrative natural-scientific worldview. In the framework of classical rationalism of the XVIII century. (and the heliocentric system of the World), born of the works of Copernicus, Galileo and Newton on the eve of the Renaissance, as the geological data accumulated, a number of theories and hypotheses (to a large extent mutually exclusive) were developed on the development of the solar system and planets (P.S. Laplas, Elie de Beaumont, O. Fisher, O.U. Schmidt). In Russia, progressive ideas about the dynamism of the earth's crust M.V. Lomonosov. The pioneer of physical geology - I.V. Mushketov in 1889 began to organize permanent seismic stations in Russia. Despite the tremendous successes of science of the XVIII - XIX centuries. and the creation on its basis of technique, technology and, as a result, a new way of life of people, the limitations and inconsistencies of classical rationalism have been noticed for a long time (I. Kant, V.I. Vernadsky and others). In the 20s of the twentieth century. quantum mechanics grew up (A. Einstein, E. Schrödinger, V. Heisenberg, M. Born). The final step was carried out by creating the quantum theory of wave-particle duality (Louis de Broglie, C. Davisson, L. Jermer) with the principle of systemic uncertainty and the principle of complementarity.

Quantum mechanics does not deny the classical mechanics of Newton, it made it a special case for processes with a speed less than the speed of light, and the sizes are much larger than atoms and molecules.

Non-Euclidean geometries appeared in the works of N.I. Lobachevsky, B. Riemann, and the non-Euclidean nature of nature was first pointed out by V.I. Vernadsky. The analytical apparatus of Riemannian geometry was a powerful development in mathematics, and it served as the basis for the creation of the general theory of relativity (GR). The concept of the world as a hologram appeared about the fundamental discovery of the twentieth century - wave-particle duality. It belongs to physicists David Bohm and Karl Pribram, whose ideas shocked the stability of the classics. The next discovery of a group of scientists led by E. Aspect at the University of Paris in 1982 is also considered one of the most significant in the twentieth century. They found that, under certain conditions, elementary particles, for example, protons, are able to instantly communicate with each other regardless of the distance between them, which violates Einstein's postulate about the maximum speed of interaction, equal to the speed of light. Further, the wave idea of space-time was developed by N.A. Kozyrev Kozyrev 1951. M. Talbot, K. Hogan, M. Rhys, K. Skenderis and other scientists and philosophers Manankov. We came to

the necessity of creating a GMV in the early 70s when analyzing our “wrong” experimental results when creating materials of a new class of “sikam”, [certificate No. 92355] and creating the science of astro mineralogy with solitons and electrets in space and underground plasma (as a nonlinear medium), showing a connection with the geodynamics of earthquakes Manankov, 2016; 2018, 2014; Manankov, 2018.

### Modern resonant Field Theory of Geodynamics

The end of the twentieth century coincided with an awareness of the physical limitations of Euclidean space, a serious transformation of science from discrete-atomic (traditional) Platonic to a holistic resonant-field Aristotle, where the shape of the systems is of fundamental importance. But the Earth sciences and its methods, including mineralogy under high T-P conditions, astromineralogy, deep geoelectrics, seismic tomography, are developing, resulting in a complicated geosphere structure for continental, island arc and oceanic conditions. The effects of phase transitions in the main pyrolyte minerals have been established:

- i. The transformation of orthopyroxene (the elastic limit is  $6, 7 \pm 1$  GPa) into a high-density garnet polymorph - majorite at  $13.5 \pm 1$  GPa,
- ii. Phase transition of g-olivine to perovskite - magnesioviustite at 23.3 GPa,
- iii. The process of melting clinopyroxene at 75-80 GPa ( $\sim 2000$  km).

On this basis, many models have been built, in which two fault zones in the already three-layer mantle are identified, the possibility of separation of currents with separation of convection in the upper and lower mantles, as well as changes in the convection speed at a depth of 410 km and at a depth of 660 km, the selection of single-layer and two-layer convection. In search of a new paradigm, we turned to elliptical ideas about space, based on the ideas of B. Riemann's geometry, which was used to create the general theory of relativity (GTR). As a result, a holographic model of matter (SMW) was formed, where a torus acts as a space with a curvature. The shape of the torus in the Euclidean space is represented by the convolution of the right circular Clifford cylinder in the Riemannian space. It is significant here that the Clifford cylinder is interpreted as a Euclidean plane, therefore the geometry of the torus is the most adequate mathematical apparatus for describing the closed dynamic structures (DPS) of various hierarchical levels. Our model does not deny the essence of the approaches from the perspective of Euclidean Principles, it turns them into special cases, as it happened in general with I. Newton mechanics in the framework of A. Einstein's quantum mechanics. In this article, from this point of view, the capabilities of the geodynamics of the Earth, whose geoid as a complex megasystem, includes all the geospheres of the planet, as well as its application for the geochemical evolution of the atmosphere, are shown.

The transfer of matter in the torus space occurs along closed trajectories when the torus rotates the inversion from the outside to the inside and from the inside to the outside. Such a transfer causes the nucleation and growth of the internal coordinated closed spaces (geospheres) and allows (taking into account the change in the size of the geoid) to simulate the dynamics of continental drift. As a result, a central, relatively compact, but most difficult core of the planet due to the vortex separation of matter was formed during the first 500-600 Ma. The core of the planet, which in the limiting case of symmetry, can have a close to spherical shape and heterogeneous composition. The structure of the central part (in any case) and the gravitational-kinetic interaction in the system determine its unambiguous correspondence with the structure of the upper shells of the planet, as well as the ongoing and ongoing emergent transfer of matter and energy, capturing both internal regions and surface arrays (subduction, spreading, continental drift) as well as upper geospheres. From the position of elliptical geometry, the traditional theories of the Earth's formation are not quite correct, because they do not take into account the kinetic features.

The nature of the motion of matter at the initial stages of accretion must correspond to the structure of the closed space formed by the parallel transfer of torus surfaces, as a result of which the condensed body is formed in the form of a polar or Equatorial torus. Equatorial Thor protoplanetary substances evolve, forming topolcianky Central (the Sun) polar tor. In accordance with this, the formation of planets in the closed toroidal space of the Solar system, according to this concept, is separated from the appearance of the Sun for a significant time period. The set of real flows of protozemals in the form of an Equatorial torus retains its helical character in the formation of a compact polar torus, the product of the evolution of which at a certain stage is the planet Earth. Structuring of spatially closed objects, i.e. having quite definite boundaries, is connected with interference of wave oscillations of different nature. Thus, in a body with a shape close to spherical, which is a planet, elastic waves of arbitrary direction as a result of multiple reflections from the surface turn into tangential, propagating in opposite directions. The presence of two traveling waves predetermines the formation of standing waves with areas of compression and stretching (Figure 1). In this case, the source of excitation of oscillations, endogenous activity or gravitational external influence, is not so important, the position of these areas is determined mainly by the geometry of the sphere and is manifested in two global structures:

- i. Stretching of the ocean floor and the formation of the basalt oceanic lithosphere (COX).
- ii. Lineaments under the action of compression forces.

The addition of oscillation used in the method of W.A. Lissajous. The shape of the Lissajous figures depends on the relationship between periods (frequencies), phases and amplitudes of harmonic oscillations. In the simplest case, the equalities of both periods of the figure are ellipses, which, with a phase difference

of 0 or  $\pi$ , degenerate into line segments, and with a phase difference of  $\pi / 2$  and equal amplitudes, they turn into a circle, called circularly polarized figures (Figure 2). If the periods of both oscillations are close, then the phase difference varies linearly, as a result of which the observed ellipse is deformed all the time. The slightest deviation from the condition of the frequency multiplicity of orthogonal oscillations leads to the transformation of Lissajous figures into unstable objects (Figure 2). If the ratio of the periods is a rational number, then after a period of time equal to the least

multiple of both periods, the moving point returns to its original position again, and with the point's velocity vector coinciding with the original, the result is closed trajectories. If the ratio of periods is an irrational number, then open paths are generated. Lissajous figures fit into a rectangle whose center coincides with the origin, and the sides are parallel to the coordinate axes and are located on both sides of them at distances equal to the amplitudes of the oscillations.

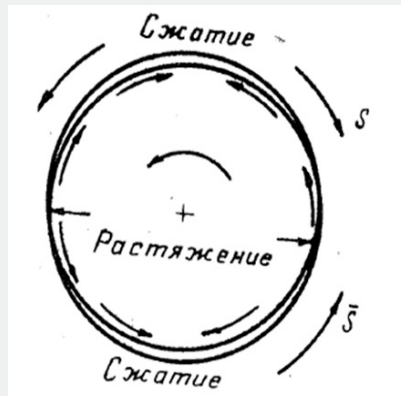


Figure 1: On the formation of tangential standing waves of latitudinal direction.

S - Traveling wave.

$\bar{S}$  - Traveling oncoming wave.

$\pi \cdot D = n \cdot \lambda / 2$ , where  $\lambda = \sqrt{E} \cdot T / \rho$ .

D is the diameter;  $\lambda$  is the wavelength.

E is the modulus of elasticity.

$\rho$  is the density.

T is the period of oscillation.

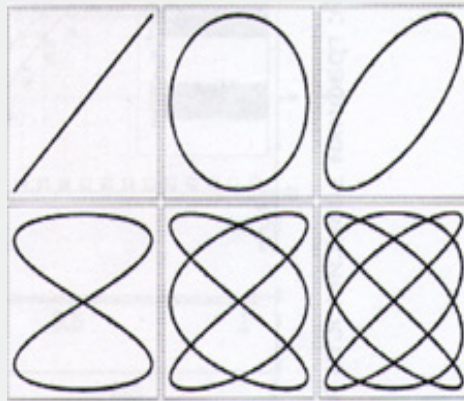


Figure 2: Forms of Lissajous figures when adding two mutually perpendicular harmonic vibrations.

Mathematical expression for Lissajous curves

$$x(t) = A \sin(at + \delta)$$

$$y(t) = B \sin(bt),$$

where A, B are the amplitudes of the oscillations; a, b are frequencies;  $\delta$  is the phase shift.

The earth's crust, like other geospheres, being bounded on both sides by a substance with sharply different dispersion properties, is a waveguide for tangential seismic oscillations. The directions of movement of its plates correspond to at least two successive turns on the surface of the polar torus, manifested in the Cenozoic in the form of continental groups and two systems of oceanic faults [1-5].

### Trigger Effects

The concepts of trigger effects developed in studies of the formation and development of the geodynamics of the lithosphere encompass a wide range of phenomena considered by tectonophysics, geomechanics, geodynamics, planetology, petrology, geochemistry, and other sciences. But such approaches are not yet properly implemented. The empirical connections of magmatism and mineralization in most cases have exhausted their capabilities and do not help to isolate metallogenic taxa of various ranks, therefore, under the influence of mobilistic hypotheses, models of magmatic and ore formation are actively developed in connection with plume tectonics. The lack of ideas is due to the fact that the place and mechanism of energy generation for plumes has not changed for a long time. These were convection-plume foci in the "subcrustal substrate". For more than half a century of the space age, man learned about the structure of the Earth much more than in the entire previous history. A need and opportunity have emerged to develop on a modern scientific basis a conceptual theory of the geodynamics of the Earth, an alternative to convection-plume. Trigger effects set and projected for the first hundred years of studying the drift of the plates.

**i.** Seismotomographic models made it possible to clarify the deep Petrology of the geoid at depths up to 310 km. At a depth of 100 km, the upper mantle is heated under the boundaries of the plates, and especially under the COX (where seismic velocities are low). On the contrary, under the continents

**ii.** The upper mantle is cold. At a depth of 310 km there is no correlation with surface tectonics. The amplitude of anomalies below 300 km is significantly reduced. In subduction zones, seismic velocities are increased (cold plates are immersed in the mantle). Only SOH is still a slower speed.

**iii.** In the process of spreading through the rift zones of the geoid, basitic magma rushes to the surface, creating mid-ocean ridges (COX) and there is a pushing of the young seabed sections lying on both sides of the trench (divergence).

**iv.** Along island arcs and continental margins, linear signs of compression and subduction (subduction) of oceanic plates of the lithosphere to depths of at least 700 km (convergence) are assumed.

**v.** Within the active structures of the lithosphere occur earthquakes, volcanic eruptions and juvenile removal of fluids with ore (black, gray smokers) and hydrocarbon (white smokers) components.

**vi.** When high-speed tectonomagmatic phenomena, followed by a release of huge masses of seismic energy ("underground storm"), as a result of the dispersion and phase transitions in minerals, the rocks are generated by electric radiation and anomalies: (lightning, Catatumbo), electromagnetic (plasma sprites, St. Elmo's fire) and low frequency (below 25 Hz) acoustic (sound of Whistler, triboluminescence, sonoluminescence).

**vii.** The influence of wave processes excited by strong catastrophes on the state of the surface atmosphere was Found: before the earthquake in the form of anomalous aerosol fields, resulting in heating of the atmosphere and a sharp change in its parameters. And after disasters – necessarily concomitant cold snap with progressive growth, which develops the law F. Omori 1984

**viii.** Lowering the temperature of the atmosphere can be determined by the amount of oxygen, and the decrease in its energy is due to the removal of energy from the tectonosphere. It is estimated that this effect is not small, especially in conjunction with the effect of emanation from the active zones of the planet impressively huge masses of dusty plasma, carbon oxides, nitrogen, and sulfur. Their number should be considered in the Geology of sedimentary facies and the atmosphere, as well as in the assessment of these pollutants in the formation of the greenhouse effect and global warming.

### Electrets, Underground Thunderstorms and Global Warming

In recent years, a deep study of dust and gas clouds in the atmosphere, the properties and processes occurring in it from the point of view of nanoscale physics. A model describing the processes of motion of fine dust particles in the plasma of dusty atmosphere from the position of the wave theory is created and the possibility of the existence of dusty sound solitons in it is shown. Registered pollutants are dielectrics capable of long-term polarization to become a source of electric field, called electret. The theoretical prediction of electret in nature was made by the English physicist O. Havisaid in 1896, and their experimental discovery was made by the Japanese physicist M. Eguchi in 1920, he also proved their relevance to the new technology. Among the electrets established the following genetic types: mechanoelectrets, termoelectrets, electroelectrets, photoelectrets, radioelectrets, triboelectrets and plasmoelectrets. According to the structural characteristics of the electret belong to different molecular groups of dielectrics: 1 group –  $N_2$ ,  $H_2$ ,  $O_2$ ,  $CO_2$ ,  $CH_4$ ...; the second group –  $CO$ ,  $SO_2$ ,  $H_2O$ ,  $NH_3$ ; the third group – inorganic dust. According to these groups, there are three types of polarization. The measure of polarity is a physical quantity called the electric moment. This parameter is an important parameter of electrets, it is also responsible for the geometric structure of molecules. Thus, the  $CO_2$  molecule is nonpolar, and the  $SO_2$  molecule has the electric moment of the dipole. This means that the  $CO_2$  molecule has a linear structure, and the electrets of  $SO_2$  molecules have angular structure.

The investigated number of substances has been studied for a long time, and not by chance. It began with the discovery of explosives and smoky (black) gunpowder. The latter consists of a fine mixture of three substances: coal, sulfur, and potassium nitrate (nitric acid salt), Under the action of a spark in a closed volume, this mixture explodes, and this is a model of an underground thunderstorm. Nitric acid is formed by reaction of

nitrogen dioxide with nanocapillary water squeezed from the compacting of the rocks. This process is studied experimentally. From the theoretical sphere of the main electrets rapidly moving into a new technique. Thus, CO<sub>2</sub> lasers are among the most powerful lasers. Now in their family already seven types of. Sulfur as photoelectret widely used in Electrophotography. The emergence of, for example, seismotomography determined the transition of Geophysics and geodynamics to a new level. In the mid-80s deep geodynamics was born, which became the youngest and most promising direction in Geocology and in General in the earth Sciences.

### Two genetic types of metallogenic zones in wave geodynamics

There are not many publications in which the achievements of the theory of tectonics of lithospheric plates would be sufficiently fully used in analyzing the metallogeny of the well-known mining provinces of the World and clarifying the genesis of many types and known mineral deposits. Among foreign publications are the books of Mitchell M & Garson M 1984, Sillitoe R 1974, F. Saukins, P. Lazniski. In Russian literature, these are the works of Zonenshayn P 1976; Dobretsov NL 1980; Sorokhtin OG 1985, 2010; Kovalev AA 1978, 1994; Kovalev AA, Leonenko EI 1992,1993 et al. An obvious systematic flaw is the presence of two metallogenies, i.e. endogenous and exogenous. Until recently, there is a perception that endogenous minerageny is very far behind the level of exogenous minerageny. It seems to me the situation is different. Mineralogs and petrologists led by Acad. D.S. Korzhinsky created a scientific foundation of acid-base interaction, mosaic equilibrium for open systems, which has not yet been assimilated, including by hypergenic tectonists. And the desire of petrologists, beginning with Baddington, Groot, to link the features of mineralization with the petrography of magmatites turns out to be unpromising. It is necessary to know the features of all objects, including the composition of magmatites, the degree of their contamination, the role of host rocks, their composition, age, tectonics, and their

dynamics in the geotectonics of the territory. For more than half a century of the space age and the achievements of experimental mineralogy, man learned about the structure of the Earth much more than in the entire previous history. A need and opportunity have emerged to develop on a modern scientific basis a conceptual theory of the geodynamics of the Earth, an alternative to convection-plume. In this report, within the framework of the modern theory of resonant field geodynamics, the wave-particle duality is analyzed and features of the distribution of ore and hydrocarbon metallogenic belts, their types and deposits in spatially closed dynamic structures are established.

Our distant ancestors did not even guess what the planet looked like. In ancient philosophy, there are several "first" who have declared that the earth is spherical and that its place is in the middle (of the whole). According to various sources, this is Anaximander of Milles or Pythagoras, or Parmenides, or Hesiod. Representations of the ancient Greeks from the VI. BC. about the universe with a spherical Earth in the center summarized in the II century Alexandrian astronomer Claudius Ptolemy. Isaac Newton concluded that the Earth rotates and is under the influence of inertia. This force is great at the equator, but absent at the poles, so the Earth, according to Newton, was not a sphere, but a compressed ellipsoid. Scientists are divided into two camps - the British were for the "flattened" Earth, the French - for the elongated. The earth is a sphere and it spins - these are two fundamental facts from the establishment of which the science of the Earth began. In 1872, the German mathematician I. Listing called the shape of the Earth "geoid", which means "earth-like." The name is very capacious: no matter how the ideas about the shape of the planet change, the "geoid" will always be. In 2011, scientists built a very accurate geoid model using the GOCE probe information; according to new data, it was updated already in 2014. From the position of resonance field geodynamics developed by us for a geoid, the most adequate mathematical apparatus for describing closed dynamic structures (CDS) is the torus geometry (Figure 3).

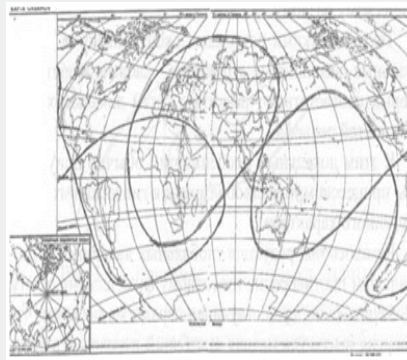


**Figure 3:** The surface of the planet Earth in the shape of a torus

Peculiarities of substance transfer in torus space makes it possible to expand the system, study all subordinate geospheres, including the core, simulate the drift dynamics of plates in space – time, and also understand the mechanism of geoid elongation to the north pole. Geoid oscillations are described by spherical harmonics. The latter can always be expanded in a natural orthogonal basis and, in some approximation, for ease of analysis, consider separately one or another type of oscillation. The natural basis for a geoid is the directions of radial and tangential oscillations, which can also be decomposed into orthogonal, within a separate shell. It is important to emphasize that the role of radial oscillations in the formation of the shell structure may be decisive. The above consideration reveals in general terms the mechanism of the formation of the inner shells of celestial bodies, but it cannot, of course, be exhaustive. The fact is that the approximation of radial oscillations is essentially one-dimensional and does not cover the essential details of the phenomenon. The radial oscillations themselves can be described by a combination of (in principle, infinite) Cartesian orthogonal components.

Each inner layer and the crust of the planet, being bounded

on both sides by a substance with sharply different dispersive properties, constitute a waveguide for tangential seismic vibrations. The structure of stresses for the lowest mode of tangential oscillations of a spherical shell is in many respects similar to the structure of an electromagnetic field if we consider oscillations of the transverse type. Longitudinal waves, of course, complicate the overall picture. Nevertheless, the presence of six continents and four oceans on our planet corresponds just to the quark-like three-loop self-interference of the main mode of transverse oscillations of the earth's crust (Figure 4). The earth's crust as a whole and its individual parts within their borders are waveguides for tangential vibrations. For the first time M.V. Lomonosov identified four forms of deformation of the earth's crust and saw in each wave nature. At the same time, long-period excitations have low attenuation and are able to accumulate in the form of antinodes, mechanical stresses and deformations. In the global zones of spreading, against the background of compression forces, powerful protonation is accompanied, accompanied by white and gray sulphate smokers, and the maturation of metallogenic zones of hydrocarbon raw materials, including gas hydrate (MZ of the UVS) (Figure 5).



**Figure 4:** Three-loop self-interference of the main mode of transverse oscillations of the earth's crust.



**Figure 5:** Circles - deposits of hydrocarbons and gas hydrates located within the global active subduction zones and nodal lines delineating the continents (shelf deposits of the Arctic).

The map must be supplemented with metallogenic zones (MZ) of the second type UVS formed on the continents. For example, on the territory of the Western Siberian platform, the MZ of the UVS is confined to the S-shaped nodal line, decorated by the valley of the Ob River, where there is a second harmonic node near Surgut and the hydrocarbon mega-deposit. Two types of ore metallogenic zones (RMZ) are also distinguished. The first is confined to the global mid-ocean ridges (MOR), in the form of linear, grandiose submarine ridges created by the spreading of the ocean floor, where tensile and expansion forces prevail with a speed of up to 16 cm / year. This type is represented by the following formations: copper-zinc-pyrite, pyrite-polymetallic, ferric oxide, manganese oxide. They first discovered in black smokers. Genetically, this form of RMZ is a product of fluid processing (with the participation of microorganisms, of which 8 are still unknown) at  $E = 300-400$  °C, iron-rich depression basites of COX (MOR). The second type of RMZ is manifested as if in parallel, according to another vector of bifurcation with respect to the second type MZ. The process begins with the regional supergene kaolinization within the continent, followed by large-scale diffusion and infiltration differentiation, and results in the formation of deposits oolite goethite-leptohlorit ore (the largest in the world Bakcharsky pool), zircon, ilmenite deposits (Tarskoe, Tuganskoe, Georgievskoe) deposits kaolinite not until the end of the studied manifestations of gold, rare-earth, radioactive elements, etc. At the same time, in the nodal zones such sedimentary deposits, being affected by physicochemical barriers formed metamorphic (glandular quartzite) and contact-metasomatic iron-gold ore and other deposits. Here, in contrast to the submarine MZ, the spatial and temporal timing of the formation of the MZ of the UVS and RMZ turns out to be completely natural.

### Conclusion

a) Justifications are presented and the resonant theory of global tectonics of planets and the geodynamics of the Earth is developed. It reveals the mechanism of hierarchical subordination and structural ordering of global natural geospheres at the level of

modern scientific rationality. From the phenomenological model of matter created on the basis of the theory of particle-wave dualism, it follows that the structure and morphology of material objects are determined by the nature of the corresponding interference pattern, and their interaction is of a resonant nature. For the geodynamics of the planets and their geospheres, it is extremely important to consider the low-frequency (low-energy) interactions responsible for their structuring. The distribution of the lowest-frequency modes of natural vibrations in the form of antinodes and nodes of standing waves is associated with natural vibrations, starting from planetary and regional structures, and is determined, to a greater extent, by their composition and geometry. The presented conceptual theory of the geodynamics of the planet does not contradict existing theories. According to the laws of the logic of science, as a new theory, it absorbs the previous hypotheses and theories created in the framework of classical ideas about the physical nature of matter, and (without looking for physical defects in them), transfers them to the category of acting in particular cases, as happened with mechanics of I. Newton in the theory of A. Einstein. The conceptual theory of geodynamics will eventually overcome the ideological positions of classical rationalism and bring Earth sciences to the next level.

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