

## Review Article

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## Degeneracy of de Broglie Waves in Geoneutrinos in the Earth's Core

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### ABSTRACT

The gravitational pressure of the environment leads to the degeneration of the electron gas and de Broglie waves in the Earth's core. The condensed de Broglie waves lose their connection with particles and become free neutrinos and antineutrinos. Neutrino oscillations generate muon neutrinos and their compounds. The capture of neutral bosons  $Z_0$  by protons gives rise to nuclear reactions. Ascending flows of protons and neutrons provide low-temperature nucleosynthesis of isotopes of chemical elements up to uranium in the core and mantle of the Earth due to  $\beta^-$ - and  $\beta^+$ -decays. The environment of the electromagnetic field spends its energy on heating the core and assembling nuclei heavier than iron.

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### Terms and Definitions

*Matter* is a substance of three nested phases that fill the Universe: prematter (dark energy), electromagnetic field (dark matter) and substance (material).

*An electromagnetic field* is a phase state of matter in the form of an invisible dispersed medium that fills all space. The smallest particles of the electromagnetic field medium are *gravitons*. They continuously move at *the speed of light*. It is necessary to distinguish between the idea of the field environment as whole and specific manifestations of this environment in the form of *flows* and *disturbances*. Rectilinear graviton flows are usually called *vector potential flows*. Vortex flows of gravitons form a *magnetic field*. We consider the forward motion of gravitons in the form of rapidly rotating thin fibers as an *electric field*. The diverging eddy currents we know as transverse radio waves. White noise from the field environment is microwave *background radiation*. Longitudinal waves in the medium arising because of accelerations and shock disturbances of space objects we call *gravitational waves*. We are convinced of the existence of the electromagnetic field as a global environment every time we bring a mobile phone to our ear.

*The speed of light* is the value of the thermal speed of gravitons. *Substance* is a phase state of matter in the form of vortex condensations of the electromagnetic field, forming the smallest particles of matter — *neutrinos and antineutrinos*.

*Photon and electron* are particles of matter from paired neutrinos. *Antiphoton and positron* are particles of matter from paired antineutrinos.

*Mass* is the number (in kg) of gravitons in a material body.

*Electromagnetic (relativistic) mass* is the number of gravitons in the boundary layer of the electromagnetic field medium attached to the material body.

*Electric charge* is the rotating ray flows of the mass of gravitons emitted by particles.

*Gravity is a single force* interaction of material objects that arise as pressure gradients in vortex disturbances of the invisible dispersed medium of the electromagnetic field.

*Bose-Einstein condensate* is a system with a large number of identical bosons in a state with minimum energy.

*De Broglie waves* are attached vortices of the electromagnetic field rotating around particles at the speed of light.

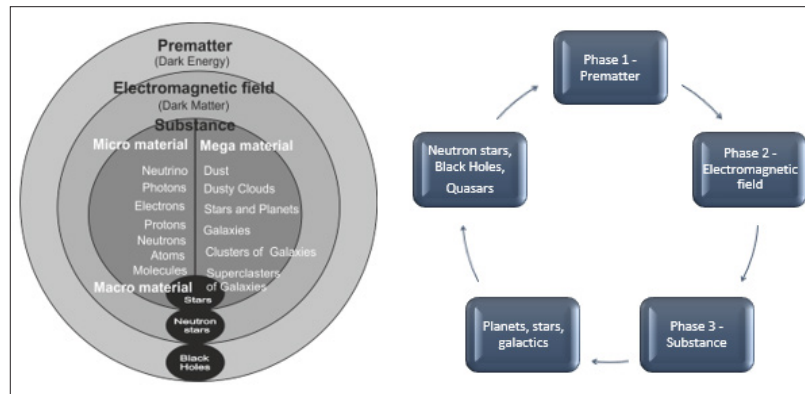
### Introduction

In 2018, the Antarctic Impulse Transient Antenna (ANITA), a balloon-mounted instrument operating in Antarctica, detected neutrinos coming from the Earth [1, 2]. These measurements were confirmed by the IceCube Neutrino Observatory, whose AMANDA neutrino detectors are located in ice boreholes 2.5 km deep [3]. However, where is the source of these geoneutrinos? In addition, why the Earth is as it is.

The Earth is an active planet. Nuclear fusion reactions occur not only on the Sun, but also in the Earth's interior. Because of these processes, new chemical elements are formed from primary hydrogen, including those heavier than iron. However, neutrino and antineutrino compounds must initiate nuclear reactions. The gravitational pressure of the environment around the Earth creates these particles by degenerating the electron gas and de Broglie waves in the Earth's core. The Earth converts the field into matter.

### Three phases of matter

It has been experimentally established that in the world around us there are three types of matter, differing in their properties: *prematter* (dark energy), *electromagnetic field* (dark matter), and *substance* [4]. Figure 1 (on the left) shows a diagram of the nested phases of matter in our Universe. The eternity of matter manifests itself in the continuous cycling of the field-substance self-renewal processes. Figure 1 (on the right) shows the cycle of matter in nature.



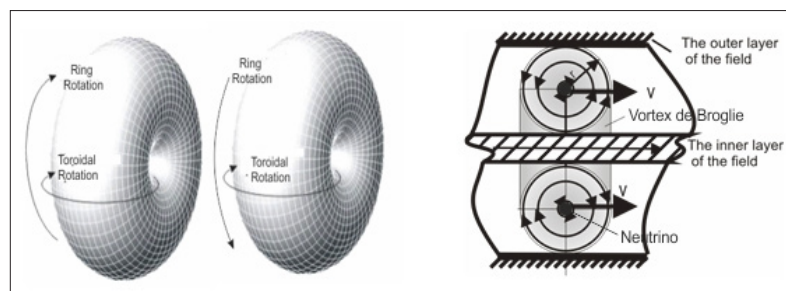
**Figure 1:** Scheme of Nested Phases of Matter and the Circulation of Matter in Nature

The space is filled with the electromagnetic field medium. The smallest vortex particles of the medium – gravitons – continuously move at the speed of light. The electric and magnetic fields are the translational and rotational flows of this medium. The set of closed vortices of the electromagnetic field medium form the third phase of matter – substance. Condensations of the proto-matter in the form of superfluid and super-solid Bose-Einstein condensate fill black holes. Condensations of the electromagnetic field form the basis of neutron stars. Degenerate matter forms the cores of stars and planets.

The smallest vortex particles of matter – neutrinos and antineutrinos – are toroidal vortex condensations of the electromagnetic field medium (Figure 2 on the left). The rotation of neutrino vortices can be divided into ring and toroidal. Neutrinos rotate as left-handed vortices, and antineutrinos as right-handed vortices.

When rotating, neutrinos entrain the adjacent boundary layer of gravitons in the medium. This vortex we call a de Broglie wave (Figure 2 on the right).

The intensity of de Broglie waves decreases with distance from the neutrino. In accordance with the Bernoulli effect, this creates a gradient of normal pressure of the external environment of the electromagnetic field in the volume of the de Broglie wave in the direction of the particle — *the force of gravity*. It forces neutrinos to pair with each other and with other particles.



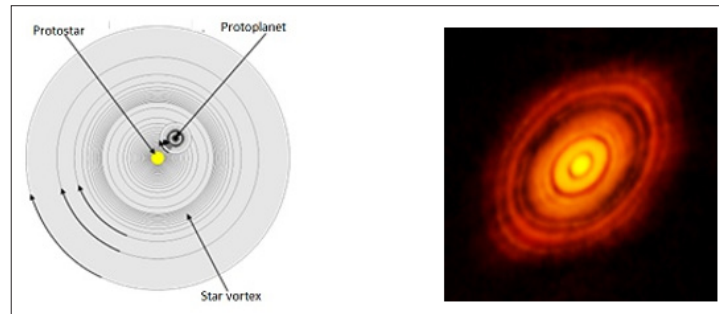
**Figure 2:** Neutrino, antineutrino and diagram of the motion of a neutrino vortex in a medium

The idea that neutrinos are inert is a myth. Electron neutrinos and antineutrinos *are the only elementary particles*. All other particles are composite. They are composed of electron neutrinos and antineutrinos. However, it is not the particles and charges, but the electromagnetic field environment that surrounds them determines the properties of the particles and organizes all physical phenomena.

### Vortices of the Electromagnetic Field Environment Form Galaxies, Stars and Planets

Observations prove that the electromagnetic field medium exists in the form of cosmic vortices interacting with each other. Large-scale vortices (halos) form galaxies, stars and planets. Gas and cosmic debris flow into giant funnels. Figure 3 (left) shows a diagram of a protostellar disk. A protostar forms in the center of a vortex, where the radial pressure is lower than at the edges. There is the greatest pressure gradient at the edges of the vortex. It creates a force directed toward the center of the vortex. This is how the “Dark Matter” effect arises — *the force of gravity without mass*. The effect ensures the attraction of objects very distant from the center (for example, the attraction of the Oort cloud to the Sun in the Solar System). The vortices of the medium are primary. They ensure the rotation and compression of protostellar and protoplanetary clouds.

Inhomogeneities in the gas-dust cloud of the stellar vortex led to the formation of protoplanetary vortices of the field environment. Gas and dust, swept by the vortex during rotation around the protostar, flow to the center of the vortex. The pressure of the external environment produces dissociation of molecules and ionization of gas atoms in the center of the gas-dust cloud of the protoplanet. Compression heats the core to a temperature of ~ 6000 K. The surrounding electromagnetic field spends its energy on the formation of the planet.



**Figure 3:** Diagram of a Protostellar and Photo of a Protoplanetary Disk

The compression of the protoplanetary cloud continued until the electron gas began to degenerate, until the hydrogen atoms approached each other at a distance of the de Broglie wave. From this moment, the formation of the Earth's internal structure began.

### The Internal Structure of the Earth

Figure 4 shows the internal structure of the Earth. Under the thin *crust* are the *mantle* and the *core*. The solid metallic inner core consists mainly of iron (85%), nickel (10%), chromium (0.9%), and cobalt (0.25%). The density of the core is  $12.5 - 14 \text{ g/cm}^3$ . The pressure in the core reaches 375 GPa (3.7 million atm). The pressure keeps the inner core in a solid state. An iron-nickel liquid outer core surrounds the inner core. The mantle is a thick layer of hot solid rock made of silicates saturated with elements: Fe, Mg, Al, Ca, Si, etc. between the earth's crust and the core. The mantle occupies 83% of the Earth's volume, making up two-thirds of the planet's mass. The mantle begins at a depth of about 30 kilometers and reaches 2900 kilometers. The solid shell of the Earth consisting of the earth's crust and the upper part of the mantle we call the lithosphere.

The heat flow from the Earth's interior through the surface is  $\sim 47 \cdot 10^{12}$  watts. Some of it is due to the radioactive decay of long-lived nuclei—primarily  $^{232}\text{Th}$ ,  $^{235}\text{U}$ ,  $^{238}\text{U}$  and  $^{40}\text{K}$ —in the crust and mantle. However, this heat is not enough to maintain the temperature of the molten core.

In addition, the question arises about the formation of ore deposits of heavy elements up to uranium. If these elements were primary, they would have formed the core of the Earth. It is obvious that all heavy elements were created anew in the lithosphere of the Earth [5].

The structure of the Earth resembles the state of a star after all its fuel has burned out, when an iron core forms in the center of the star. This is the end of the nuclear evolution of all massive stars. Further release of nuclear energy in such a core is impossible. It is obvious that the Earth has also gone through the stage of "nuclear burning" from a hydrogen-dust cloud to an iron core.



**Figure 4:** Diagram of the Internal Structure of the Earth

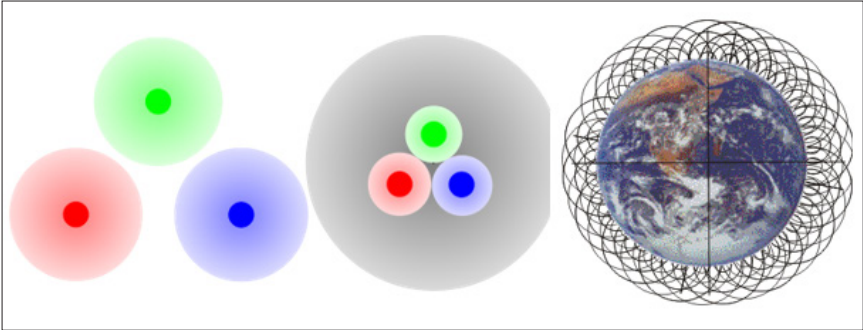
Ore formation in the depths of the Earth continues today. A necessary condition for these processes is the presence of neutrino flows [6].

### Degeneration of de Broglie Waves

The clumping of particles causes degeneration of de Broglie waves. When neutrinos form bodies in the form of particles, atoms, molecules and fragments of matter, the de Broglie waves of individual neutrinos are partially displaced outward (Figure 5 on the left). It has been shown that 92% of the primary neutrino vortices are generalized, and 8% remain in the neutrinos as eigenvalues of de Broglie waves [7].

The Earth began its life as a large diffuse cloud of molecular gas and dust, which was spun and compressed by the pressure of the protoplanetary vortex of the field environment. As it compressed, a de Broglie wave formed around the cloud — a vortex layer of the electromagnetic field (Figure 5 on the right). The intensity of the vortices in the de Broglie wave decreased with radius. In accordance with the Bernoulli Effect, a gradient of the radial pressure of the external environment — the force of gravity — arose in the volume of the de Broglie wave. Gravity forced the Earth to slowly compress toward the center so that both the pressure and temperature increased in this direction.

When the average distance between particles and fragments of matter in the Earth's core becomes comparable to the de Broglie wavelength, degeneration of de Broglie waves occurs. Waves (vortices of field gravitons) break away from particles and, condensing under the action of external pressure, begin an independent existence in the form of neutrinos and antineutrinos.



**Figure 5:** Formation of composite particles and the Earth's de Broglie wave

The process of transition of the field into matter gives rise to various nuclear reactions, as a result of which all chemical elements arise, including uranium, and compounds of elements are formed, including water, oil, and organic compounds.

**Neutrino and Antineutrino Oscillations**

Some of the newly formed geoneutrinos and antineutrinos pair with each other to form photons, electrons, and positrons [8]. These particles, in turn, capture neutrinos or antineutrinos to form muon neutrinos or intermediate vector bosons  $W^-$  or  $W^+$ . The pairing of muon neutrinos and antineutrinos (or intermediate vector bosons  $W^-$  and  $W^+$ ) produces the muon neutral boson  $Z^0$ . All neutrino compounds are unstable.

| Particles                                        | Antiparticles                                                | New particles                              |
|--------------------------------------------------|--------------------------------------------------------------|--------------------------------------------|
| $\nu + \nu \rightarrow \gamma$                   | $\bar{\nu} + \bar{\nu} \rightarrow \gamma\sim$               | Photon and antiphoton                      |
| $\nu + \bar{\nu} \rightarrow \gamma_0$           |                                                              | Neutral Boson (Dark Photon)                |
| $\nu + \nu \rightarrow e$                        | $\bar{\nu} + \bar{\nu} \rightarrow e\sim$                    | Electron and positron                      |
| $\gamma + \bar{\nu} \rightarrow \nu_\mu$         | $\gamma\sim + \nu \rightarrow \nu\sim\mu$                    | Muon neutrino and muon antineutrino        |
| $e^- + \nu\sim \rightarrow W^-$                  | $e^+ + \nu \rightarrow W^+$                                  | Intermediate vector bosons $W^-$ and $W^+$ |
| $\nu_\mu + \bar{\nu}_\mu \rightarrow \gamma_\mu$ | $\nu\sim_\mu + \bar{\nu}\sim_\mu \rightarrow \gamma\sim_\mu$ | Muon photon and muon antiphoton            |
| $\nu_\mu + \nu\sim_\mu \rightarrow Z^0$          | $W^+ + W^- \rightarrow Z^0$                                  | Muon neutral boson $Z^0$                   |

Figure 6 shows the structural diagrams of the muon neutrino and intermediate vector bosons  $W^-$  and  $W^+$ . The capture of an antineutrino by an electron or by the capture of a neutrino by a positron during their counter motion create the bosons. The mass of  $W$  bosons is  $\sim 80$  GeV, so the bosons have a small size, comparable to the size of a proton.  $W$  bosons are short-lived; their half-life is about  $2\cdot 10^{-10}$  s [9].

Let us recall once again that the connection of particles and their retention occurs under the influence of pressure from the external environment.

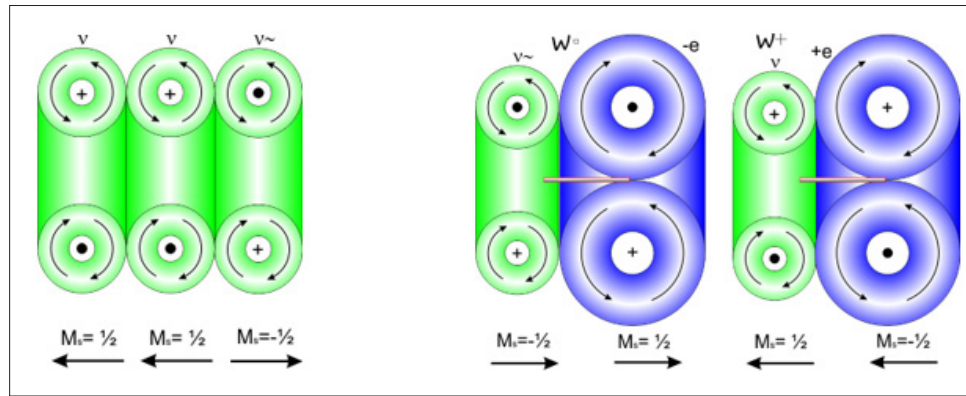


Figure 6: Muon neutrino and intermediate vector bosons  $W^-$  и  $W^+$

### Hydrogen Cycle Scheme

Nuclear reactions inside the Earth are similar to reactions occurring on the Sun. Let us list the main reactions of the most probable pp-I cycle of formation of helium  $4\text{He}$  from hydrogen, in which energy of  $\sim 18$  MeV is released.

- Formation of a neutron. Capture of the muon neutral boson  $Z^0$  by a proton. Decay of the boson  $Z^0$  into intermediate vector bosons  $W^-$  and  $W^+$ . Capture of the intermediate vector boson  $W^-$  by a proton. Decay of the intermediate vector boson  $W^+$ :  $p + Z^0 \rightarrow p + W^- + W^+$ ,  $W^+ \rightarrow n + e^+ + \nu$ .
- Formation of a deuteron. Capture of a neutron by a proton.:  $p + n \rightarrow D^2$ . This process is accompanied by the release of 0.42 MeV of energy.
- Formation of helium  $\text{He}^3$ . A deuteron combines with a proton to form the isotope helium-3 and release 5.49 MeV of energy:  $D^2 + p \rightarrow \text{He}^3 + \gamma$ . Average reaction time 5.7 sec.
- Fusion of helium  $\text{He}^3$ . Two helium  $\text{He}^3$  nuclei combine to form a helium  $\text{He}^4$  nucleus, releasing 12.85 MeV of energy. In the process, two protons are ejected, which trigger new reactions:  $\text{He}^3 + \text{He}^3 \rightarrow \text{He}^4 + p + p$ . Average reaction time  $\sim 10^6$  years.

The essence of the pp-cycle is the formation of a neutron ( $\beta^+$ -decay of a proton). Particles are formed from what they decay into. The capture of an intermediate vector boson  $W^-$  by a proton forms a neutron (Figure 7 on the left). Figure 7 on the right shows the final product of the pp-cycle — the nucleus of a helium atom  $^4\text{He}$ .

Like all particles with spin  $\frac{1}{2}$ , the neutron can only decay into three particles. When the antineutrino dissipates energy due to its removal by photons, the pressure on the proton decreases, and the particle sizes increase. The increase in size will lead to a decrease in the force of vortex adhesion between the particles. The external repulsion forces will exceed the force of inertia - the neutron will decay. The described interaction of particles is called weak interaction. The essence of weak interaction consists in the opposition of repulsive and attractive forces of parts of constituent particles that have excess energy. The compressive factor can be third particles that exert a force effect from the outside.

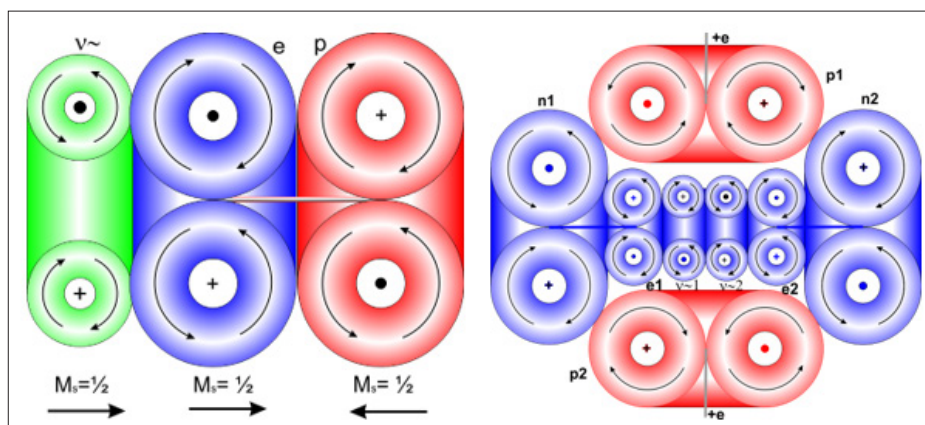


Figure 7: Structural diagrams of a Neutron and an Alpha Particle

The alpha particle keeps the neutrons from decaying due to its structure. The protons  $p1$  and  $p2$  are located on the proton axis. The neutrons  $n1$  and  $n2$  are located on the neutron axis. The moments and charge tubes of the protons are directed outward, and the moments of the neutrons are directed inward. The total moment of the  $\alpha$ -particle is zero. All nucleons have no orbital momentum, but rotate only around their axis. The upper proton (if you look from the top of the figure) rotates counterclockwise. The lower proton rotates clockwise. The neutrons rotate around the axis in opposite directions as well.

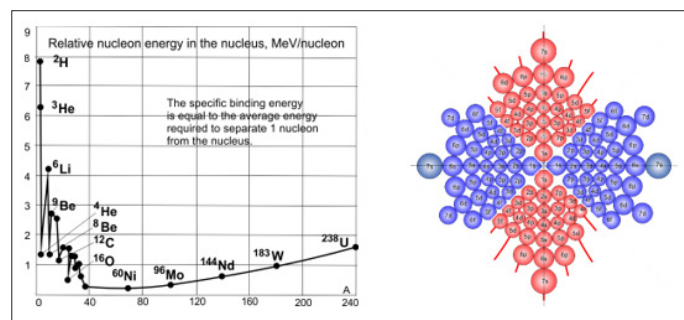
## Formation of Chemical Elements

Neutrons formed in the  $\square^{+}$ - process and helium nuclei formed in the pp cycle become the basis for the chain of formation of new chemical elements due to  $\square^{-}$ - processes. The nuclei of new elements, starting with helium, capture neutrons, becoming radioactive neutron-excess isotopes. After some time, the neutrons decay:  $n \rightarrow p + e^{-} + \bar{\nu}$ . The proton remains in the nucleus, forming an element with a higher atomic number.

The formation of new elements before iron occurs with the release of binding energy. Figure 8 on the left shows a graph of the relative energy of a nucleon in a nucleus. The nucleons in the nuclei of iron and nickel have the lowest energy. These are the elements that make up the Earth's core today.

Long-lived isotopes of elements heavier than iron were formed with the expenditure of energy. Degeneration of de Broglie waves into neutrinos occurs with the release of energy. It is spent on heating the nucleus and activating nuclear reactions. At the same time, stable isotopes contain one and a half times more neutrons than protons. The quadrupole magnetic moment of the nucleus determines this ratio. As an example, Figure 8 on the right shows the nucleus of a uranium atom  $^{238}\text{U}$ . The nucleus contains 92 protons and 146 neutrons.

The conversion of de Broglie waves into geoneutrinos explains the effect of the increase in the size and mass of the Earth [10]. Of course, some growth is due to cosmic dust. In 1899, the Russian geologist I. Yarkovsky first put forward the hypothesis that the radius and mass of our planet increase as a result of the "transformation of weightless ether into matter." The Earth grows from within, increasing its radius by  $\sim 0.4$  mm per year. It is believed that the size of the protoplanet was  $\sim 60\%$  of the existing one. We are convinced of the increase in the size of the Earth by observing the work of archaeologists.



**Figure 8:** Relative Energy of Nucleons and the Uranium Nucleus  $^{238}\text{U}$

It was not supernovae, but the Earth itself that formed all the chemical elements and ores, including oil and uranium. Our task is only to create nature-like technologies.

## Conclusion

In the century before last, Michael Faraday put forward the idea that it is not the particles and bodies themselves, but the space between them, filled with an electromagnetic field that organizes and supports all physical phenomena. In the last century, Louis de Broglie deepened this idea by proposing the concept of corpuscular-wave dualism. All particles rotate. Rotation entrains the boundary layer of the medium into a stationary de Broglie wave with the same phase and frequency. When forming composite

particles and fragments of matter, de Broglie waves degenerate — they are forced out, leaving the particles with only their own values.

In the vortex layer — the de Broglie wave of the Earth — gravity is created as pressure from the external environment of the field. Gravitational pressure leads to degeneration of de Broglie waves in the Earth's core, which are reconstructed into geoneutrinos. Neutrinos provide the synthesis of particles and elements from photons to uranium nuclei due to low-temperature nuclear reactions. Beta-plus decay of protons creates neutrons. Beta-minus decay of neutrons creates nuclei of heavier elements.

The conversion of the field into matter in the Earth's core through the mechanism of degeneration of de Broglie waves is part of the circulation of matter in nature. The instrument of this mechanism is pressure. Due to the gravitational energy of the environment, a chaotic gas-dust cloud is transformed into a highly organized system of not only inert but also living matter. What is the outcome of this transformation?

After the hydrogen burns out, the Sun will move from the main sequence to the red giant class, capturing the Earth. The combustion processes of carbon, neon, oxygen and silicon will take place in the Sun's core in sequence. After all the fuel has burned out, an iron core will remain in the center of the star. The formation of neutrinos and the "neutronization" of protons require a lot of energy, so the pressure in the core will drop. The outer layers will fall onto the core — gravitational collapse [11].

During the gravitational collapse of a star, the neutrino structure is destroyed and a neutron star core is formed with a Bose-Einstein condensate of electromagnetic field gravitons or (for massive stars) a black hole core with a condensate of prematter. Matter turns into a field. Nature has chosen a simple impact as the instrument of this phenomenon. Then neutron stars emit jets of gravitons, and black holes emit jets of prematter. Both of them turn into streams of neutrinos and photons.

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