

Optics professionals, get involved in fundamental physics, both in teaching and in research

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Abstract: Physics has been strongly guided by optical science and engineering since ancient times. However, modern physics is ignoring the reality of parameters, permittivity and permeability of vacuum, which define light velocity, refractive index, dispersion, etc. © 2021 The Author(s)

1. Initial argument

Optical science and engineering have been guiding the evolution of physics since ancient times, specifically starting from the sixteen hundred through the very end of eighteen hundred. However, since the beginning of the nineteen hundred, fundamental physics has been guided dominantly by mathematical theories and experimental validations. The prevailing tendency is to avoid describing the invisible physical interaction processes that give rise to the physical transformations. These transformations finally appear as data in our instruments. For successful evolution, all species are functionally engineers at the molecular levels and at the macro levels of interacting with our biological environments. Nature itself, at the fundamental level, a marvelously creative system engineer driven by reproducible causal rules. None of us knows these rules in complete detail. Only those attempted engineering functions are successful that emulate nature allowed rules. We now know that we can keep thriving as engineers even in the absence complete understanding of the laws of nature. We still do not know exactly what electrons are, or the photons are [1]. Yet, we have been successfully utilizing our limited knowledge about electrons and photons to generate, manipulate, propagate and detect them in our desired ways to create the modern Global Village by building a global communication system. Without understanding the quantum mechanical tunneling of electrons in semiconductors, we could not have built the densely packed computer chips. Without the knowledge of stimulated emission, we could not have built the semiconductor lasers, which is the backbone of fiber optic communication system. As engineers, we need to understand which physical parameters in these mathematical theories represent nature's engineering lever parameters for direct manipulation and which are secondary or tertiary parameters that can be manipulated only via the primary parameter.

Therefore, to continue our successful engineering evolution, we must keep paying close attention to identifying nature's engineering lever parameters, while perpetually enquiring what we still do not know, or neglecting to explore deeper. A case example is Maxwell's wave equation, which gives us the velocity of light in terms of the permittivity and permeability of the media. In free-space, it is $c_0^2 = 1/\epsilon_0\mu_0$, and in material media, it is $c^2 = 1/\epsilon\mu \equiv c_0^2/n^2$. Once generated by a source, the EM waves keep propagating *perpetually*, whether it is in the cosmic-space or inside some material medium. Our existing knowledge of physics tells us that a perpetual wave propagation requires a continuous energetic tension field. Therefore, the permittivity and permeability of the cosmic space, ϵ_0 & μ_0 , and their modified versions, ϵ & μ in media, must represent physical electric tension and magnetic resistance, to allow the perpetual propagation of EM waves. There is no dispersion in the cosmic space with properties ϵ_0 & μ_0 ; but there is dispersion in material media with properties ϵ & μ , which we have learned to manipulate to bring out new useful properties of EM wave propagation. A completely new engineering field of metamaterials [2] have emerged over the last few decades.

Unfortunately, we still keep neglecting the reality of the physical properties of the free space ϵ_0 & μ_0 and keep denying the existence of ether. Surprisingly, all currently working major theories of physics are already "unified" by this ether. All these mathematical representations contain the parameters from Maxwell's velocity of light, $c_0^2 = 1/\epsilon_0\mu_0$, and/or Einstein's mass-energy equivalence relation, $m_0 = E_0/c_0^2 = E_0\epsilon_0\mu_0$. Therefore, ϵ_0 & μ_0 must be the *two key actionable engineering lever parameters of nature*. We should not keep neglecting the physical reality of nature's evolution promoting *primary* lever parameters ϵ_0 & μ_0 , while hiding them under the banners of the secondary (derived) parameters c_0 and m_0 .

Therefore, as optical scientists and engineers, we should take active roles in advancing the fundamental physics through teaching (write better textbooks, etc.) and research [1].

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2. Supporting Justifications

Null results of Michelson-Morley experiments: This experiment was designed to measure the ether-drag against the earth's movement. *The absence of the postulated drag cannot confirm the absence of ether itself* [3]. Ether holding the physical properties ϵ_0 & μ_0 are real. Einstein was later obligated to define gravity as a "curvature of space", while using the secondary parameter c_0 in his theory, as if nature's primary lever parameters, ϵ_0 & μ_0 , do not play any physical role in engendering gravity as a "curvature of space". Further, as formalisms of Quantum Mechanics kept evolving, physical properties like "Background fluctuations", "Quantum foam", etc., have been assigned to the space without acknowledging a real physical ether.

Newton's second law of motion: $F = m_0 a = (E_0 \epsilon_0 \mu_0) a$ implicates that the tension properties of ether plays some critical role in defining the "forces" that is being experienced by a localized bundle of inertial energy E_0 . A similar kind of conjecture can be drawn by re-writing Newton's law of gravity, $F = G(m_1 m_2) / r^2 = G E_{01} E_{02} (\epsilon_0 \mu_0 / r)^2$. Hence, even gravity is an emergent electromagnetic property of ether, empowered by its tension properties, ϵ_0 & μ_0 .

Properties of γ radiation: Let us look at the role of very high frequency γ radiation in pair production, $\gamma \rightarrow e^- + e^+$, and in particle-antiparticle annihilation, $e^- + e^+ \rightarrow \gamma + \gamma$ [4]. While charge is "conserved", as postulated via contrived mathematical logic, it is obvious that the properties, "charge" and the "inertial mass" of localized particles, are emergent properties out of oscillating electromagnetic γ , which *initially did not have either the charge or the mass*. (The arrow ' \rightarrow ' implicates that the interaction process is facilitated by collision with heavy nuclei.) The conclusion is that the observable universe is essentially electromagnetic. The emergence of quantized charge out of ϵ_0 & μ_0 can be further appreciated by re-writing the expression for the fine structure constant, α :

$$\alpha = e^2 / (2h\epsilon_0 c_0) = (e^2 / 2h)(\mu_0 / \epsilon_0)^{1/2} \Rightarrow e^2 = 2\alpha h(\epsilon_0 / \mu_0)^{1/2} \quad (1)$$

3. Conclusion:

In the daily lives of optical physicists and engineers, ϵ_0 & μ_0 and ϵ & μ , or the effective refractive index n , are physically very real parameters. We routinely measure and/or manipulate these permittivity and permeability parameters of free space or material media. They determine the velocity of light in free space without any dispersion and the velocity and the dispersion within material media that consist of assemblies of polarizable atoms and molecules. Permittivity and permeability represent real physical properties of Maxwellian ether. They are nature's critical engineering levers. Therefore, optical physicists are in an important position to break open the prevailing stagnancy in Physics. That the field of basic physics needs new thinking can be appreciated from these recent publications [5-7].

3. References

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