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Relativism of Coulomb's & Ampere's Laws

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Abstract

The finiteness of the propagation speed of the charge field change, according to the Principle of Causality, leads to longitudinal and transverse relativistic effects of the Coulomb field. Thus, relativism is the cause of the magnetic field. However, historically, the description of the magnetic field was conducted without taking into account the Principle of Relativity. Thus, an indirect characteristic of the magnetic field—the Ampere force, defined only for low charge velocities—was incorporated into the Lorentz force as the modulus of the magnetic force and, thus, into the very definition of magnetism. However, the Ampere force, by its nature, is a purely relativistic characteristic, whereas Ampere's law was formulated as a rough linear approximation, valid only for diffuse currents. However, for a rigorous definition of the magnetic field, one must consider relativism, the Ampere force, and its parametric relationship with the Coulomb field flux.

Keywords: Longitudinal Charge Inertia, Longitudinal Current Relativity, Transverse Effects, Parametric Relationship.

Preamble

People, arrogantly considering themselves to be an intelligent species, saw their own unreasonable reflection in the Artificial Internet and were horrified, attributing unreasonableness to it rather than to themselves.

Grokipedia, created by Elon Musk using Artificial Intelligence, systematized a number of sections of Science and, dryly and dispassionately, as befits a robot, stated how WRONG even scientists think. Abstract Mathematics has come up with many CORRECT Proofs. Some of them take up hundreds of pages. But for Physics, it has invented Selection Rules, but for itself, there are none. So Mathematics often proves, or tries to prove, what DOESN'T EXIST. And what DOES EXIST, it either doesn't manage to prove itself or doesn't reach the Consciousness of those who use it. And half-baked mathematicians, calling themselves theoretical physicists, often simply speculatively use sections of Mathematics, without bothering with either a deep analysis of Mathematics or an analysis of the Physical Foundations of their Theories. To construct a CORRECT Description of Nature, one must analyze what should have been analyzed from the start—the ELEMENTARY. And in doing so, one must wade through unsubstantiated, yet canonized, speculations.

This is evident in the section on ECONOMICS, which is nothing more than a section on Game Theory. This is even more clearly demonstrated in the section on MAGNETISM, which speculates on the Euler-Laplace equations, but essentially remains limited to the representation of the Force of the Tao.

So, "There is no sadder story in the world than the story of" the INTERCONNECTION of Fields – Electric and Magnetic, which, like the LOVE of Romeo and Juliet, is impossible to understand not without Quantum Mechanics, but without Relativism!

Introduction

Paradoxically, electromagnetic energy conversion has become, in many cases, practically 100% lossless. However, a closer look reveals that this has only been achieved at optimal frequencies and in specific cases. But the limits of specific cases have been exceeded, and the Basic Model is still missing. Although Nature has provided an example/hint in Superconductors, which was highlighted by the founders of the scientific journal "Journal of Superconductivity and Novel Magnetism." But even this single, specific (at zero frequency) case was insufficient to understand that "Old" Magnetism simply hasn't been analyzed generally enough, and that superconductivity simply demonstrates that our understanding of the Magnetic Field is INCOMPLETE. But theorists have hidden their MISUNDERSTANDING behind abstract formulas constructed without a proper foundation based on Invariant Elements and behind the "Logical Inference" about the supposed impossibility of a classical description of the Nature of the Magnetic Field [1, 2]. But my previous articles have shown how Phenomenological Errors distort the Description of Nature and lead entire branches of science and industry down the wrong path [3, 4].

And for the Magnetic Field, as has been shown previously, there is actually no strict DEFINITION! So there's nothing surprising in the saturation of achievable limits, in the confinement of Plasma in the Magnetic Field of Tokamaks, in the information recording density in hard drives, and in the reaching of the limits of MEASURABILITY by electronic devices. And everything comes down to a practically philosophical question – the interaction of a Particle (Charge) with its own Field, which is not taken into account in modern Quantum Theory [5-10]. And the widely used analogy of mass as a gravitational "hole" in supposed space-time contains a fraud, not an answer to the question posed. But this clear analogy raises another question – why is the "hole" caused by mass, and not by charge?! So, phenomenological confusion lies at the very foundation of Quantum Field Theory! Quantization is used merely as a screen—youthful enthusiasm for abstract multidimensional constructs obscured the Principle of Logarithmic Relativity, UNDERSTOOD by the ancient Greeks. After all, describing the behavior of a flying cannonball doesn't require an additional dimension to account for the behavior of individual atoms within it, something the ancient Greeks "discerned" purely logically. Just as describing the behavior of a sea wave doesn't require a multidimensional construct that accounts for the oscillations of individual molecules within the wave. So, the beautiful multidimensionality only exacerbates the fact that modern abstract theories are founded not on Relativism, but on the ancient Chinese Power of Tao [11].

Analysis of the Relativity of Coulomb's Law

Coulomb's Absolute Law describes only statics. However, all dynamics are hidden in a substructure of the previously unknown continuous characteristic, the Field [12].

In our previous work, we began our analysis of the reliably established qualitative relationship between the Electric Field and the Magnetic Field by considering the influence of charge dynamics on Coulomb's Absolute Law for stationary charges.

An electrostatic field, by definition, corresponds to statics, i.e., the distribution of stationary charges. However, as shown in, the movement of charges leads, to a first approximation, to a distortion of Coulomb's static Absolute Law. The distance between equipotentials near a charge in front of a moving charge decreases, while that behind it increases (Fig. 1a):

$$\Lambda_{1\{\}}=1-v^{*}Sign[x]e^{-Abs[x]} \tag{1}$$

So, for a Charge moving relative to an observer, the "instantaneous photograph" of the distribution of the Intensity of its Electric Field (in a plane) is transformed:

$$F_C=k_e\frac{|q_1||q_2|}{r_{12}^2}=k_e\frac{|q_1||q_2|}{x^2+y^2}\Rightarrow F^{*}{}_C=\frac{1}{x^{*2}+y^2} \tag{2}$$

That is, the spatial distribution of the Coulomb force depends on the reduced velocity of the charge (Fig. 1b):

$$x^{*}=x\left(1-v^{*}Sign[x]e^{-Abs[x]}\right) \tag{3}$$

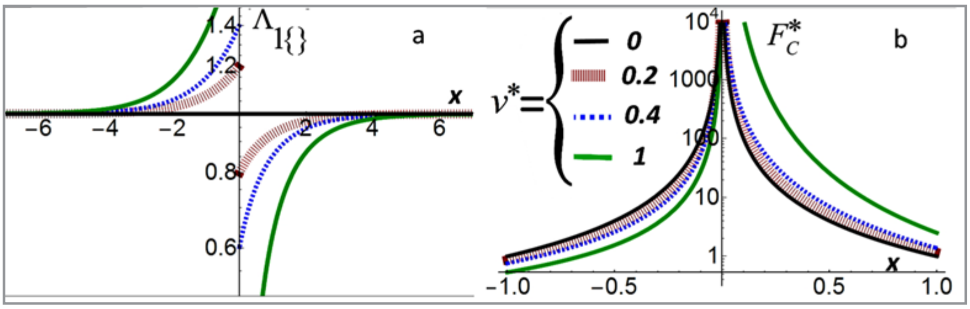

Figure 1: Distortion of the spatial distribution of the Electrostatic Field for different values relative to the velocity of the charge: a – correction for the distance to the Equipotentials, b – transformed Coulomb's Law.

Thus, starting from Statics (Fig. 2a), dynamics – the movement of charges – leads to distortion of the "cloud" of Equipotentials and their compression at the leading edge at a velocity equal to the speed of light (Fig. 2b):

$$\left\{\left\{y\to-\sqrt{R^2-x^2+2xx_0-x_0^2}\right\},\left\{y\to\sqrt{R^2-x^2+2xx_0-x_0^2}\right\}\right\},\quad R=2^n,\quad x_0=-2^n \tag{4}$$

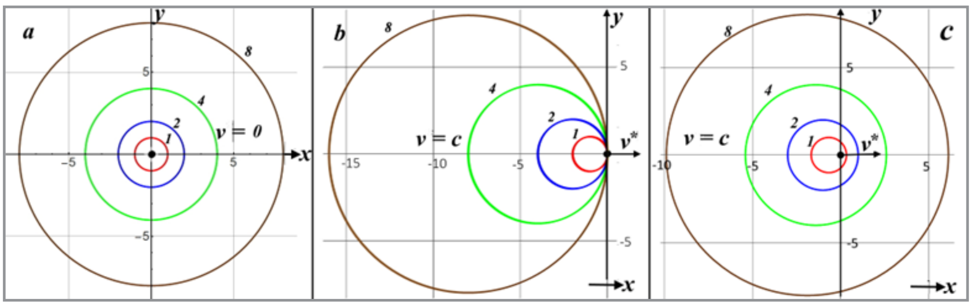

Figure 2: Section of a plane passing through a charge of Coulomb Equipotentials: a – for a charge at rest (relative to the observer),

b – for a charge moving at the speed of light, taking into account the limitation of the longitudinal propagation velocity of the electric field disturbance (according to formula 4), c – for a charge moving at the speed of light, taking into account the exponential decay of the change in the distance between Equipotentials (according to formula 3).

Distortion of the Coulomb Equipotentials leads to the emergence of a longitudinal velocity of force, which corresponds to relativity and manifests itself similarly to mass and for a charge in longitudinal inertia. As the speed of light is approached, this force tends to infinity, which corresponds, as noted in the previous work, to Einstein's relativistic correction. However, as already noted there, this tendency of the force to infinity is determined simply by the fact that Einstein's correction itself is only a rough approximation at the speed of light. Most likely, when approaching the speed of light, similar to an acoustic explosion, when approaching the speed of sound, a final release of electromagnetic energy will occur, which corresponds to the finiteness of the region of distortion of the Equipotential distribution (Fig. 2c).

Analysis of the Relativity of Ampere's Law

Ampere's Law, unlike Coulomb's Law, initially relies not on statics—the positions of charges—but on their dynamics—the currents of charges. Even in the first experiments with the Ampere Force—when studying the relationship between the force of interaction between linear conductors and the Coulomb Force—a constant equal to the speed of light was obtained, directly indicating the relativistic nature of this force. However, its expression, which for simplicity can be considered two equivalent wires carrying equal current, can only be considered an approximation for low velocities, since it does not take into account the speed of light as a limiting expression for the force. In principle, observing the Ampere Force as a correction to the Coulomb Force was only possible because, in experiments to determine the Ampere Force, the velocities of charges in conductors were the drift velocities of electrons in metals, which are much slower than the speed of light. Therefore, expression (1) corresponds. with good accuracy, experimental results:

$$dF_{12} = k_m \frac{2I_1 I_1}{r} dl \Rightarrow F_{12} = k_m \frac{2n^2 v_1 v_1}{r} \cdot l /_{l=1} \qquad (5)$$

The fact that when Charge Currents flow in conductors, the stationary Coulomb force is compensated—screened by the charges of the ions in the crystal lattice of opposite sign—allows for the observation of a much weaker Ampere force. Although the Ampere force has long been used empirically to generate electron beams, its smallness compared to the repulsive force of the Coulomb force has been overlooked. Thus, the incorrectness of all Definitions of the Magnetic Field is due to the fact that they have essentially jumped the boundary of Descriptions between the Static Model, which is not based on the Absolute Law of Force, and the Dynamic Model, which is based on Charge Currents! Thus, Ampere's Law, even then implicitly, formed the basis of the future Theory of Relativity. However, the intrinsic relativity of Ampere's Law was not analyzed. But in fact, it was hastily used by Maxwell to mathematically formulate the quantitative relationship between the Electric Field and the Magnetic Field, which led to Fundamental Errors even in the Definition of the Magnetic Field.

To avoid confusion and insurmountable contradictions associated with the Law of Conservation of Current in a closed circuit, which can be resolved/bypassed in a more General Model, we will immediately stipulate that the details of the simplest model of Ampere's Law will be analyzed by considering two independent electron beams passing an observer, moving parallel, in the same or opposite directions.

$$v^* * v^*, \left(v^* * \left(-v^*\right)\right), \left(v^* * v^*\right)\left(\frac{1}{1-Abs\left[v^*\right]}\right), \left(v^* * \left(-v^*\right)\right)\left(\frac{1}{1-Abs\left[v^*\right]}\right) \qquad (6)$$

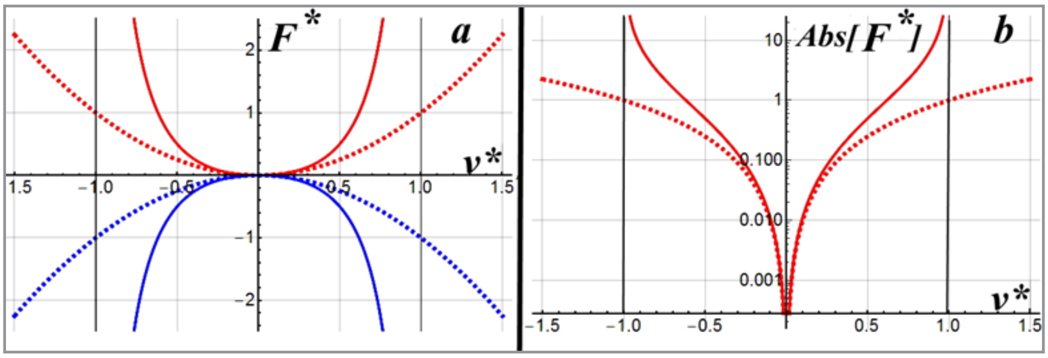

Figure 3: Dependence of the reduced Ampere force (red lines – attraction, blue lines – repulsion) on the electron velocity reduced to the speed of light in the traditional canonical notation (dashed lines) and with a relativistic correction (solid lines): a – on a linear scale, b – on a logarithmic scale.

If we assume that the observer is moving parallel to the electron flow, then the speed of charge motion relative to the observer will naturally change:

$$v^* \to \left(v^* - v_0^*\right) \to \left(v^* - v_0^*\right)^2 \qquad (7)$$

In this case, expressions (5) for the given Ampere forces are modified, as in the traditional notation (Fig. 3, dotted lines):

$$F_+ = \left(v^* - v_0^*\right)^2, \quad F_- = \left(\left(v^* - v_0^*\right) * \left(-v^* - v_0^*\right)\right) \qquad (8)$$

and with a relativistic correction (Fig. 3, solid lines):

$$F_+ = \left(v^* - v_0^*\right)^2 \left(\frac{1}{1-Abs\left[v^* - v_0^*\right]}\right), \quad F_- = \left(\left(v^* - v_0^*\right) * \left(-v^* - v_0^*\right)\right)\left(\frac{1}{1-Abs\left[v^* - v_0^*\right]}\right) \qquad (9)$$

In this case, for the given speeds of movement of the observer, far from the speed of light (0, 0.1, 0.2, 0.3), we obtain the following dependencies (Fig. 4).

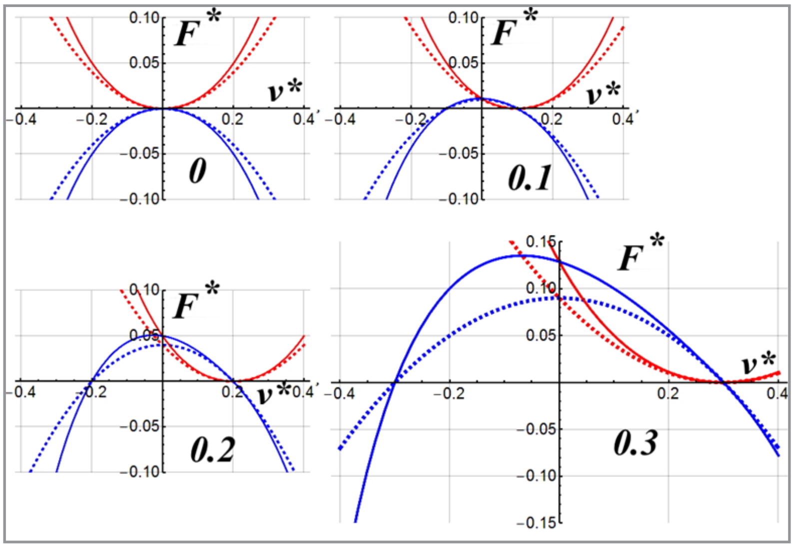

Figure 4: The dependence of the reduced Ampere force (red lines – attraction, blue lines – repulsion) on the electron velocity reduced to the speed of light for different reduced velocities of the observer along the current line.

Fig. 4 demonstrates, in particular, an ELEMENTARY thing. First, the attractive force of parallel currents tends to zero as the observer's velocity approaches the electron velocity if the velocities are subtracted, and increases if the velocities are added. Second, the repulsive force is equal to zero not only at zero currents in parallel conductors, but also when the observer's velocity is equal to the velocity of one of the flows/charges. In this case, the x-axis intersects at two points. And at intermediate values of charge velocities, the repulsive force changes sign and transforms into an attractive force. Thus, the absolute value of the Ampere force is not invariant for reference frames moving relative to each other at constant velocity. Therefore, its automatic use (in disguised form) in Maxwell's equations calls their validity into serious question. Apparently, this is why these equations, as shown earlier, incorrectly describe even an elementary electromagnetic wave [13].

Parametric Relationship between Coulomb and Ampere's Relativity

Ampere's force does not exhaust all the effects transverse to the current that determine the occurrence of Magnetic Field. However, before addressing another effect related to Oersted's "Law," let's consider effects transverse to the direction of charge velocity, related to the distortion of the spatial distribution of Coulomb equipotentials by the charge velocity. In doing so, we will also try to take into account the relativity of Ampere's Law discussed above. Although the Coulomb and Ampere Relativity discussed above, which are essentially determined by the same thing—charge movement at a given velocity—have only a parametric correlation [14]. Thus, within the framework of the simplest assumption of a linear relationship between the relative velocity of a Charge and the Eccentricity of its Equipotentials from expression (4) and the compression/stretching of Equipotentials not only along the direction of velocity, as shown in Fig. 2b, but also in the perpendicular plane at x=0, we have a supposed decrease in the repulsion velocity of like Charges with a simultaneous increase in the relative velocity of one charge (Fig. 5):

$$/x=0 \Rightarrow \left\{\left\{y \to -\sqrt{1-\left(v^*\right)^2}\right\},\left\{y \to \sqrt{1-\left(v^*\right)^2}\right\}\right\} \Rightarrow \frac{F}{F_0}=\sqrt{1-\left(v^*\right)^2} \quad (10)$$

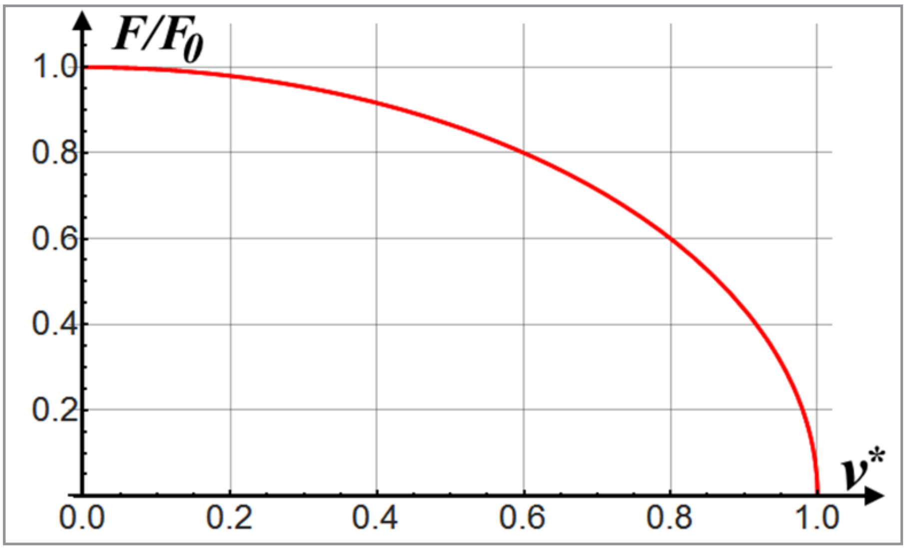

Figure 5: A decrease in the repulsive force between parallel, like charges moving in parallel with an increase in their relative velocity, assuming that the propagation speed of longitudinal Coulomb waves is also equal to the speed of light.

This reduction in the repulsive force of moving charges, taking into account their screening by ion charges in metals, is in qualitative agreement with the Ampere force of attraction for parallel currents. BUT! The Ampere force of a moving charge relative to a stationary charge is, according to its expression (1), ZERO! And even for countercurrent charges, the simple assumptions used, leading to the transverse effect shown in Fig. 5, will yield the same attraction of charges, rather than the repulsion resulting from Ampere's law. Thus, a combined analysis of these two relativities shows that the Ampere force is determined not by a local distortion of the Coulomb field around moving charges, but by the interaction of field flows moving around the charges. Moreover, the averaged moving fields—the spatial distribution of the Coulomb field of a charged line—can be quite rigorously described by smooth cylindrical equipotentials. Thus, a joint analysis of the Relativity of Coulomb's and Ampere's Laws revealed a fundamental point: the interaction of charge currents, manifested in the Ampere Force, is determined not directly by the interaction of the Field of a charged Particle or Line with another Particle or Line, but by the interaction of their FIELDS, which indirectly affects the charged Particle-Lines themselves. In principle, this interaction of Fields is reflected by Maxwell's equations. This is why an electromagnetic wave can propagate in a vacuum, where there are no charges. However, the form of the equations, borrowed by Maxwell from the senior telegraph operator Heaviside, requires clarification.

For a charged Line, the polarity of compression/extension of the Local Field of a Charge-Particle can, in principle, manifest itself only as edge effects. Thus, for charged Current Lines, we have the Ampere Force as the Effect of Friction of Fields—smooth cylindrical Equipotentials. Bernoulli established the parametric relationship between pressures in an incompressible fluid flow along and across the flow direction through the kinetic energy of particles per unit volume in the flow. Modifying his formula, we obtain:

$$P_{\perp} = P_{\parallel} \mp \rho \cdot \frac{v^2}{2} \quad (11)$$

Here, the MINUS sign corresponds to the flows of charge fields moving parallel to each other and attracting each other due to the decrease in transverse pressure in the field, while the PLUS sign corresponds to those moving in opposite directions and repelling each other due to the increase in transverse pressure due to the friction of the counter-moving fields.

So, the anharmonic parametric relationship between the motion of the Coulomb field and the density of its cylindrical Equipotentials is clearly present – it also determines the transfer of linear current energy into the inductance. The only deflection of the string, in either direction, that is inverse to the tension of the string, is the penetration of the wedge into the (split) log (naturally, from either side).

But this alone, as will be shown below, is insufficient. To fully characterize the Magnetic Field, one must also consider the "Oersted Force," which is an additional orthogonal force arising in the region of "friction" of the equipotential fields.

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