

An introductory note on I.L. Gerlovin's Theory of Fundamental Field (TFF)

By: Michael Irgang (Moscow, Russia)
mi6807509@gmail.com

With special thanks to:
Iosif Benenson (Lake Forest Park, USA), Vladimir Pakhomov (Moscow, Russia).

Moscow, February 17th, 2015

Preamble

For words highlighted in **yellow** (at their first citation only), please refer to the **definitions** section, in **Appendix 1**.

This note attempts to shed light on the work done by the Russian scientist **Ilya Lvovich Gerlovin**, whose book on the "**Principles of a Unified Theory of all Interactions in Matter**" ¹ (or "**Theory of Fundamental Field**", hereunder "**TFF**") has been published on the Web by the Author's widow (in Russian language), after I. Gerlovin died, in 1993.

On that year, I. Gerlovin intended to make to the US, in order to meet with foreign colleagues and share his ideas ...

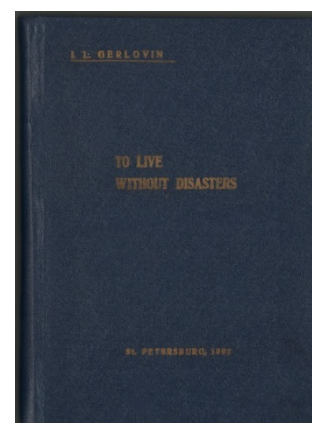
Cover of the original book published in Russian (1991)



The Author and some of his Soviet colleagues published about 55 works. However, partly due to the difficult mathematical tools used in the TFF, the Author's works and ideas remained largely unknown.

As the Author put it in the preface to the American edition of its book:
"This book is the result of a fifty years long work of a small group of scientists who were not afraid of new ideas. [...]"
This book, as a whole, is intended to those who are interested in concrete suggestions towards directing both science and technology in harmony with Nature to prevent the further destruction of our fragile planet".

Cover of the original book published in English (1992)



¹ I.L. Gerlovin, "**Principles of Unified Theory of All Interactions in Matter**" (in Russian), EnergoAtomIzdat, Moscow (1990), 432 pages.

An English translation exists, simply entitled "**To live without disasters**". It has been published in limited quantity in 1992, in St-Petersburg ; I will make a scanned copy available.

We will use here some scanned schemes, taken from the English version of the book.

The TFF theory finds its origin in the Soviet Union in the 1940's, and today pretends to be, **not an alternative theory** to the currently existing versions of the so-called "Theories of Everything", but **a theory which interpretes differently and achieves stronger and deeper results**, while remaining in full conformity with the others.

Approximately in the middle 1960's, the **Russian physicist and mathematician Ilya L. Gerlovin** has developed a variant of the hypothetic "Unified Field Theory" (UFT).

His first results led him to believe that the work done on "classical" UFT was not correct. He thus decided to name his variant "**Theory of Fundamental Field**".

But from his point of view, it is even more correct to speak about the "**Unified Theory of all Interactions in the Matter**", which he managed to do in the frame of the TFF

The TFF unifies all the known types of interactions in the matter: strong, weak, electromagnetic (EM) and gravity. They are all considered to be a manifestation of one single fundamental field.

The TFF is based upon a new paradigm called the **Paradigm for Viable and Developing Systems (PVDS)**: see from page 5 below.

Following are the main results obtained, and the successes to which the TFF pretends:

For the first time ever, the TFF:

- found the physical phenomena, responsible for the quantum and relativistic properties, and defined the boundaries of the domain over which these properties prevail / are applicable;
- discovered the unified approach to describe the fermions and bosons, which is more wide than the "super-symmetric", found later and being intensively developed now ; and discovered a periodic law for the elementary particles;
- Found the structure of the **physical vacuum**, considered it as a structural material form; formulated and calculated the properties of the Physical Vacuum (ϕV);
- Proposed and studied a string-based model of particles (though the very term "string" has not been earlier proposed in the TFF). This model is deeper and essentially richer than the string and superstring models being widely developed now;
- Uncovered the physical nature of quarks, tachyons, virtual states and some other postulated objects of the modern microphysics;

The TFF does not contradict known physical theories, but provides an underlying reason to their postulates, and reveals the boundary of use of these postulates. **Thus, the TFF, far from being an alternative to generally accepted principles, simply develops and deepens the perceptions of these theories, in full agreement with the correspondence principle.**

The TFF has a peculiarity which is important to underline here. In the book, it is shown that **how** all types of interactions are obtained, and how the constants of these interactions are calculated from one system of equations representing the **Triunity Law Space – Time – Matter**; discovered in the theory.

Among other results, the TFF:

- demonstrated that the proper constant of “strong gravitation” predicted by A. Salam, but still unfound (at the time the book was published), corresponds to each constant of interaction by means of the Unified Fundamental Field, and follows the same equations.
- is able to compute other **global constants**, be they dimensionless or not, from ... dimensionless constants found in the TFF theory: this is a paradoxical finding, but at the same time, it makes a very strong case in favor of the TFF. **See Appendices 2 and 5.**

For instance: G , the constant of gravitation.

Until this time, G could never be obtained other than through experiments². G could never be obtained from any theoretical combination of other physical constants and it could not be numerically evaluated in the framework of a physical theory.

From the new TFF's picture of the structural geometry of the physical vacuum, V. Krat and I. Gerlovin (at that time, from the Pulkovo Astronomical Observatory, Leningrad, USSR) published a Letter on Jan. 14, 1974, finding a new theoretical value of G based on the mass of the proton, the Compton wavelengths for a proton, and some other dimensionless constants determined by the TFF without basing on any hypothetical constants.

*The **calculated value of G** ³ coincides with the experimental value in the range of computation accuracy.*

- **eliminates the need for arbitrary constants**: none of them are used in the TFF. The calculations made (the one above and others) are a direct result of the TFF's equations.
- explained why the law of conservation of “spatial parity” for the weak interaction (*translation correct ?*) is violated.

With respect to **elementary particles**, the FTT:

- gives the **periodic law ruling over the elementary particles**, which allowed to calculate (up to the 10th decimal) the masses, charges, life duration and other characteristics of both known and unknown / still undiscovered elementary particles (some of which have been discovered afterwards, and their characteristics were fully in line with the calculated values, to the extent of the experimental measuring error, up to the 5th decimal). **See Appendix 4.**
- explains why “light” quarks can form heavy elementary particles, and why “heavy” quarks can form light elementary particles. More generally, it provides a sound explanation to the origin of masses of particles. **See Appendices 3⁴ and 4.**
- explains the formation of “Cooper Pairs” when superconductivity is observed, calculated (still from the theory) the temperatures of transition to the superconductive state for different materials: the values are fully in line with experimental data; also the TFF predicts the possibility to get a new form of superconductivity at temperatures over 100 °K.

² $G = 6.6732(31) \times 10^{-8} \text{ cgs}^{-2}$ (cf B. Taylor, W. Parker, D. Langenberg, 1969 : “The Fundamental Constants and Quantum Electrodynamics”, Academic Press, New-York and London)

³ See “On the Constant of Gravitation”, V.A. Krat and I.L. Gerlovin, Letter received on Jan. 14, 1974, in Appendix 2 to the present note.

⁴ Regarding the issue of “mass settings” and problems, I recommend the article “Mysteries of Mass: Some Contrarian Views From an Experimenter”, by Martin L. Perl (Stanford Linear Accelerator Center, Stanford University, 2575 Sandhill Road, Menlo Park, California, 94025 U.S.A. ; martin@slac.stanford.edu). See Appendix 3.

- explains more in depth why the phenomenon of melting of materials takes place at given temperatures, and uncovered a proved method of theoretical calculation of the melting temperature.
- found the possibility to explain the observed phenomenon of “strong” nuclear force saturation (i.e. each nucleon can be linked by attraction forces with no more 3 other nucleons), as well as the observed preferred spatial localization of electrons in the atoms.
- formulated a physic-mathematical model, as a basis for computerized modeling of structural particularities, quantic properties and particular interactions for all “observable” and “virtual” micro-particles, as well as for various physical processes and phenomena.

Why this note? ...

First of all, because the TFF looks like a fantastic theory, apparently **compatible and larger** than the existing ones, able to reach unmatched results.

Because it is **a theory that deserves to be spread and circulated** to the largest possible panel, for assessment and discussion.

Pursuing the same goal as Gerlovin’s book, this note aims at drawing the scientific community’s attention on the TFF theory, on its underlying ideas.

The modern scientific community will be much more skilled than me to assess:

- ◇ the originality and relevant character of the Gerlovin’s approach;
- ◇ the similarities you will be able to see with existing theories (Branes, M-Theory, Loop Quantum Gravity, String Theories,...): I remind that Gerlovin pretends that the TFF does not contradict the existing theories, but rather setting a more general frame, and showing the limits in which the other theories are applicable;
- ◇ the difficult physic-mathematical tools used by the Author;
- ◇ the impressive results which the TFF gives makes him a candidate to become the so-called “Theory of Everything” (ToE), though Gerlovin would rather have preferred to stick to the original name he gave : **“Unified Theory of all Interactions in Matter”**.

The book contains very ambitious declarations (results obtained, predictions and ideas about how to use the TFF, etc.), and only a genuine assessment work of the TFF (including its difficult mathematical tools) by a community of high level “ToE-oriented” scientists, can tell us if Gerlovin’s TFF is a sound candidate or not.

Also the book doesn’t always give all the details how we get to certain results / assumptions: here again, a serious work should be undertaken, in order to finalize the Author’s work.

Tentative presentation of TFF's founding approach and results

1. The underlying principles: the “Paradigm for Viable and Developing Systems” and layered spaces (fiber bundles)

Because it should explain nature, the TFF uses the principles of another Soviet theory, inspired by the laws of nature : the **“Paradigm for Viable and Developing Systems” (“PVDS”)**, with strong, necessary and self-sufficient rules.

The Paradigm answers the following question: what is the essence of the universal law governing Nature, which provides the ability of systems to live and to develop themselves, and what are the mathematical tools which could describe this universal law and which can be used to build the theory ?

As early as in 1946, the Soviet Academician **V. Vernadsky** felt that the nature-driving **Darwin triad “heredity – variability – (natural) selection”** should play a central role in the evolution of the elements of the living and non living nature on Earth (he called it all these elements the “noosphere”). Other Russian scientists, as well as the French philosopher **P. Teilhard de Chardin** have contributed to develop this concept.

At the same time, as the Author underlined, prominent scientist of the 20th century (A. Einstein, L. de Broglie and P. Dirac), all expressed the need to move from the “quantum-relativistic” views of the “modern” physics.

In today's modern scientific language, according to Gerlovin, the principles of the **“Paradigm for Viable and Developing Systems”** (first published in 1988, due to Soviet censure) should be enounced as following:

(1) For a full description of any viable and developing system, it is necessary to consider it being simultaneously in different **Sub-Spaces (SS)** of an enclosing, comprehensive layered space (also referred to as **“Fiber Bundle”** in the English version of the book).

The space which includes other layers is called the **Enclosing Space**, and the sub-spaces (layers) inside are both a **base** for other layers, and a **layer** themselves.

It is important to note that such **layered spaces** are not used as a “convenient mathematical tool” by Gerlovin, but they are seen as real objects in the Nature. An unified, closed theory of the matter cannot be build-up else than in such a layered space.

(2) The structure of space-time of a system of fibers (base) of an enclosing space under any (no matter how cardinal) differences is strongly controlled by a single law valid in all the layers, the **Triunity Law (TL) of space – time – matter**.

In the TFF, for any viable system, there exists a mechanism of **Spatial Metamorphosis (SM)** for which this system in the different layers will have mutually coordinated, but different space-time structures.

In other words, the **SM** involves the **simultaneous existence of single object in different sub-spaces / fibers**, while in each sub-space / fiber this object has very different characteristics and structures. See Fig. 2, page 8.

This SM is essential in Gerlovin's work: if some living systems use Time Metamorphosis (like the caterpillar becoming a butterfly), the TM is absolutely neither a rule, nor a necessity in Nature, while SM is an essential and necessary phenomenon for all viable and developing systems.

The SM isn't possible in the usual 3D + oriented-time, "Euclidian" spaces, but only in layered, multi-dimensional spaces: this scheme is used by the Nature and by the TFF.

(3) With respect to any sub-space (base and / or layer), any other sub-space, part of an enclosing space, is always in the domain of "imaginary". Here the "imaginary domain" is not a formal mathematical dodge / tool, but it should be understood as a real structural property of all viable and developing systems.

The first 3 principles characterize the stability of systems, their viability.

But for a system to be viable over the time, and not just at the present moment, it should comply with other conditions, providing for their stability in the time, and ability not only to develop, but also to "self-develop", themselves. The 5 principles hereunder rule over this ability.

Ability to "self-development" is one of the main principles of viable systems. In the process of "self-development", a system may undergo "Time Metamorphosis" (TM) but, again: unlike the "Spatial Metamorphosis" (SM), the TM is not compulsory for systems which comply with the Paradigm.

(4) Between the sub-spaces (fibers), and between the basis of the considered layered space (fibration) and its layers (fibers), there exists only an **information channel**.

This channel bears not only data about the processes taking place in the layer which is the origin of this data, but also signals which are regulating general processes.

Here "information" is taken in its broad sense.

(5) In a stationary regime, the information channels bears a signal which can bring only negative entropy into the sub-space in which it enters.

(6) The development of the viable systems involves a sharp increase in the information debit carrying negative entropy. This information can also contain signals, which regulate the "Darwin Triade": "heredity – variability – (natural) selection".

If the debit of negative entropy dominates over the production of positive entropy, then the system is capable of self organization.

(7) Leakage of the channel carrying a positive-entropy signal into the information channel, or the break of the information channel carrying a negative-entropy signal, leads to illness or death of the system.

(8) If the closure and / or the commutability of the reflection / mapping diagram, describing all the information channels of an enclosing space, is broken or violated, then the system loses its viability and is condemned to death.

The **eight principles** above are significantly restraining the quantity of possible solutions contained in the mathematical equations of the theory.

Note: the principle of the “Darwin Triade” has not been used, however it has been added above, in the definition of the Paradigm.

2. Main features of the TFF, with respect to the matter, and some results of the theory:

In the TFF:

- ◇ All the “fundamental interactions” (strong, weak, EM and gravity) are considered as different manifestations of a **unique “fundamental field”**.
- ◇ The analysis of **all fundamental phenomena and matter** observed in the nature must then be made exclusively in **layered spaces**.

A layered space is a known modern mathematical tool, where the space which comprises all the other elements is called an **Enclosing Space**, and the sub-space inside it is divided in **Sub-Spaces**, which are themselves simultaneously base of a layering / stratification, and layer.

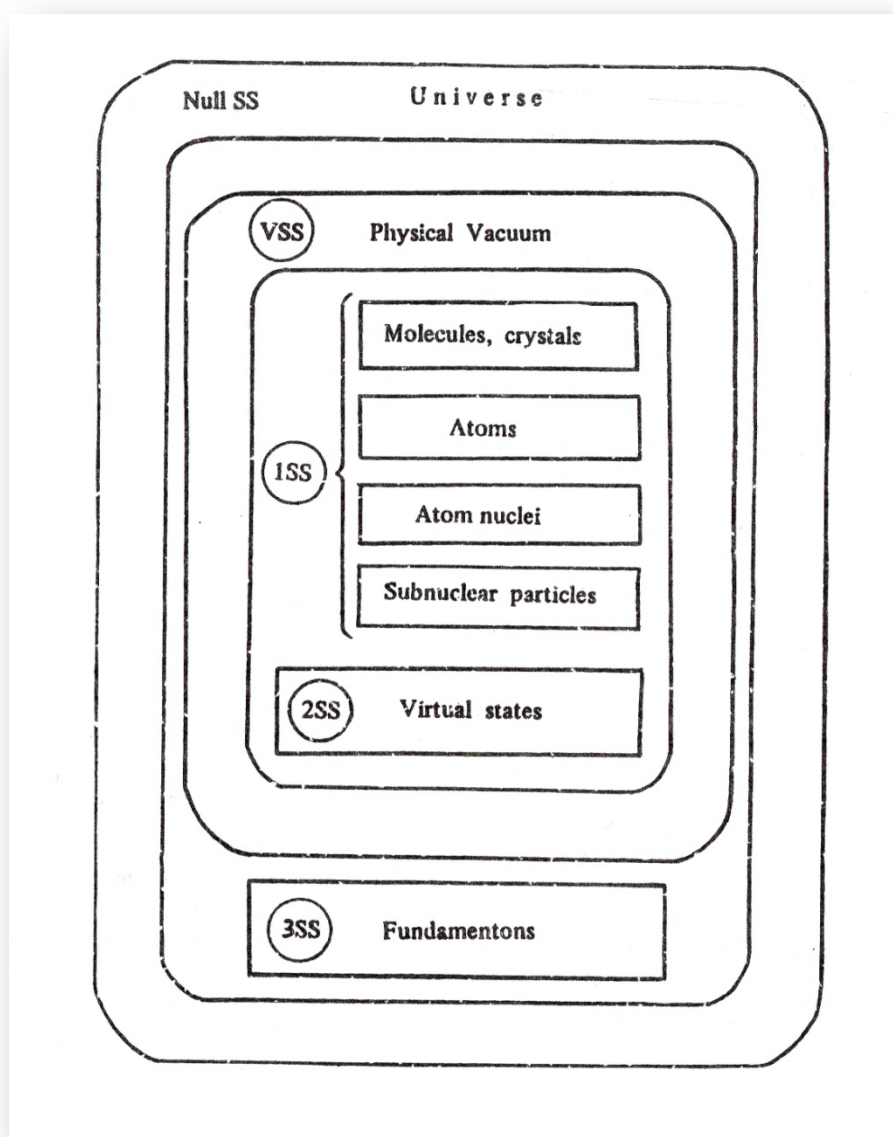


Fig. 1. Closed System of discrete structures.

The "**laboratory**" **physical Sub-Space** which we observe is the basis for layers / stratifications, and out of this space, there are sub-spaces where the hidden properties of the elementary particles appear, and where various interactions take place.

In "our" laboratory space, we observe only the result (or the image / reflection) of a process, which itself takes place in these other layers / sub-spaces. See "Spatial Metamorphosis", below.

The main parameters which we observe in "our" laboratory sub-space (mass, charge, spin, magnetic moment, etc.) are formed in other layers of our layered space. Therefore we cannot define with precision the quantic parameters in "our" laboratory sub-space, and we are forced to use a probabilistic approach to evaluate them.

◇ As seen in the PVDS, with respect to any sub-space (base and / or layer), any other sub-space, also part of an enclosing space, is always in the domain of "imaginary".

Between the sub-spaces / layers, or between the basis of such layering and a layer, only an **information channel of communication** is possible.

◇ A necessary condition for the functioning of such physical-mathematical model is the "**Spatial Metamorphosis**" (SM).

The SM sets different geometric forms for one single object, which are observed in different sub-spaces of the layered, enclosing space.

The main principle of the SM is the compliance with the communiteness conditions for "images" exchanged between the different layers of a given enclosing space.

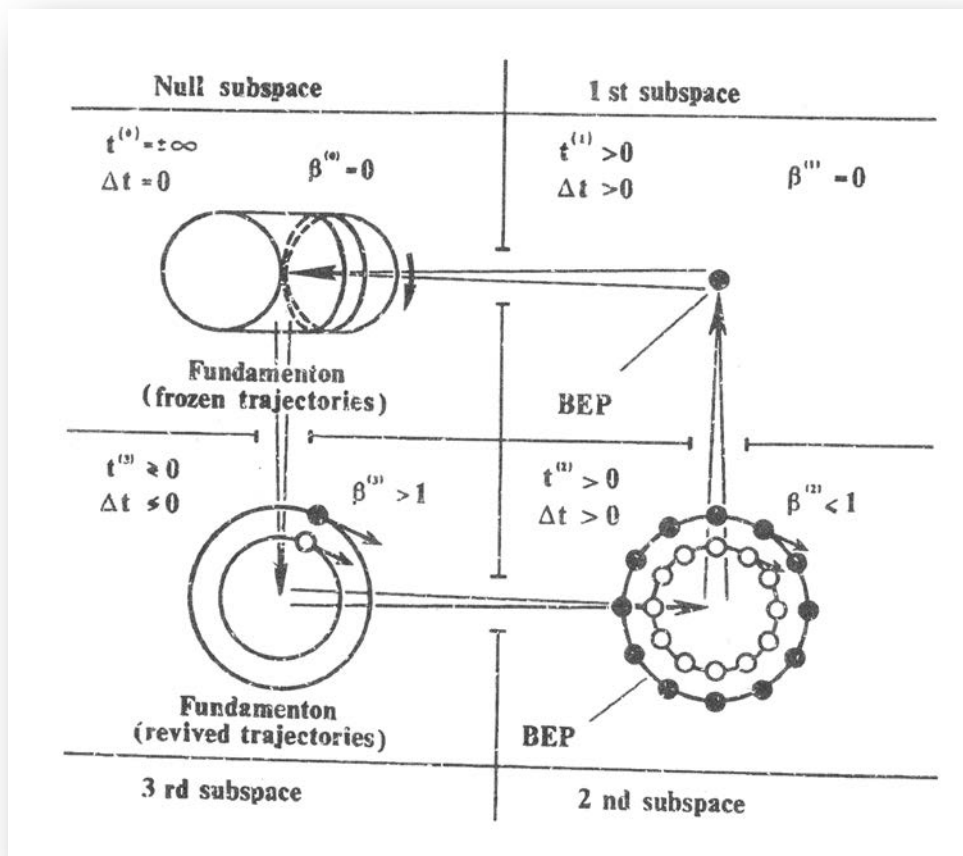


Fig. 2. Spatial metamorphosis of structures of a Bare Elementary Particle (BEP).

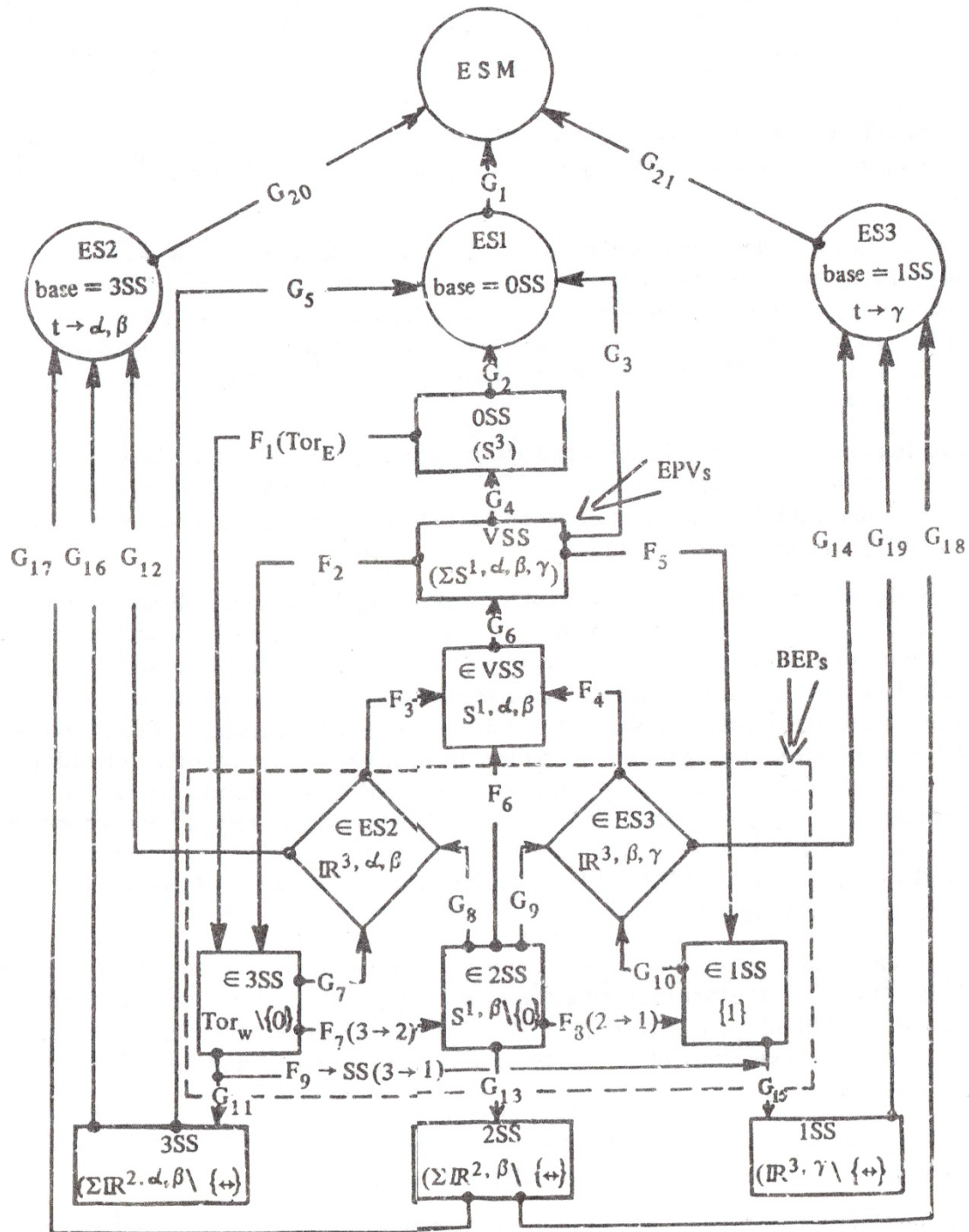


Fig. 1.2. Complete sheme of all subspaces, functional communications and mappings between them; sum of sub-space elements in which BEPs are realized and a subspace element to which EPVs belong.

□ — physical subspace; □ — physical subspace elements; ○ — enclosing space; ◇ — enclosing space elements; G — operator of embedding; F — mapping of any nature; $t \rightarrow \alpha, \beta, \gamma$ — time scale (α , or β , or γ) in the corresponding space or in its elements.

Fig. 3. Complete Scheme of all subspaces, functional communications and reflections / mappings between them; sum of space elements in which BEPs are realized and of subspace elements to which Elementary Particles of Vacuum (EPVs) belong.

◇ Unless the General Theory of Relativity of A. Einstein, where the main accent is put on an equation over a field, the TFF focuses on the principle of the **Triad Law “Space – Time – Matter”**. The TFF tells us that there is a **covariant link between the Space – Time and the Matter** in all the sub-spaces / layers.

◇ The elementary particle of the matter, according to the TFF, is the “**Fundamenton**”, which does not appear directly in our “laboratory” sub-space.

It is present in the deepest level of our layered space (3SS), and it is formed by a **dipole (doublet) of charges of the fundamental field (FP)**, a tachyon.

In other sub-spaces it appears like a “**Bare (nude) Elementary Particle**” (BEP).

In fact it can be considered as a “Planck Particle”, though the TFF enlarges the definition.

When the fundamenton is excited, it means an oscillation of this dipole. And when we observe a particle in our “laboratory” sub-space, we observe only the manifestation of a stable excited state of a fundamenton.

Metastable states of the fundamentons correspond to short-living elementary particles (including resonances).

◇ According to the TFF, different types of excited states (oscillations) of fundamentons give birth (SM principle), in different layers of the space, to different types of BEPs.

BEPs are usual fermions, which, according TFF, do not appear in the “laboratory” sub-space independently, without interaction with the **Physical Vacuum (ϕV)** (without forming “quark structures” of a principally new type, with comparison with this understanding in physics, before the TFF).

There is a large number of theoretically possible types of BEPs (about 800 000), but those which we observe in our world (result of an interaction with the ϕV) is only a small fraction of this number (including those predicted by the TFF, still undiscovered), because the others have a life duration of less than 10^{-13} s, hence they cannot be observed in our “laboratory” space. Other BEPs are virtual particles.

◇ The structure of **Physical Vacuum** is not a “curved void,” as generally assumed, but a real material substance consisting of **Elementary Particles of Vacuum (EPV)**, not observable in our “laboratory” sub-space.

Elementary Particles of Vacuum exist, not in our “laboratory” space, but in another layer of enclosing space, and for us, making observations in laboratory space, they are **virtual particles**.

Such, according to TFF, is the real nature, and not the formal nature, of **virtual states**: particles that really exist, but not in our space, however: they exist in another sub-space, which is complementary (in the mathematical sense) to it.

Elementary Vacuum Particles (EPVs) and other virtual particles are states of the micro-world that manifest themselves indirectly in our “laboratory” space through the results of processes taking place in other spaces

◇ **Each EPV is a pair formed by a BEP and an anti-BEP** (fermion - antifermion pair: for example, a **proton**⁵ and an **antiproton** or an **electron** and a **positron**).

According to the TFF, proton-antiproton and electron-positron vacuums are a physical reality.

The Physical Vacuum is a mix of different “types of vacuums”, and the TFF tells us that there are **9 types of vacuum**.

The most present types of vacuums are of **2 types**, having the highest density:

- the EPV concentration in the case of **proton-antiproton** is the highest ($\sim 1.54 \times 10^{39} \text{ cm}^{-3}$),
- while in the case of **electron-positron**, it is 10 orders of magnitude less ($\sim 1.73 \times 10^{29} \text{ cm}^{-3}$).

The **principal properties of the “laboratory” physical vacuum** (for instance, its dielectric permeability) are dictated by the properties of the **proton-antiproton vacuum**.

◇ In the case, in the physical vacuum (out of our “laboratory” sub-space), there are “excess”, unpaired BEPs, which cannot form an EPV, then they join / unite with an EPV to form a “**quark structure**”, with corresponds in our “laboratory” sub-space to various observed **elementary particles**.

According to TFF, “quark structures” differ from quarks (as defined by physics until now) by the fact that they have a specific structure, which defines their properties. Moreover, the TFF defines a “periodic law” for the quark structures.

According to TFF, only lepton BEPs do not form “quark structures”, but they form some analog (called “**pseudo-quark structures**”: association of a lepton BEP and an excited proton-antiproton EPV).

The TFF has been the first to fully explain all the paradoxal properties of quarks, which earlier wasn't possible.

◇ According to the TFF, **non excited EPVs** are not observable in our “laboratory” sub-space.

When excited, the EPVs acquire a polarization (increase of the dipole arm between its two antiparticles), thus they form pairs of close antiparticles, which are then able to unite: such state of an EPV is named a **photon**.

The process of propagation of the excitation state from one EPV to another (by interaction with an alternative field, or a field impulsion) represents the propagation of light, and it defines also the **speed of the light propagation (light speed)** in the vacuum.

In this process of propagation of excitation from one EPV to the other, the photon loses a very small part of its energy. This allows explaining differently the “**redshift**” of stars' spectrum (earlier interpreted only by the recession of stars from our Solar system).

◇ The **projections of oscillating dipoles of the fundamental field's (FF) Fundamenton** on other layers of the layered space correspond to different rotational motions of FF's charges on circular trajectories, as well as the geodesic spiral path on the surface of a torus in a sub-space with pseudo-Riemannian geometry.

The dynamics of movement of FF's charges on the toroidal surface is determined by the fields of two current strings of the FF. One current line passing through the axis of the torus, and going to the “infinity” (i.e. forming a closed loop but at distances of about the radius of the universe), creates a magnetic field that interacts with the magnetic field of another current line that runs along the axis of the torus, which results in a field along a n-coiled line on the surface of the torus.

⁵ Though the proton has a quark structure, Gerlovin considered it compulsory to consider proton-antiproton like a type of vacuum, because his views of “quark structure” in the FFT differs from the usual definition by physics.

The first, sloping string revolves around the "axial" string, forming a "cone of anisotropy" of the corresponding BEP.

The half-angle at top of the cone is called in the TFF: "**angle of anisotropy**" (see Fig. 4 below). For example, for an **electron**, the angle of anisotropy is $\sim 22^\circ$, for the proton, it is $\sim 17.5^\circ$.

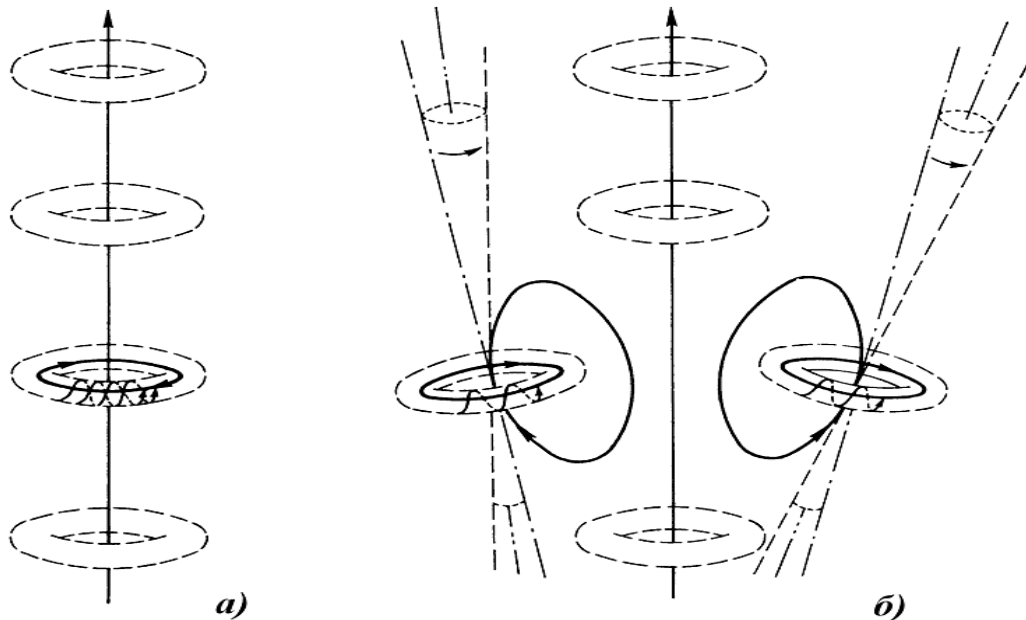


Fig.4 Scheme of a EPV and a BEP in one layer of the layered physical space:
a) EPV; b) BEP.

These 2 angles determine the anisotropy of properties for all the BEPs, EPVs and Elementary Particles. For non excited EPVs this angle is equal to zero, but it becomes greater than zero if there is a sufficient excitation.

◇ The force interactions between atoms in molecules and crystals have not a spherical, but an axial symmetry and, due to the rotational movement of FF's strings in particles, they change over time with very high frequency (at approx. 10^{18} GHz). The forces of particles' interactions are changing all the time, but because of the very high frequency of these changes, this does not result in any observed effects.

◇ Almost all material structures "remember" that they are based on a string of the FF, which "scans" the surface of a cone.

This memory may manifest itself in macro-objects, when they form a shape of a cone or a pyramid with an angle at the top close to 35° ($2 \times 17.5^\circ$) and 44° ($2 \times 22^\circ$). The formation of these geometric objects may cause resonance effects on the state of the physical vacuum and on the substances within these macro-objects. This can lead to a very unusual and various forms of effects caused by forms.

◇ **Gravity in the TFF** is explained as the result of "shielding", by the structural elements of the Elementary Particles, of the force lines ("strings") of the fundamental field.

The **gravity shield**, present for all the elementary particles, has not a spherical, but an **axial symmetry**.

As a result, the effective value of the shield depends on the **orientation** of the Elementary Particle. In the direction of the vector of spin of the EP, the shield is stronger, than in its orthogonal plane (the shield is maximal along the axis of rotation of the substructure, for an EP).

Therefore, if the spins of the EPs which are forming an atom (essentially nucleons, because they define the main mass of the atom), are oriented in one direction, then gravitational force is maximum in the direction of this direction, while in the perpendicular plane, it will be minimum.

Weight loss of the SP due to spin structure can reach approx.

Unfortunately, the experimental testing of this fact is very difficult, because this effect can be observed only almost all of the EP spins' orientation is controlled, at the level of a macro-object (weighing at least a fraction of gram, or more).

When gathering in a small amount a very large number of particles, this may displace (chase, crowd out) some EPVs: therefore, this tends to reduce tension forces of the vacuum.

If the concentration of EPs in a given volume is close to the concentration of EPVs ($\sim 10^{39} \text{ cm}^{-3}$), then the forces of gravitational interaction between them can greatly decrease. Reduced gravitational forces result in a defect of mass and liberation / discharge of energy.

So the TFF theory predicts the possibility of liberation / discharge of gravity-vacuum energy in the internal part / core of the some stars and planets.

◇ The **anisotropy of electron properties** identified by the TFF (as well as in other EPs) has made it possible to explain the mechanism of formation of "**Cooper pairs**" when **superconductivity** emerges, as well as to calculate the temperature of transition into the superconducting state, for various substances; and the calculated values match the experimental data.

The Cooper pairs appear when both electrons approach each other so much that their structure in the exterior sub-space (from the point of view of our "laboratory" sub-space), trap each other in their respective" cones of anisotropy.

I.L. Gerlovin has predicted that the theoretical limit temperature of superconducting state of conventional type is equal to $\sim 100^\circ \text{ K}$, which subsequently has been confirmed experimentally.

According to I.L. Gerlovin, the formation of superconducting state in the matter is provided for by excited EPVs. The "usual-type" superconductivity arises from excitation of electron-positron vacuum (which, for example, is made possible by the micro-porosity of high-temperature superconductive ceramics).

But it is also possible to generate high-temperature (up to $10^5 \text{ }^\circ\text{K}$) superconductivity with the participation of excited proton-antiproton vacuum.

◇ One of the consequences of the TFF development was to create a **new crystallic model of atomic nuclei**.

According to generally accepted ideas, the nuclei of the atoms are made up of Z protons and N neutrons in the nucleus A.

In contrast, the TFF tells us that **the nucleus contains A protons and N negative "metons"**, which neutralize part of the positive charge of the nucleus.

The **meton** is a specific and metastable state of electron, which finds itself inside the nucleus.

It doesn't exist in a free form. The meton is formed when an electron interacts with a proton, in such a way that it leads to the "compression" of the electron.

The **meton's Compton wavelength** is equal to 3 times the proton's Compton wavelength, so, unlike electrons, the meton can be part of the nucleus. Therefore, the neutron in the nucleus is considered to consist of a proton and a meton.

In a coordinate system, where the elements of the nuclei structure can be considered as fixed, all the protons of the nuclei form a proton spatial shape, and all the metons form a “metonic” spatial shape. The symmetries of these 2 shapes are mutually “coordinated”. Each of these figures individually is unstable, but together, they form a stable nucleus.

The degree of anisotropy fields (relationship between maximum and minimum) for the proton is equal to 10^7 , while for the meton, it is 10^{27} , i.e. 20 orders of magnitude more.

Therefore, the nuclei structure will mainly depend on the number and relative positions of the metons' cones of anisotropy. The field minimum field is located on the axis of the cone of anisotropy, or on a plane perpendicular to the axis, passing through the meton's centre. All the protons, rejecting each other, will tend to sit symmetrically on the elements of symmetry of the proton figure, where interactions between the protons is minimal, and at the intersection of the metons' cones of anisotropy, where link with the metons is maximum.

This **new crystallic model of nuclei** explains well the reasons of the instability of some isotopes of substances, leading to their radioactive decay, as well as some other physical effects.

◇ Also, the TFF manages to explain why the solids melt at strictly defined temperatures: the theory found, and confirmed by calculations, a method of theoretical determination of **melting temperatures**.

According to the TFF, in the crystallic structure of the matter, there exist some specific objects, called the “**cresons**” (for “critical resonances”), which correspond to long-live excited states of EPVs, located at the symmetry nodes of the crystals (for instance in the octahedral or tetrahedral free spaces): this is caused by the anisotropy of the force field created by the EPs.

At these locations, the cresons enjoy the maximum linking energy with the atoms of the crystallic grid. Therefore, the cresons play a determining role in crystallic and poly-crystallic matters, thanks to the strength of their links inside these matters.

The melting of a substance takes place when the cresons leave the symmetry nodes of the crystals, destroying the internal and inter-crystallic links.

3. Some Applications of the TFF:

3.1. Activation of liquid substances:

The TFF allows explaining the mechanism of **structural activation of pure water**, as well as of **chemical catalyzes**.

The structural activation of substances correspond to the change of state of their molecules, into a specific, activated state with increased level of energy, which triggers chemical reactions.

For water, this state corresponds to the dissociation of its molecules into H^+ и OH^- ions. However, in the reality, there is no real dissociation, but formation of “**quasi-molecules**” H^+e^- и OH^-e^+ (quasi-acid and quasi-base), which enjoy a high level of stability (during a few days, with progressive decline of their concentration, after the activation took place).

This effect is observed, in particular, for various activation of water with electrical current, using special separators between the electrodes, or without current but using an electrical field created by isolated electrodes. (see Fig. 5).

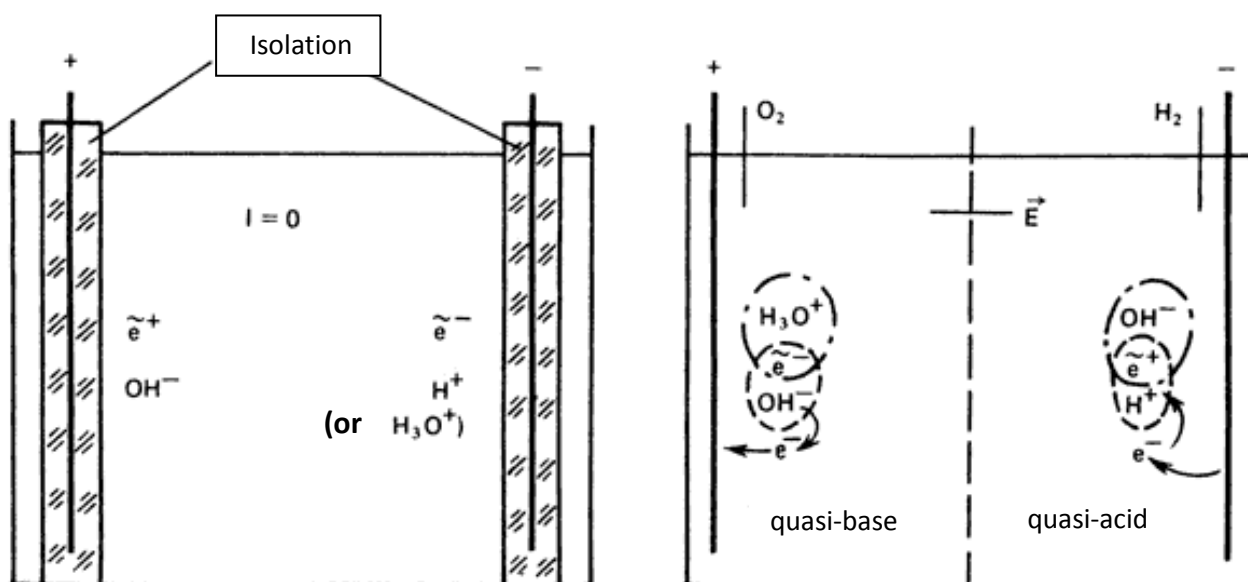


Fig.5 Scheme of physical-chemical activation of water:
without current (right), with current (left).

According to the TFF, there is a kind of permanent level of excitation state of the real physical vacuum. In this state, the electron-positron particles of vacuum are at a (dipole arm) distance of about $\sim 1,79\text{\AA}$

As this dipole arm is greater than the distance between the atoms in molecules of water ($0,96\text{\AA}$ between O and H, and $1,53\text{\AA}$ between H и H), this virtual (in our “laboratory” sub-space) electron-positron pair will tend to break the water molecules into ions. This effect will especially impact the link between O and H, therefore the molecule is dissociated into ions H^+ и OH^- . But these ions immediately pair with the electron and positron of the EVP which caused this break (see Fig. 6).

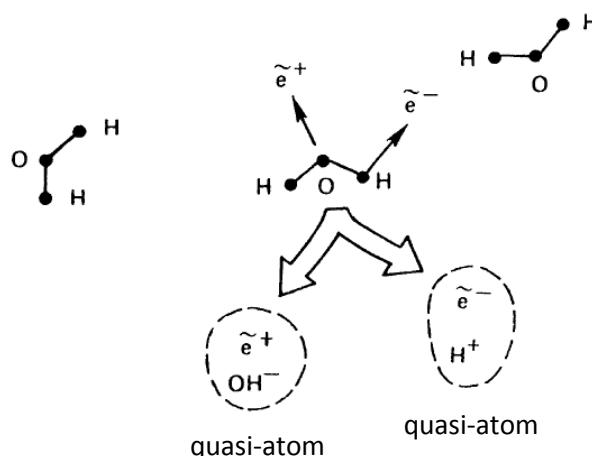


Fig.6. Scheme of water dissociation due to physical-chemical activation.

These 2 quasi-molecules are permanently present in water, but as they are always diluted and mixed among themselves, there is no particular / visible effect. However, if one applies an electrical field, these quasi-molecules migrate to the cathode and the anode, forming stable fractions of activated water, as quasi-acids and quasi-bases.

◇ **Activation of substances** can also be triggered by a magnetic field. In this case, the field creates a Larmor precession of electrons, which have (see above) an anisotropy of their properties along the axis, which corresponds to their spin's axis.

This effect has the potential to impact molecular links of the said substances, which, on its turn, influences their physical-chemical activation.

◇ Hence, the TFF predicts theoretically different possibilities of physical-chemical activation of substances, and various experiments took place to check this, including on liquid fuels.

The results of these experiments showed that activation increased the calorific power of the fuels by 5 – 10 % (see Fig. 7 below), as well as other changes of characteristics of the activated fuel (increased red-ox potential, decreased flash point by approx. 6 °C, increased volatility, decrease of superficial tension by approx. 4.8 %, increase of viscosity by approx. 2.6 %).

At the same time, there were also differences between the samples taken at the anode or at the cathode of the activator (activation via electrical field).

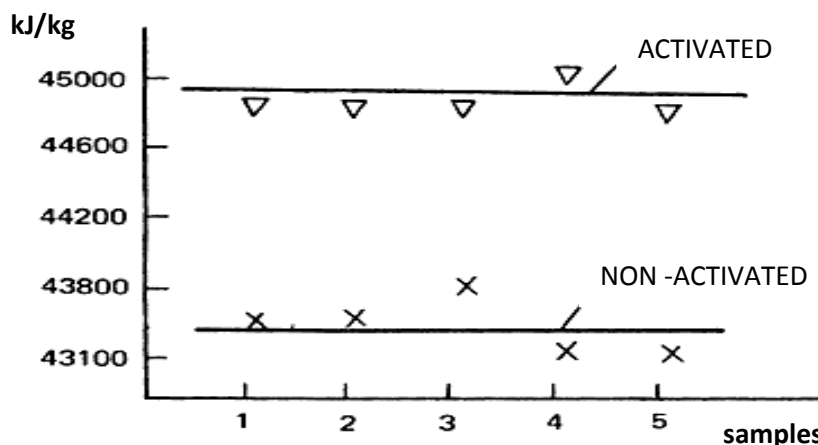


Fig.7. Diagram showing the increase of calorific power of aviation kerosene (type TS-1: Russian norm) after physical-chemical activation.

These quite simple experiments showed that the activator needed an empirical regulation to work in an optimal regime, and also that the activated fuel cannot be stored for a long time. The fuel's characteristics go back to their initial values after approx. 3 hours from the activation.

Sometimes, however, the deviation of characteristics from norms, caused by activation, continued to increase for a certain time after the activation process ended.

3.2. New Approach to the cold fusion:

The physical vacuum not only plays a major role in spontaneous processes of **nuclear decay**, but **also in nuclear reactions**.

According to TFF, the basic unified fundamental field is concentrated in an almost linear string, which for elementary particles scans in the surface of a cone. Therefore, it follows, as we have seen above, that in the sub-space where nuclear particles interact there is an enhanced field (fundamental, and not Coulomb) barrier along the string of the fundamental field that is greatly reduced in the orthogonal plane.

One consequence has been described in the article **"New approach to cold fusion (low-temperature nuclear fusion)"** ⁶, where I.L. Gerlovin is a co-author: the encounter of interacting particles depends chiefly not on the relative energy of the encounter (temperature), but on the mutual orientation of the spins of the particles interacting in a **low-temperature nuclear fusion (CF)**, since the axial symmetry noted above is related to the orientation of particle spin.

Thus, **artificial orientation of the spins** of particles interacting in Cold Fusion (CF) should have a substantial effect on the course of the process.

Experiments conducted showed that **even a constant magnetic** field has a substantial effect on the entire course of the process and on the yield of neutrons in particular.

The effect of the physical vacuum's properties on the process of CF has not been taken into account previously and the paper summarizes the attempts by its authors to take it into account, in order to imagine CF reactions involving the physical vacuum.

According to these authors, and based on the TFF concepts, the process generally called cold fusion is in fact a result of the **interaction of nuclei with the physical vacuum** and is only accompanied by a minor process of nuclear fusion: therefore, the energy characteristics of the process cannot be entirely determined by nuclear fusion.

In order to check this theoretical conclusion experimentally, tests have been conducted in the US, on the basis of the authors' predictions, in 2007 or 2008. This was done in cooperation with the Director of the American Corporation for International Trade and Development at that time, Michael Mitchell, who considered these researches and helped to raise a financial support for some of these works. An article was to be published on the results of theoretical and experimental investigations, but I couldn't find it yet.

⁶ I. L. Cerlovin, R. Kh. Baranova, and P. S. Baranov
(Translated from Zhurnal Obshchei Khimii, Vol. 62, No. 1, pp. 230-232, January, 1992.
Original article submitted December 15, 1991.)
0022 - 1279/92/6201-0193 © 1992 Plenum Publishing Corporation
Article cited in specialized website on Cold Fusion : <http://www.lenr-canr.org>

Conclusions

We have tried here to underline some important facts about the TFF theory, which also give strong arguments in its favor, among which are:

◇ the TFF is inspired by laws governing the Nature (see the “**Paradigm for Viable and Developing Systems**”, paragraph 1.3. below).

From the beginning of its book, I.L. Gerlovin described his work as an attempt to tackle the problem of “aggravating conflict between Humanity and Nature”. Hence the Author decided to go from a right set of laws describing natural systems (living or not, but viable and able to develop themselves).

◇ the TFF allows **calculating several physical values** directly from the basic principles and results of the theory, while, at the same time, getting rid from several arbitrary factor in its equations;

◇ the TFF predicts certain **new phenomena** (emerging from the energy of the vacuum, among others, activation of substances, ...), some of which were confirmed by experiments.

In some cases, the TFF has been the first to give a satisfactory explanation to facts known earlier, but which remained unexplained.

◇ The **gravity properties** are explained by a new “**shielding**” effect (shield from the fundamental field), with an axial symmetry.

◇ The TFF is capable to justify the postulates on which the other existing candidate theories are built on, and at the same time, is capable to defined the limits in which these postulates and other theories can be applicable.

The TFF pretends to encompasses and to enlarge all the **modern theories** (strings, superstrings, etc.: i.e. the current so-called (tentative) “theories of everything”), interpreting differently observed the facts and underlying principles.

According to the Russian Academy of Natural History (RAE) ⁷, this is the **most relevant theory of the matter and the interactions inside matter** (gravitation, electromagnetic, weak nuclear and strong nuclear), in all times.

When trying to compare (“helicopter-view” and with the eye of a non specialist) the TFF with other theories, we observe that:

◇ the TFF uses similar mathematical tools, modern algebra, and uses modern results of the theory of groups. Of course, only specialists will be able to give a full assessment of these works, but the entire book (430 pages) needs to be studied.

The TFF uses topological / algebra tools, whose relevance can be assessed by modern scientists. Have a look to the topological dimensions of the various sub-spaces and enveloping spaces, in Gerlovin’s book.

◇ the TFF is based on a **layered space / fiber bundle** (to my opinion, it is similar to the brane-based theories, and approach to be also compared to the “hidden” dimensions used in other theories: M-Theory, Strings, ...)

⁷ <http://www.rae.ru/monographs/21-556> (in Russian)

◇ the TFF uses conformal transformations (called “**Space Metamorphosis**” in the Theory), which are equivalent to what we can call “**intricate information exchanges**” between the layers (sub-spaces) of the global “enclosing” space.

This is as a central and structural element of the theory, a “vector for interactions” between particles, virtual states of particles, energy, ... (this statement, as well as the terms to be used, needs to be fine-tuned by specialists, because it is very important and a key point in the theory).

◇ the Author used tools similar to “**strings**”, even before the string-based theories have developed.

◇ the TFF introduces a **new structure for the physical vacuum**, and hints to the energy of the vacuum.

◇ the TFF introduce “**fundamentons**”, which are similar to the Planck Particles, while other theories define it as a hypothetical particle (a tiny black hole whose Compton wavelength is equal to its Schwarzschild radius; its mass is approximately the Planck mass, and its Compton wavelength and Schwarzschild radius are about the Planck length), as well as a “**fundamental field**” (reference to the various field theories developed in the last decades).

Based on the above, I would like to submit you the following “equation”:

STRONG BASIS OF THEORY, COMING BACK TO THE BASIS OF THE LAWS OF NATURE
 (“PVDS”)

+

POTENTIAL TO “COMPUTE” EXISTING FACTS WITHOUT ARBITRARIES

+

STRONG SIMILITUDES and alleged CONFORMITY WITH EXISTING THEORIES

+

POTENTIAL TO PREDICT NEW PHENOMENA, WITH SOME ALREADY CONFIRMED BY
EXPERIMENTS

=

?

Don't we have here some essence and ground for a **strong theory**, the “**theory of all interaction in matter**”, as I.L. Gerlovin called it ??

What comes next ? ...

Unfortunately, the ideas of I.L. Gerlovin remained too unusual and difficult to understand (reference to the very complex mathematical tools used) for the majority of the other Soviet physicists, and remained largely unknown abroad.

I believe that the TFF represents a global theory, with its far-reaching consequences, able to explain a large number of phenomena, still unexplained by modern science.

Of course, it remained unfinished, and like any theory, it might have mistakes, hidden or not ⁸.

But, as we have seen above, the number of theoretical estimates / calculations (**see Appendices 2, 4 and 5**), made on the basis of the TFF and finding **values in line with the experimental data**, shows that it is likely a very promising theory.

As a single man, I.L. Gerlovin made humanely everything possible for the development of the TFF. The further development of his ideas shall be addressed by the joint efforts of several scientists. This work also requires an objective relationship to it, without *a priori*, as well as rare intellectual efforts.

⁸ The book in Russian has been corrected a few times (typos), and the English version has already eliminated most of the typos.