

Fundamental REPRESENTATIONS (Concepts) and Magnetism

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Abstract

The attempted construction of a detailed picture of the magnetic field distribution in space revealed a number of contradictions in modern concepts of it, the cause of which lies in the formal use of the Euler equation for an ideal incompressible fluid and Laplace hydrodynamics to describe the magnetic field. But moving away from formalism required not only constructing a picture of the magnetic field in depth, in its fine details, but also correcting it from above – rethinking the very fundamental concepts used in theories: field, space, relativity. This approach allowed not only to correct the general physical picture of the magnetic field, currently described as a single-particle phenomenon, as reflected by Maxwell's equations, but also to eliminate contradictions in abstract concepts, including mathematical ones.

Keywords: Space, Time, Relativity, Chaos, Harmony, Games, Reality, Magnetic Field

Introduction

Selection Rules formulated in mathematical language have made it possible to systematize and describe many physical phenomena [1, 2]. However, their absolutization has overshadowed Imagery, which manifests itself, both explicitly and implicitly, as a more universal Selection Rule even in such abstract games as Tic-Tac-Toe, Checkers, and Go. Imagery is present in Psychology [3], and in Art, of course - directly in the Visual Arts, and indirectly in Music. Furthermore, both Color Symmetry [4] and the Images of Literary Works fully demonstrate that the Dimension of Imagery is greater than 3. Meanwhile, the mathematization of the Magnetic Field was based on Descartes' Primitive Visualization and Laplace's equally Primitive Hydrodynamic Model. However, elementary mathematical errors were also made. And, as a consequence of the non-strict, in fact not taking into account the Relativity, DEFINITION of a purely relativistic Phenomenon – the Magnetic Field – the Concepts of Space-Time were also distorted.

Mind Games and Reality

Games in childhood are crucial for the development of not only children but also baby animals. While baby animals' games are relatively short-lived, for humans, this playful period can last for a long time. Moreover, some Games have even been elevated to the status of socially significant. However, any Game leads into a World of Artificial Rules that don't always take into account the Fundamental Laws of Nature, thus separating one from Reality. Furthermore, a Game by rules fundamentally limits the number of possible combinations.

And as we can see, computers are already significantly better than humans at handling this task, limited by a finite number of combinations. This was demonstrated by Gary Kasparov's Chess Game with a Computer. This is also demonstrated by modern Theoretical Physics, which has long been built not on the basis of a Unified Picture of the World, but fragmentarily, according to Niels Bohr's imposed schizophrenic Rule about the existence of mutually exclusive entities in Nature.

The disconnect between Fragmented Science and Reality has been vividly demonstrated by Elon Musk's Grokipedia, which, with the help of Artificial Intelligence, quickly concocts a very decent compilation of Scientific Knowledge on any given topic, the fragments of which do not fit into the Unified Picture of Reality. Psychology classifies this game-like View of the World as a pathology, as schizophrenia. But the issue is not so much the individual schizophrenia of some talented individuals in Science, but rather that the schizophrenic absolutization of a certain area of knowledge inevitably leads to a Dead End [5], to a finite number of combinations limited by the Limit, determined by the rules of the Game.

On the one hand, this seems INEVITABLE, since the CHAOS of Dynamic Flows in Nature, which over time destroys any static Harmony, also manifests itself in the Highest Degree of Harmony in Nature – in Consciousness. On the other hand, Music constructed according to Harmonic Notes IDEALLY ensures the transition between Notes without disrupting Harmony, and the Music of Brilliant Composers does not disrupt Harmony in the entire musical work, nor in the Music of all humanity. Science, in principle, should also strive for such an Ideal State. But, as noted above, even primitive Artificial Intelligence has "seen" that this is not currently the case. Thus, Mathematics, which is not surprising, since it is, in principle, at the forefront of the Struggle between Harmony and Chaos in Human Consciousness, has effectively become an abstract Game, divorced from Reality. Moreover, with the same additional restrictions imposed when dividing Mathematics into sections. The modern separation of Mathematics from Reality was marked by an attempt to Generalize it: mathematicians David Hilbert (formalism), Bertrand Russell (logicism), and Egbert-Jan Luitzen Brouwer (intuitionism) competed for the right to single-handedly determine the direction of this discipline's development in the 20th century.

In reality, the three Luminaries could not have written ELEMENTARY Mathematics, since they fundamentally relied on the laws they themselves studied - particular, non-invariant, i.e., non-general. Moreover, as has now become clear to mathematicians themselves, Mathematics, having relegated Geometry to the background, even with its multidimensionality - the algorithms of Riemannian Geometry - lost its IMAGERY and found itself at a dead end. That is, the task of constructing ELEMENTARY Mathematics at a modern level turned out to be (even for me) quite difficult, and only now do I understand why Grisha Perelman did not respond to my request to write a modern ELEMENTARY Mathematics. But then, at the dawn of the last century, the mathematician David Hilbert, not considering himself a physicist, also declared the vector of Physics's development: "Physics is too complex for physicists," which prompted the elevation of theoreticians above "primitive" Classical Physics.

But the dull following of half-baked mathematicians - theoretical physicists - at the tail end of the achievements of Mathematics, which had sunk to a mere game of Algorithms and Formulas, naturally separated them from Reality. This has now become obvious after analyzing the "FOUNDATIONS OF quantization" [6]. But not only for the layman, but also for a wide circle of scientists, it was postulated that the pinnacle of Physics was Quantum Electrodynamics, built on sand. Thus, the luminaries of "Quantum Theory" and those who knew only the word "Quantization" found themselves at the same level of UNDERSTANDING – the level of MISUNDERSTANDING.

Moreover, some theorists themselves even went so far as to say that "Theoretical Physics is dead, since all the equations have been solved." That this is not at all the case is clearly demonstrated by the example of the incomplete equation of the ELEMENTARY Harmonic Oscillator, the formulation and solution of which turned out to be fixed at the level of Newton's Particular Solution [7, 8]. Others, such as the "quantum classicist" of Magnetism, Matisse [9], sank so low that, considering Classical Physics dead, he commissioned his wife, an art historian, to write a Classical Description of Magnetism in his book! And he "justified" this by -

saying that an UNDERSTANDING of Magnetism is supposedly only possible at the Quantum Level. While it was precisely in Maxwell's Classical Electrodynamics that the Magnetic Field was introduced, without the necessary scrupulous Classical Experiments. This is why there is still no strict definition of the Magnetic Field and no unambiguous understanding of what it is. And some authors reject its existence altogether, basing it on the fact that it is included in Maxwell's equations together with the Electric Field and is its simple consequence. In doing so, they only take into account the formal relativistic connection of these Fields, thereby failing to understand the nature of the Magnetic Field. One could just as easily claim that there are no stress fields in materials, but only the interaction of electron orbitals in atoms. For practical purposes, of course, it doesn't matter what the Field is. What it is is the cause of the emergence of a real (not theoretical) Force. And a field, as Academician Alexandrov said, is that Force which we can measure. Therefore, the Magnetic Force cannot be dismissed, if only to understand the structure of the Field of this Force. And most importantly, to eliminate the phenomenological prohibition of the very existence of the Magnetic Field, as posited by the Curie theorem.

As the hero of "The Matrix" said: "Fate has a sense of humor." Einstein, whom Niels Bohr, with his schizophrenic Principle of Complementarity of Mutually Exclusive Entities in Nature, had pushed out of Quantization. Having become acquainted with Poincaré's works through his mathematician wife, he interpreted them in the Theory of Relativity as a manifestation of one of these mutually exclusive entities, incompatible with everyday consciousness. But being a physicist, unlike Bohr, Einstein was tormented to the end of his days by the resulting disruption of Harmony in Nature. Therefore, as Lev Termen told us at the Academic Council, he approached him with a request to play Elementary Geometric Figures on the theremin. But, as Termen said: "Einstein was a good man, but a weak physicist, and I kicked him out." A scientist whose work was based on UNDERSTANDING had no point in communicating with someone who had allowed MISUNDERSTANDING into his calculations. To clarify and correct the situation with the Magnetic Field, an Analysis of abstract, mathematical concepts that had become canonical was needed, and their transformation into OBVIOUS - physical - concepts, i.e., VISUALIZATION.

Visualization of various Fields is often used by creating an Image Picture based on indirect evidence, for example, the Stress Fields in materials. Unfortunately, not all Discoveries in Physics are widely recognized. For example, Andrei Ivanovich Shelykh discovered the Magneto-Optical Effect long ago. He even became the official Author of the Discovery for the USSR. But his first step was to be discredited by those who had done nothing worthwhile in Physics. So, Shelykh's experimental method never found its natural continuation. And we, like the ancient Greeks who discovered the Atom, will have to mentally VISUALIZE the Magnetic Field following the logic of Basic Experiments in Magnetism. Finally, the introductory section of this article, "Visualization of the Magnetic Field," was already sent to the journal's editors for review only. However, without my consent, it was published as a full article. Therefore, to avoid repetition, I am omitting this section, including the background to the topic, and providing only a reference [10]. However, for a meaningful reading of this article, it would be a good idea to first read it, as well as my previous articles on the Magnetic Field [11-16]. However, it should be taken into account that these previous articles were analyzed in the order determined by the history of the development of the now widely accepted concepts of the Magnetic Field, which, as follows from this article, contained fundamental omissions and mathematical strains.

ELEMENTARY REPRESENTATIONS of the Field

ELEMENTARY is fundamentally different from PRIMITIVE. ELEMENTARY is composed of invariant elements and provides a general picture, while PRIMITIVE reflects only the characteristics of the immediate environment. Proofs of the existence of elements can be quite complex and voluminous, both in Physics and Mathematics. For example, Bourbaki devoted an entire volume to proving the invariance of the unit, and four schools of mathematicians have written four books confirming the validity of the solutions in Grisha Perelman's 20-page open access article. But it is precisely from invariant elements that a SIMPLE, consistent, and holistic picture of natural phenomena is formed. Using non-Invariant "Primitive Cells" instead of ELEMENTS, corresponding to Particular Regularities familiar to a narrow specialist, only describes a fragment of the General Picture of Nature. And with the Primitive Approach, going beyond the Applicability of Particular Regularities leads to what in Mathematics is called a FALSE! And rigorous proof of the ELEMENT's existence, as Mathematicians themselves (but not most theoretical physicists) have understood, is based not so much on the mathematical notation of reasoning in the form of formulas as on Geometric Images.

These are accessible to a wide range of researchers, not just narrow theoretical calculus specialists. The General ELEMENTARY Picture is further simplified significantly if ORTHOGONAL Elements are chosen, as their required number is minimized. So, let's begin with ELEMENTARY, but far from universally understood, Concepts of the Field in general.

The ELEMENTARY Concept of the Sea, across which Waves run, was acquired by man through direct observation - through sight. It was by analogy with the Sea that man initially perceived a Field overgrown with grain, across which a breeze can also drive waves, which gave rise to modern Field Concepts and Methods of Mathematical Physics.

Subsequently, the everyday concept of a Field was extended to many other macroscopic phenomena, the holistic Picture of which is described by continuous functions. In this case, invisible Particles (like, say, ears of wheat, which are quite visible nearby) of the collective Whole, even if they are known, are excluded from the Field Consideration itself (from the Function describing a given Field). In practice, Academician Alexandrov defined the Field, even one we cannot directly perceive, as a manifestation of Power: "A Field is something that can be measured."

His terse words can be expanded upon: a Field is something we don't always see directly, but we can measure its Power. And we can add: we can VISUALIZE the Field Power Distribution Picture, and the Fields themselves, and thus attempt to detail it, identifying its constituent ELEMENTS, both static and dynamic. Thus, strictly in accordance with the Concept of the Sea-Field, Field Methods began to be used to describe stresses and pressures in solids, to describe invisible but audible sound waves in gases and condensed media, to describe vortices and vortices, and to describe emerging flows. Moreover, it became possible to VISUALIZE what occurs within many Fields. For example, just as sound waves consist of particles – atoms/molecules, the movement of which forms the Field, we have learned to both measure and depict.

Logarithmic Relativity and Magnetism.

Logarithmic (Ordinal, Power) Relativity manifests itself in all Dimensions: Time, Space, Force-Intensity, and Frequency-Energy. Its reflection, naturally, is present in Scientific Description, as well, as an adiabatic decomposition of energy. And the alternation of Field and Partial Descriptions of Nature, in accordance with the Principle of Logarithmic Relativity, has implicitly entered into theories, but has often been misinterpreted. Niels Bohr interpreted it as his Principle of Complementarity, allowing for the coexistence of incompatible Entities (just like in the joke about the philosopher). Logarithmic Relativity extends across many scales, both in depth and breadth. But even the blind mathematician Pontryagin realized that a Functional Relationship can exist between certain Functional Sets, such as the Fourier transform between de Broglie's matter waves and Newton's ELEMENTARY Particle [17, 18], which also applies to a charge with its electromagnetic waves [19]. Usually, this alternation is used CORRECTLY, namely, for conjugate, bordering scales. For example, we can describe the Spiral Galaxy, a consequence of the (continuous) Mass Flows in the Universe, by the averaged motion of "Particles" - Stars and Planets - their Kinematics, while we can describe a sound wave by the Statistical Mechanics of atoms and molecules. But neither the Electric nor the Magnetic static Field has yet been decomposed into particles, and perhaps for this very reason, we have not learned to correctly VISUALIZE the Fields themselves. Hence the "theoretical prohibition" on the existence of an Electrostatic Field within a charged sphere, supposedly following from the Ostrogradsky-Gauss theorem. Hence the laxity of the very definition of a Magnetic Field and, as a consequence, the imaginary nature of Time introduced into Maxwell's equations. And so it happened that the loss, as already noted, of Imagery in Mathematics itself suppressed Imagery even in Physics during the mathematization of Descriptions of Phenomena. Indeed, without Imagery, Mathematics itself degenerated into a mere Mind Game. Even the definitions of Scalar and Vector Potential, taken as fundamental in Magnetism, are based solely on memorized formulas, and their verbal definition is a veiled recurrence formula: «The first formula implies the second, and the second implies the first. But we'll examine this point in detail later».

For now, I'll just emphasize that truly accomplished theorists are adept at seeing what formulas express as a necessary and very useful element of analyzing a phenomenon. This was once vividly demonstrated to us,

participants of the International School of Physics, by Academician Gorkov. Now, they don't make people like the ones they did at the Landau School. And at our Ioffe Institute, they don't make people like Venya Kozub, who read "The Ballad of Superconductivity" to the stunned academics at that International School of Physics, figuratively encapsulating the entire Bardeen-Cooper-Schrieffer Theory within it. Physicists now either become, as Dmitry Gidman, a theorist from the Landau School, once surprised me by saying, "You're a solid-state physicist, but you understand the String Theory MODEL better than my graduate students." To which I handed him Feynman's book, "The Theory of Fundamental Processes," and said, "Everything is described here without embellishment or artifice."

Or they pursue a scientific career even while trying not to occupy their minds with Physics, like my former, but far from excellent, graduate student, now a department director at the Ioffe Institute, who ran to my house after his pre-doctoral defense so I could explain the theoreticians' questions. But modern Theoretical Physics, unfortunately, has mostly merely prolonged the loss of Imagery in Mathematics itself and has been reduced to the formal use of algorithms derived from primitive models. And the argument of narrow-minded theoretical physicists: "From a formula, this and that is what we get!" reflects, on the one hand, a careful attitude toward the discovered Fundamental Laws, but, on the other, it reflects an absolutization of the level of UNDERSTANDING once achieved. And yet, more intentionally than unintentionally, the often-low level of understanding at which the "insight" of the formula came, which became the foundational (and untouchable) formula for an entire generation of researchers, is concealed. And Magnetism, as I have repeatedly noted in my articles, even regarding the REDEFINEMENT of the Magnetic Field, clearly demonstrates this. So, in this work, before continuing the rigorous Mathematization of the Magnetic Field, I am compelled to note a striking fact demonstrating the complex CONNECTION between "Insight" and Reality. The mathematician Laplace discovered a purely mathematical CONNECTION between different variables in the first quantitative experiments on the magnetic field, similar to that obtained in hydrodynamics. As the saying goes: "For this, honor and praise to him!" And now I myself have to deal with the fact that, having begun to analyze the basic model, sometimes, simply by "glancing" at it, I immediately draw the final formula. But I won't publish it until I've traced this discovered CONNECTION with the variables embedded in the formula as strictly as I can. I'm simplifying this work only by trying to use variables reduced to universal constants, often setting the latter equal to unity. And, of course, I'm relying on modern concepts. But what did Laplace have to draw his conclusions from? Data from the optician Biot, who discovered the rotation of the plane of polarization of light in tourmaline, and from the acoustician Savart, who created an ultrasonic generator - the "Savart Wheel" - based on "the flow of a Magnetic Field through thin electrical conductors?!?" Frankly, it's not much. And the hydrodynamics used by Laplace has itself been repeatedly corrected and, as follows from the Visualization of the Magnetic Field, should be fundamentally corrected.

The appeal to hydrodynamics in describing the Magnetic Field was, on the one hand, entirely appropriate and consistent with the Principle of Logarithmic Relativity. However, on the other hand, Maxwell's Electrodynamics was based on the incorrect notion that the Magnetic Field flows through wires and was therefore applied not to the primary currents that generate the Magnetic Field, but to the secondary current, which is, in fact, the Magnetic Field. It's like trying to calculate the weather not from the movement of air masses, but from the movement of the vortices they generate. Therefore, Laplace's formulation of the Biot-Savart-Laplace Law, based on hydrodynamics, is quite incomplete. Just like hydrodynamics itself, which could never explain how a tornado lifts a 3-kilometer-high column of water into the sky. Thus, Laplace's formulas only indirectly and approximately reflect certain aspects of the Magnetic Field's manifestation, but they provide no comprehensive description, much less a description of its structure. They missed (as will be shown) a significant point, both literally and figuratively.

Maxwell, in his formal construction of Electrodynamics (borrowing Heaviside's mathematical physics), used Laplace's hydrodynamics (although Maxwell's equations are a special case of the equations derived for an ideal incompressible fluid by Euler back in 1760). At the same time, in his Concepts of the Magnetic Field, he relied on the abstract relationship between Flux and Force (as in Coulomb's Law for electric current) and the naive notion that Magnetic Flux flows analogously to the flow of Electrons through wires. With this compilation approach, Maxwell's original starting point in his generalized equations was lost and supplemented by -

Oersted's "Law," which merely qualitatively indicated the Force rotating a magnet located near a conductor carrying an electric current, and Faraday's "Law," which only partially describes the phenomenon. Let us remember that the Field is a distribution of Force, and in the Description of the Magnetic Field, they tried to avoid the Magnetic Fat itself, since initially, starting with Bio-Savart, they built Streams that did not always correspond to the Stream of Force!

Thus, the expression for the magnetic field force implied in Ampere's law, generated by a moving electric charge, was not initially formulated explicitly. It was incorporated into Maxwell's equations as a special case of Euler's equations, and Hendrik Lorentz derived it from Maxwell's equations in 1892. As a result of the aforementioned phenomenological confusion, the circle was closed - this follows this, and that follows that. And the baby was thrown out of the bath. Meanwhile, the Lorentz force, fundamentally determined by Relativity, entered in compiled form as a single-particle force into Maxwell's classical theory of Electrodynamics, which also became single-particle. And Maxwell's formulas were not to be UNDERSTOOD, but accepted as the basis of Electrodynamics. Thus, obvious flaws in the underlying UNDERSTANDING were concealed. Thus, on the basis of Maxwell's description of the electromagnetic wave, which fundamentally disregarded Relativity, the Theory of Relativity was constructed, which required a bending of the coordinate grid of Space. Thus, in a perfectly empty space, they missed the presence of the FIELD of the entire Universe. Thus, they mentally "froze" the Universe in four-dimensional space, discarding as an obstacle the POLARITY OF TIME, without which even an electromagnetic wave cannot exist! While the VISUALIZATION of the Magnetic Field made it possible to exclude the non-physical Concept of OBSERVER from Relativity!

Note

The conducted UPWARDS analysis - the clarification of the concepts used in describing Magnetism - was required as a result of the achieved advancement in VISION INTO DEPTH - the details of its structure. This achieved VISION will be described in detail in the article "ELEMENTARY Visualization of Magnetism." Here, merely to demonstrate the ELEMENTARY work accomplished, I am attaching an image of the distribution of forces of a moving ELEMENTARY Charge, removing Curie's prohibition on its EXISTENCE (Fig. 1).

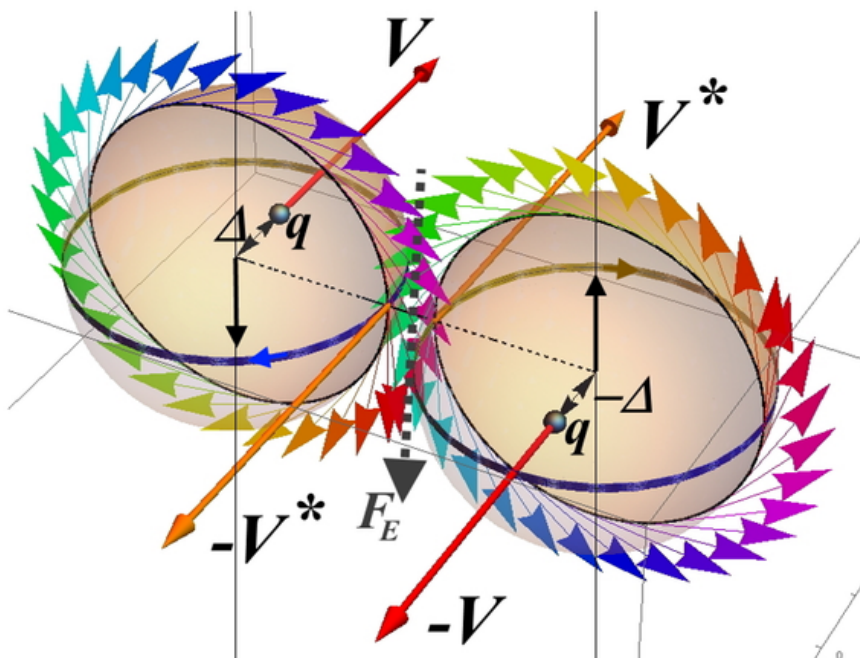


Fig.1. Demonstration of the "Twisting" of the Oersted Force, guessed by Descartes, arising from the friction of the Coulomb Fields of counter-moving ELEMENTARY Charges.

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