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Journal of Physics and Astronomical Sciences
Volume 1 | Issue 1

Short Commentary

Visualization of the Magnetic Field

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Citation: Stanislav Ordin (2026) Visualization of the Magnetic Field. J of Phy Astro Sci 1(1): 1-2.

Received Date: April 20, 2026
Accepted Date: May 11, 2026
Published Date: June 20, 2026

Abstract

A detailed characterization of the Magnetic Field was conducted and its graphical representation was obtained. This demonstrated that the formal mathematization used for the Magnetic Field does not fully reveal its relativistic nature, which has led to confusion even in its definition. The foundations of a consistent Phenomenology of the Magnetic Field were constructed, and a path to its correct mathematization was demonstrated, taking into account the complexity of the Law of Conservation of Momentum. This path eliminates contradictions both within Magnetism itself and in its extensions to Electrodynamics, and then to the Theory of Relativity.

Keywords: Images in Science, Descartes' Gimlets, Relativism, the real structure of the Magnetic Field, angular momentum, the law of conservation of momentum.

Preamble

Seeing what formulas express is a necessary and very useful element in analyzing a Phenomenon. But theoretical physics, unfortunately, has 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 theoretical physicists: "From a formula, this and that is obtained!" reflects, on the one hand, a careful attitude toward the discovered Fundamental regularities, and, on the other, an absolutization of the level of UNDERSTANDING once achieved. But at the same time, more intentionally than unintentionally, the often low level of UNDERSTANDING at which the "insight" of the formula came, which became the foundation (and untouchable) for an entire generation of researchers, is also concealed. And Magnetism, as I have repeatedly noted in my articles on the REDEFINITION OF THE MAGNETIC FIELD, clearly demonstrates this. In this work, before continuing with a rigorous characterization of the Magnetic Field, I am compelled to note a striking fact demonstrating the complex CONNECTION between "Illumination" and Reality. The mathematician Laplace discovered a purely mathematical CONNECTION between various variables in the first quantitative experiments on the magnetic field, similar to that obtained in hydrodynamics. As the saying goes: Honor and praise to him for this! And now I have to face the fact that, having begun to analyze the basic model, I sometimes, simply by "glancing" at it, immediately draw the final formula. But I will not publish it until I have traced this discovered CONNECTION with the variables embedded in the formula as strictly as possible. I simplify this work only by trying to use variables reduced to universal constants, assuming the latter to be equal to one. And, of course, I rely on modern concepts. But what did Laplace have to draw conclusions from? Biot's optics and Savaro's acoustics on the "flow of a magnetic field through thin electrical conductors"!? Not much, to say the least. And the hydrodynamics he used, as follows from this work, itself needs to be corrected.

Maxwell, Laplace's successor, had the task of deriving even more general equations from which Laplace's formula follows. True, he also used Oersted's "Law," which "quantitatively" indicated the force rotating a magnet located near a conductor carrying an electric current. But the magnitude of this Oersted force, for lack of a better alternative, was assumed to be the Lorentz force, equal in magnitude to the Ampere force, the only force strictly described quantitatively in the form of Ampere's Law, demonstrating its connection with the Coulomb field through the speed of light! Thus, Laplace's theory itself was built on the foundation of hydrodynamics, which, until Magnetism "opened its eyes" (as will be demonstrated in the article), missed a significant point, both literally and figuratively.

Therefore, faced with such confusion in the very UNDERSTANDING of the Magnetic Field, a strictly quantitative REDEFINITION in the form of an axiomatization of Basic Experiments initially required a purely qualitative Characterization of the Magnetic Field.

And finally, mathematicians themselves realized, as already noted, that the crisis in Mathematics itself arose from a certain misunderstanding of its fundamental Foundation – Geometry. And theoretical physicists prolonged this erroneous tendency to replace imagery with the manipulation of algorithms and formulas. However, in my recent works, I deliberately try to use images and graphs, and do not describe the formulas in detail. Thus, these articles are accessible to a wider range of readers. Someone who is proficient in formulas will easily see them behind the drawings, while someone who rarely uses them will perceive the drawings themselves as "visible" arguments for the reasoning.

History of Magnetism Visualization

The first, largely accurate, visualization of the Earth's Magnetic Field was made by Descartes (Figure 1).

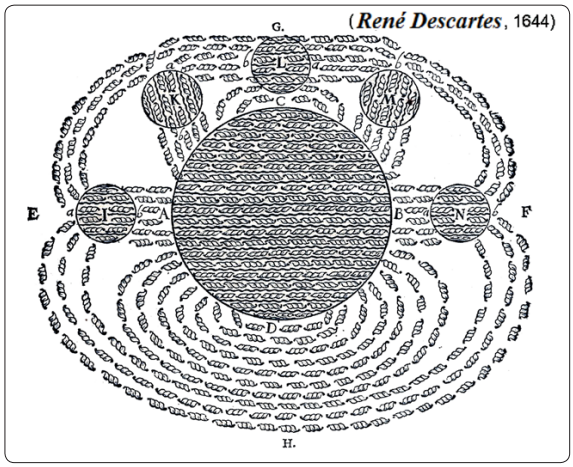

Figure 1: The Earth's Magnetic Field according to Descartes

And his visual demonstrations of the arrangement of iron filings around the poles of a magnet added little to his picture of the Magnetic Field. Descartes, like the ancient Greeks, observed the abrasion of stones and conceived of atoms. He also considered Reality—the rotation of the Earth—and intuitively reflected it in his gimlets. But the gimlets were mystical, penetrating both bodies and space. The rotation of the gimlets, however, characterized isotropic space itself with an axis of rotational symmetry for any direction, and according to Curie's Symmetry Theorem, this was a mutually exclusive factor. Thus, Descartes' Magnetic Force remained, to this day, incompletely explained and, in fact, remained similar to the ancient Chinese Tao Force.

Coulomb, within the framework of his Concepts of Magnetic Charges, simplified Descartes' Picture, replacing the gimlets with simple arrows. In this case, he also obtained, for Magnetic Charges, a strict quantitative Coulomb Law, which gives a Cartesian-like distribution of the Magnetic Force in space (Figure 1), if the Magnetic Charge is similar to an Electric Dipole (Figure 2).

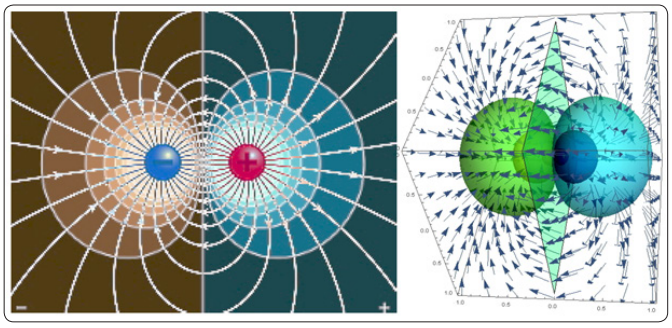

Figure 2: Equipotentials (the sign of which is determined by the charge) and electric dipole field lines (the direction indicated by the arrows is determined by the charge sign): on the left – in the plane passing through the charges; on the right – their image in volume.

The Coulomb Field distribution (Figure 2) becomes practically equivalent to the Cartesian Magnetic Field distribution (Figure 1) if we use not a single dipole, but a linear chain of dipoles – a polarized rod. Thus, the Coulomb Magnetic Field diagram also gave rise to a mystical phenomenon – the Magnetic Field Monopole, the search for which continues to this day.

However, the discovered connection between magnetism and electric current yielded the Ampere Force, which had a different dependence of Force on distance (as shown earlier, not entirely different, since the dimensionality of the Source of Force was not taken into account) and a different distribution of Magnetic Field Equipotentials in space. But the Ampere Force not only provided a strict quantitative law for its distribution, but also its connection to the speed of light! Thus, the loss of Descartes's gimlets distorted the picture of the Magnetic Field and led to the no less mystical substitution of the Oersted Force for the Ampere Force in Lorentz's formula.