Revision of Maxwell’s Equations

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DRAFT revision 13.

Note: article needs some re-writing, see discussion included in this version.

Abstract. It is well known that the Maxwell equations predict the existence of electromagnetic transverse waves. It is well known that, in practice, there are significant differences between the "near" and "far" fields, whereby far field radiation is found to be quantized and shows behavior that shares aspects both associated with "particles" and "waves", a finding that has so far not been explained in a satisfactory manner. It is also well known that the Maxwell equations are not invariant to the Galilean coordinate transform, which is what led to the formulation of the Lorentz transform and its subsequent application to physics with Einstein's relativity theory. It is also well known that the magnetic vector potential field has not been uniquely defined in the Maxwell’s equations, which introduces a degree of freedom in the choice for the magnetic vector potential, which is what led to Gauge theory upon which Quantum Field Theory rests.

This paper contributes to the growing body of work revisiting Maxwell’s equations.[1,2,3,4,5,6,7,8,9] We derive equivalents for the Maxwell equations directly from a superfluid medium model by applying the discrete Laplace operator to the discrete medium volume velocity vector field **V**, and associate the intermediate terms with their familiar names, symbols and historic signs. This leads to equations which are known to be mathematically consistent and free of singularities, are invariant to the Galilean transform, uniquely define the potential fields and describe three types of wave phenomena, including longitudinal sound-like waves.

Unlike Maxwell’s equations, which are the result of the intertwining of Faraday's circuit level law with the more fundamental model for describing wave motions within the medium arguably creating most of the problems in current theoretical physics, these revisions describe the three different electromagnetic waves observed in practice and so enable a better mathematical representation.

Keywords: Classical Electrodynamics, Superfluid medium, Theoretical Physics, Discrete Calculus.

Introduction

In 1861, James Clerk Maxwell published his paper “On Physical Lines of Force”[10], wherein he theoretically derived a set of twenty equations which accurately described the electro-magnetic field insofar as known at that time. He modeled the magnetic field using a molecular vortex model of Michael Faraday's "lines of force" in conjunction with the experimental result of Weber and Kohlrausch, who determined in 1855 that there was a quantity related to electricity and magnetism, the ratio of the absolute electromagnetic unit of charge to the absolute electrostatic unit of charge, and determined that it should have units of velocity. In an experiment, which involved charging and discharging a Leyden jar and measuring the magnetic force from the discharge current, they found a value 3.107 x 10^8 m/s, remarkably close to the speed of light.

In 1884, Oliver Heaviside, concurrently with similar work by Josiah Willard Gibbs and Heinrich Hertz, grouped Maxwell's twenty equations together into a set of only four, via vector notation. This group of four equations was known variously as the Hertz-Heaviside equations and the Maxwell-Hertz equations, but are now universally known as Maxwell's equations.

The Maxwell equations predict the existence of just one type of electromagnetic wave even though it is now known that at least three electromagnetic wave phenomena exist, namely the "near" and the "far" fields and a LE,TM mode guided surface wave[11]. The Maxwell equations have not been revised to incorporate this new knowledge.

This has led to two different interpretations of the Maxwell equations:

(1) In the everyday practice of Electrical Engineering, it is the near field that can be computed with "FTDT" simulation software, which simply takes Maxwell's equations and evolves them over time within some finite computational region, essentially performing a kind of numerical experiment[12]. Once the near field has been computed, the far field is computed afterwards as a post-processing step;

(2) In the quantum view of electromagnetic interactions, far-field effects are manifestations of real photons, whereas near-field effects are due to a mixture of real and virtual photons.

It seems unlikely that both these interpretations can be correct.

It can also be shown that without charge or current, Maxwell's equations reduce to one and the same standard wave equation such as that which governs sound waves[14].

It was the mistake of believing that Maxwell's equations were invariant which led to the Lorentz transformation, which in turn led to Einsteinian relativity. In other words, Einsteinian relativity is directly based upon the Maxwell equations.

However, without charge or current, Maxwell's equations do become invariant by Galilean transformation to some other reference frame.

Given the above, the following questions should be asked:

- What is charge?
- Why is it a property of matter?

As long as we insist that charge is an elemental quantity that is a property of matter, we cannot answer these questions. Also, when the wave particle duality principle is considered in relation to what is considered to be the cause for electromagnetic radiation, charged particles, in Maxwell's equations electromagnetic radiation is essentially considered to be caused by electromagnetic radiation, an obvious case of circular logic which is not desirable.

A further problem with the Maxwell equations is that the magnetic vector potential **A** has not been uniquely defined and allows the arbitrarily addition of curl-free components to the magnetic potential without changing the observed magnetic field. Given that Maxwell worked within the aether concept, the introduction of a degree of freedom in the choice for a potential field is unwarranted. It is this unwarranted degree of freedom which enabled the development of gauge theories, which eventually led to the current Standard Model. The Standard Model is a non-abelian gauge theory and has a total of twelve gauge bosons: the photon, three weak bosons and eight gluons. This means that the Standard Model is also directly based upon the Maxwell equations.

In the area of vector calculus, Helmholtz's theorem, also known as the fundamental theorem of vector calculus, states that any sufficiently smooth, rapidly decaying vector field in three dimensions can be resolved into the sum of an irrotational (curl-free) vector field and a solenoidal (divergence-free) vector field; this is known as the Helmholtz decomposition. A terminology often used in physics refers to the curl-free component of a vector field as the longitudinal component and the divergence-free component as the transverse component. This theorem is also of great importance in electromagnetic (EM) and microwave engineering, especially for solving the low-frequency breakdown issues caused by the decoupling of electric and magnetic fields.[16] Further, a vector field can be uniquely specified by a prescribed divergence and curl and it can be shown that the Helmholtz theorem holds for arbitrary vector fields, both static and time-dependent[17].

In Maxwell's equations, the two potential fields which are used with Helmholtz's theorem are the electrical potential **Φ** and the vector potential **A**, which are defined by the equations[18]:

$$\mathbf{B} = \nabla\times\mathbf{A}\,,$$
$$\mathbf{E} = -\nabla\Phi - \partial\mathbf{A}/\partial t$$

where **B** is the magnetic field and **E** is the electric field.

The Helmholtz theorem can also be described as follows. Let **A** be a solenoidal vector field and **Φ** a scalar field on $\mathbf{R}^3$ which are sufficiently smooth and which vanish faster than $1/r^2$ at infinity. Then there exists a vector field F such that:

$$\nabla\cdot\mathbf{F} = \mathbf{\Phi} \text{ and } \nabla\times\mathbf{F} = \mathbf{A},$$

and if additionally the vector field **F** vanishes as $r \to \infty$, then F is unique[19].

Now let us consider the units of measurement involved in these fields, whereby the three vector operators used all have a unit of measurement in per meter [/m]. The magnetic field **B** has a unit of measurement in Tesla [T], which is defined in SI units as [kg/s^2-A]. So, for the magnetic vector potential **A** we obtain a unit of [kg-m/s^2-A] and for d**A**/dt we obtain a unit of [kg-m/s^3-A]. The electric field **E** has a unit of measurement in volt per meter, which is defined in SI units as [kg-m/s^3-A], which matches that for d**A**/dt. So, for the electric scalar potential **Φ** we obtain a unit of [kg-m^2/s^3-A].

Obviously, however, neither the units of measurement for **E** and **B** are the same, nor are the units of measurements for **Φ** and **A**. This is in contradiction with Helmholtz's theorem, which states that a vector field **F** exists that should have a unit of measurement equal to that of **Φ** and

A times meters or that of **E** and **B** times meters squared and thus we can conclude that Maxwell's equations are inconsistent and should therefore be revised.

Methods

It can be shown[20] that by using the 19th Century's atomic vortex postulate in combination with a superfluid model for the medium, it is possible to construct a single simple integrated model that encompasses all known physical processes, and which covers all major branches of physics including kinetic, fluid, gravitation, relativity, electromagnetism, thermal, and quantum theory. With this method, it can also be shown that anomalous observations such as Pioneer's drag and the electron's magnetic moment can be directly accounted for by the model. Furthermore, with this model all units of measurements are defined in terms of just three fundamental units of measurement: mass, length, and time.

It should be noted that there are two distinct levels in this model, with each playing their own role. The first consists of basic media quanta, which forms a superfluid model for the medium itself. The second describes vortices within the fluid, which forms a particle model on top of the medium model. The lower base level is assumed to be an (if not ideal, nearly so) in-viscous superfluid system obeying the defined rules of basic kinetic theory and that is the model this paper is based on, which means that the equations presented in this paper do not depend on the higher level Atomic Vortex Hypothesis based model.

Of course, this lower base level superfluid model can also be described in vector notation and since this model essentially describes a fluid/gas like medium, we can apply continuum mechanics fluid dynamics vector theory to re-derive the Maxwell equations from the basic model. As is common practice in continuum mechanics fluid dynamics vector theory, we can describe it's dynamic behavior by working with the medium's flow velocity vector field[21] **v**, with **v** representing the local average bulk flow velocity.

It should be noted that because we use continuum mechanics, the equations presented in this paper are independent on the detailed description of the constituents of the medium itself and that there is a lower limit with respect to scale below which the medium can no longer be considered as a continuum. In that case, the model is no longer applicable, which is a well-known limitation of continuum mechanics. The Knudson number can be used to estimate this limit, which is defined as

$$Kn = \frac{\lambda}{L},$$

where λ is the mean free path of the particles making up the medium in meters [m] and L the representative physical length scale in meters [m].

Interestingly enough, this lower limit with respect to scale is also reflected in the applicability of potential theory in infinitesimal vector notation to continuum mechanics, which can be shown as follows. Let us start out with the definitions for the scalar and vector potentials as used in potential flow theory. The scalar potential φ for an irrotational velocity field **E** is defined as

$$\mathbf{E} = \nabla\varphi,$$

and is known as the velocity potential for **E**. The vector potential **A** for an incompressible velocity field **B** is defined as

$$\mathbf{B} = \nabla \times \mathbf{A},$$

which denotes the rotational or vorticity velocity potential. Both of these potential fields have a unit of measurement in meters squared per second [m^2/s].

According to the Helmholtz theorem, a unique vector field **V** exists, which has a unit of measurement in cubic meters per second [m^3/s], and can be defined as:

$$\nabla \cdot \mathbf{V} = \varphi \text{ and } \Delta \times \mathbf{V} = \mathbf{A},$$

which defines a vector field denoting the volumetric flow rate or volume velocity. This can also be defined as the flow velocity vector field **v** times an area A perpendicular to **v** with a surface proportional to h^2 square meters [m^2], with h the physical length scale in meters [m].

Obviously, this results in the zero vector when taking the limit for the length scale h to zero, while we obtain a non-zero result for any scale $h > 0$. Therefore, infinitesimal vector calculus cannot be applied for computing analytical solutions to the Helmholtz theorem within the area of fluid dynamics. Thus, recourse must be taken to finite difference or discrete vector calculus methods, such as used in FDTD simulation software, where h denotes the spacing of the discretization grid, which may be variable or constant. Fortunately, for discrete vector calculus methods the divergence, gradient, curl operators as well as the Laplacian can be defined analogous to the ones used in infinitesimal notation[23].

Using discrete vector calculus methods, we can derive equations for two separate discrete flow velocity fields **E** and **B** from the volume velocity vector field **V** by application of the discrete Laplace vector operator:

$$\nabla^2\mathbf{V}=\nabla(\nabla\cdot\mathbf{V})-\nabla\times(\nabla\times\mathbf{V})$$

(eq 1)

We can resolve for discrete vector fields by writing out the above terms in their components and giving these their familiar names and historic signs. Thus, we define a discrete vector field **A** for the **magnetic potential**, a discrete scalar field Φ for the **electric potential**, a discrete vector field **B** for the **magnetic field** and a discrete vector field **E** for the **electric field** by:

$$\mathbf{A} = \nabla\times\mathbf{V}$$

(eq 2)

$$\Phi = \nabla\cdot\mathbf{V}$$

(eq 3)

$$\mathbf{B} = \nabla\times\mathbf{A} = \nabla\times(\nabla\times\mathbf{V})$$

(eq 5)

$$\mathbf{E} = -\nabla\Phi = -\nabla(\nabla\cdot\mathbf{V})$$

(eq 6)

According to the Helmholtz theorem, **v** is uniquely specified by Φ and **A**. And, since the curl of the gradient of any twice-differentiable scalar field Φ is always the zero vector, $\nabla\times(\nabla\Phi)=\mathbf{0}$, and the divergence of the curl of any vector field **A** is always zero as well, $\nabla\cdot(\nabla\times\mathbf{A})=0$, we can establish that **E** is **curl-free** and **B** is **divergence-free**, which means we obtained a valid Helmholtz decomposition, and we can write:

$$\nabla\times\mathbf{E} = 0$$

(eq 7)

$$\nabla\cdot\mathbf{B} = 0$$

(eq 8)

For the summation of **E** and **B**, we get:

$$\mathbf{E}+\mathbf{B} = -\nabla(\nabla\cdot\mathbf{V}) + \nabla\times(\nabla\times\mathbf{V}) = -\nabla^2\mathbf{V},$$

(eq 9)

which thus gives the negated vector Laplacian for **V**.

Thus, the application of the vector Laplacian to the discrete volume velocity field **V**, with a unit of measurement in $[m^3/s]$, results in a decomposition into a rotation free component **E** and a divergence free component **B**. These components are both discrete volumetric flux fields, describing the rate of volume flow across an area with a unit of measurement in $[m^3/m^2\text{-}s]$, but can also be seen as discrete flow velocity fields with a unit of measurement in [m/s], as is commonly used in infinitesimal continuum fluid dynamics vector theory.

Since **V** is uniquely specified by Φ and **A**, and vice versa, we can establish that with this definition, we have eliminated "gauge freedom" and since we know these equations can be transformed using the Galilean coordinate transform, we have also eliminated the need for the Lorentz transform, while we are also no longer bound by the universal speed limit demanded by the Lorentz transform.

With this application of discrete fluid dynamics vector theory, we have thus come to a revised version of the Maxwell equations that not only promises to resolve all of the problems that have been found over the years, we also obtain a model that is easy to interpret and can be easily simulated and visualized with finite-difference time-domain methods (FTDT) as well.

Now let us consider the difference between the definition we found for **E** and the corresponding definition in Maxwell's equations:

$$\mathbf{E} = -\nabla\Phi - \partial\mathbf{A}/\partial t$$

(eq 10)

When considered from the presented perspective, this is what breaks the fundamental result of Helmholtz' decomposition, namely the decomposition into a rotation free translational component and a divergence free rotational component, since **A** is not rotation free and therefore neither is its time derivative.

When taking the rotation on both sides of this equation, we obtain the Maxwell-Faraday equation, representing Faraday's law of induction:

$$\nabla \times \mathbf{E} = -\partial \mathbf{B} / \partial t$$

(eq 11)

Faraday's law of induction is a basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF), which is thus a law that applies at the macroscopic level. It is clear that this law should not be intertwined with a model for describing wave motions in a medium and therefore our revision should be preferred.

Discussion and Conclusions

We have shown that Maxwell's equations intertwine a model for describing the dynamics of the medium with the macroscopic Faraday law of induction. This led to both Einsteinian relativity and Quantum Field Theory thus creating a paradox as they are mutually exclusive; they cannot both be correct.

Revising Maxwell equations by deriving directly from a superfluid medium model we have called upon discrete fluid dynamic vector theory for an ideal, compressible, non-viscous Newtonian fluid that has led to equations which are known to be mathematically consistent, are known to be free of singularities and are invariant to the Galilean transform as well.

As is known from fluid dynamics, these revised Maxwell equations predict three types of wave phenomena, which we can easily relate to the observed phenomena:

1. Longitudinal pressure waves, Tesla's superluminal waves[24] c.q. the FTL longitudinal dielectric mode;

2. Transverse waves, occurring at the boundary of two media with different densities such as the metal surfaces of an antenna and air, aka the "near field";

3. Vortices and/or vortex rings, the "far field", which is known to be quantized and to incorporate a thus far mysterious mixture of "particle" and "wave" properties, the so called "wave particle duality" principle.

Further Research

Theoretical

While the revised Maxwell equations presented in this paper describe wave motion in the medium accurately, we have also argued that Faraday's law should not be intermingled with the model for the medium, which leaves us without revised equations for Faraday's law of induction nor Ampère's circuital law.

It is expected these can be worked out by considering the electron as having a ring vortex topology and working out the fields for this topology, whereby an important detail to consider is that a steady state vortex ring is known to propagate at a constant speed along its axis of symmetry[25], which undoubtedly has implications with respect to the relation between the propagation direction and the E and B fields emitted by an electron. From that, the fields resulting from a number of these vortex rings moving along the surface of an ideal conductor can be worked out for a number of scenario's, which are expected to result in descriptions of transverse surface waves, longitudinal dielectric surface waves and/or steady state magnetic fields, which are thus described in relation to the elemental charge q of the electron as well. It is expected that this way, a full description of these macroscopic circuit laws can be obtained.

Practical

The revised Maxwell equations presented in this paper open the possibilities of further considerations and research into the properties of the dielectric and gravitational fields and associated wave phenomena. Because both of these fields are considered as one and the same within the above presented revised Maxwell paradigm, a wide range of possible applications become conceivable, some of which are hardly imaginable from within the current paradigm and/or are highly speculative while others are more straightforward.

Superluminal communication

This is the most direct application of the theory presented in this paper, which is supported by a number of sources concerning electrical methods[26,27], the oldest of which[28] dates back to 1834, and a number of sources concerning methods around anomalous dispersion in optical fibers,[29,30,31,32] some theoretical work[33,34,35,36] as well as some preliminary experimental work by the author. There is active and ongoing experimental research in this area.

Experiments regarding gravitational effects, such as aimed at obtaining thrust.

The Biefeld-Brown effect is an electrical phenomenon that has been the subject of extensive research involving charging an asymmetric capacitor to high voltages and the effect is commonly attributed to corona discharges which occur only at the sharp electrode, which causes an imbalance in the number of positive and negative ions created in comparison to when an symmetric capacitor is used.

However, according to a report[37] by researchers from the Army Research Laboratory (ARL), the effects of ion wind was at least three orders of magnitude too small to account for the observed force on the asymmetric capacitor in the air. Instead, they proposed that the Biefeld–Brown effect may be better explained using ion drift instead of ion wind. This was later confirmed by researchers from the Technical University of Liberec[38].

If this is correct, then the need for an asymmetric capacitor raises the question if the resulting diverging electric field can indeed be used to obtain thrust by working on an electrically neutral dielectric, in this case a dielectric consisting of air and net neutral ions, and how this results in a net force acting upon the capacitor plates. The ions would cause a diverging steady state current to flow, which has been shown by Van Vlaenderen to violate N3LM with respect to the Lorentz force, which suggests this mechanism may play a role in this phenomenon.

Similar questions arise when a neodymium magnet is used as an electrode in an electrolysis experiment, which results in a vortex becoming visible in the electrolyte above the magnet, which also relates to the question of why a DC current trough a wire loop results in a magnetic field, but the magnetic field of a permanent magnet does not induce a current in a wire wound around it. When we add the notion that the polarity associated with charged particles is a result of the toroidal vortex ring topology associated with the electron and it's particular direction of movement, a number of questions arise:

1) What happens when a solid state dielectric is placed in between asymmetric capacitor plates charged to a high voltage, such as used in BB experiments? Does this result in a force akin to thrust?

2) Is a steady state magnetic field present in between capacitor plates charged to a high voltage? Can this be measured with a hall sensor?

3) Does a vortex appear in an electrolyte when instead of using the magnet as an electrode, using it as an asymmetric capacitor plate, while placing a bigger capacitor plate above the electrolyte and charging that to a high voltage?

4) Does the "electrostatic" field emitted by electrons indeed consist of longitudinal dielectric waves with a frequency equal to the characteristic (longitudinal) oscillation frequency of the electron (about 160-180 GHz)? Is it possible to construct devices with which this can be measured?

Another line of research in this regard has to do with gravity, which in our model is proposed to be caused by longitudinal dielectric flux, which causes a pushing and not a pulling force. This is supported by Van Flandern[39], who determined that with a purely central pulling force and a finite speed of gravity, the forces in a two-body system no longer point toward the center of mass, which would make orbits unstable. The fact alone that a central pulling gravity force requires an infinite speed makes clear that pulling gravity models are untenable and recourse must be taken to a Lesagian type of pushing gravity model. The longitudinal dielectric flux which describes gravity in our model is probably caused by cosmic (microwave) background radiation. If this naturally occurring flux had an arbitrary frequency spectrum, superconductors would reflect this flux and would thus shield gravity, which does not happen.

However, acceleration fields outside a rotating superconductor were found[40,41], which are referred to as Gravitomagnetic effects, and also anomalous acceleration signals, anomalous gyroscope signals and Cooper pair mass excess were found in experiments with rotating superconductors[42].

It can be speculated that the relation Stowe and Mingst found between the characteristic oscillation frequency of the electron and the cosmic microwave background radiation is what causes the spectrum of the gravitational flux and that this is related to the characteristic oscillation frequencies of the electron, neutron and proton as well. If that is the case, then the incoming flux would resonate with the oscillating particles within the material at these specific frequencies, which would therefore not be blocked/reflected but would be absorbed/re-emitted along Huygens' principle.

It can further be speculated that when objects are rotated, their "clock", the characteristic oscillation frequency of the elemental particles making up the material, would be influenced, causing them to deviate from the specific frequencies they otherwise operate at. It is conceivable that this would result in a condition whereby superconductors would indeed reflect the naturally occurring gravitational flux, which could explain this anomaly.

Acknowledgments

This work would not have been possible without the groundbreaking work of Paul Stowe and Barry Mingst, who succeeded in integrating the gravitational domain with the electromagnetic domain within a single superfluid based model. It is this integration that resolves the classic problems associated with aether based theories, namely that because the gravitational field was considered to be separate from the electromagnetic domain, the movements of planetary bodies would necessarily result in measurable disturbances in the medium. When no such disturbances were found in the Michelson-Morley experiment, the aether hypothesis was considered as having been disproven. But because the gravitational force is now considered to be a force caused by longitudinal dielectric waves, which propagate trough the medium, this argument no longer applies. And therewith there is no longer any reason to disregard an aether based theory as a basis for theoretical physics.

The two most important findings in their work insofar as related to this paper are:

1) The theoretical factor between longitudinal and transverse wave speeds in an isotropic material of $\sqrt{3}$ applies to the predicted longitudinal dielectic waves as well, which are therefore predicted to propagate at a speed of $\sqrt{3}$ times the speed of light in free space;

2) their model for the electron as a single vortex ring reveals the actual nature of charge, the reason for its polarity as well as providing a link between the characteristic oscillation frequency of the electron and the observed microwave background radiation.

Discussion on LinkedIn

What's following are excerpts from a discussion on LinkedIn in the "Theoretical Physics" group.

Since this is a draft paper and it came forth from the discussion that the need for discrete mathematics no longer holds because of Laplace's equation, I include these here in this revision and will later re-write the article itself. Since I did not ask for permission, I've only used initials to indicate what was said by someone else.

The complete discussion is only accessible to group members:

https://www.linkedin.com/feed/update/urn:li:activity:6656522596546334721/

What I'm arguing in my paper is that Maxwell entangled a sub-nanoscale model for the medium with the macroscopic Faraday Law.

Since historically, the aether was considered to behave like a fluid/gas, the most natural way of describing such a medium is using fluid dynamics vector field theory, which is well known.

Within this context, the Helmholtz decomposition describes a fundamental distinction between rotational phenomena and translational phenomena, which should hold within an aether model. In Maxwell's equations, this is not the case as can be seen from a simple unit of measurement analysis.

Therefore, our revision should be preferred, which predicts Tesla's longitudinal waves to exist and to propagate faster than light. So, I argue **#QFT** should be revised, whereby the current abstract wavefunction should be related to this longitudinal wave. Of course, it's a lot of work to do all this, but I think it would be hard to argue such is impossible.

This way, lots of **#QE** experiments can be re-interpreted and revised and the classic idea of forces and fields can be restored.

-:-

The Aharonov–Bohm effect is interesting to analyse. On WP I note the following:

"An electric Aharonov–Bohm phenomenon was also predicted, in which a charged particle is affected by regions with different electrical potentials but zero electric field, but this has no experimental confirmation yet."

Would be interesting if I could explain that, but I have to study this first in order to understand what is going on.

Edit: Very interesting, indeed:

"The Aharonov–Bohm effect is important conceptually because it bears on three issues apparent in the recasting of (Maxwell's) classical electromagnetic theory as a gauge theory, which before the advent of quantum mechanics could be argued to be a mathematical reformulation with no physical consequences. The Aharonov–Bohm thought experiments and their experimental realization imply that the issues were not just philosophical."

-:-

I believe all of this can be explained eventualy, but it's vey complicated and I've only scratched the surface with the discovery of the inconsistencies in Maxwell's equations, but these are very important IMHO. All of modern science has been built upon Maxwell.

The problem is that that charge has been defined as a fundamental quantity, while in reality it is a consequence of what particles are: vortex rings. This leads to circular logic, since EM radiation is being regarded as being caused by EM radiation if we apply the wave-particle duality principle to "charge carriers" which are particles.

A more simple question is why a D.C. current trough a wire/coil gives a magnetic field, but the field of a permanent magnet does not induce a current in a coil. This has to do with the dynamic behavior of electrons c.q. vortex rings.

So far, I have not worked on the problem of how to descibe Faraday's law. I have some ideas, which are in the paper, but I concentrated on working on an experiment to prove the existence of FTL longitudinal Tesla waves. So far, I have not been successful.

Paul Stowe:

Maxwell would have absolutely no problem understanding the Aharonov–Bohm effect. One look at the configuration tells the whole story. The cork-screw spinning magnetic field is imposing a simple Bernoulli flow field distortion. It is rather obious, No???

https://en.wikipedia.org/wiki/Aharonov–Bohm_effect

Me: Have to take a closer look at it and ponder about it for a while. Usually, your hints are helpful.

Stowe:

Maybe I can describe it more clearly. Create a simple desktop analog. Setup the two slits, acoustic generator, an a cork-screw vane rod where the B-Field generator is. Do you think the pattern form from the slits will be the same when the rod is not rotating as when spinning rapidly? The pattern will distort in opposite directions depending upon the 'direction of spin'. The B-Field is simply an induced vortex, as is induced by the spinning vaned rod.

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Philosophically, the abstract wave function is closely related to the physical longitudinal wave, or should be.

Experiments with so-called "cymatics" show that longitudinal standing waves are very important with regards to geometry. Pressure variations because of longitudinal waves yield a real force, but these are not in the model. This explains why recourse has been taken towards probability models.

And because the Helmholtz decomposition has been broken in Maxwell's equations, things have become inconsistent and very hard to fix, which is why we still don't have a Theory of Everything.

Fixing Maxwell's equations promises to be a real breakthrough, but time will have to tell.

-:-

I made the argument in my (draft) paper, linked above. When you start out at a fluid dynamics model for the medium, you find that

1) units of measurements to not match and break the Helmholtz decomposition

2) Faraday's law has been entangled with the medium model.

Please do read the paper and consider the arguments in there, since that's what we're discussing here.

Maxwell states: $\nabla \times E = -\partial B/\partial t$

I say: $\nabla \times E = 0$.

This is where Faraday's law is (pardon my French) rammed into the model and I argue this should be introduced in a higher level model which incorporates a particle model based on vortex rings.

-:-

Q: Why is the idea of some kind of vortex rings or motion so popular with dissidents?

It is a logical consequence of the idea the aether can be described as a fluid, wherein these three phenomena are well known:

1) longitudinal waves;

2) transverse survace waves;

3) vortices and vortex rings.

The "vortices of what" are vortices within a fluid-like medium we call the aether. So, it's vortices of the aetheric fluid in motion.

Furthermore, **Paul Stowe** has shown that by modelling the electron as a ring vortex, one can compute the value of the elemental charge e as a result of a torroidial topology.

-:-

I made the argument in my (draft) paper linked above.

The inconsistency can be found by an analysis of the units of measurement in relation to the Helmholtz decomposition, which shows itself in the inclusion of Faradays law in the model.

Maxwell:
$\nabla \times E = -\partial B/\partial t$

A model derived from a fluid dynamics perspective:
$\nabla \times E = 0$

The fluid dynamics perspective results in a model whereby the Helmholtz decomposition establishes a fundamental difference between the rotational part around the magnetic field B and the translational part around the electric field E. This also eliminates the gauge freedom from the model, while essentially replacing the abstract probability wave function used in **#QFT** with a physical longitudinal wave (function) as a basis for field theory.

Please do read the paper, there's quite a lot more in there.

-:-

Stowe: One thing that you seem to never grasp is that any physical field has to have a physical origin. Maxwell did not make that mistake! He very clearly states their source as a physical aetherial medium. I all of known science the are numerous examples of 'fields', a whole branch devoted to them called Continuum Mechanics. The bulk behaviors well known. We certainly can say atmospheric weather climate models can be well described by 'field' models and those are all that are needed but it is irrational to deny and ignore their basis. The same is especially true for the foundations of the physical universe...

Me:
The problem is that because Maxwell included Faraday's law at the wrong level in the model, it has become widely accepted that "fields" are the primary cause for physical effects. See my quote from Freeman Dyson above.

This idea has become so natural to most scientists, that it's very hard to let go of that idea, especially because so many technological and scientific advancements have been made on top of Maxwell's equations.

The introduction of probabilistic methodologies has been proven to be very successfull and so far there has not been a reason to revise those theories, even though f/e Einstein was very critical about this:

"Even the great initial success of the Quantum Theory does not make me believe in the fundamental dice-game [...] No doubt the day will come when we will see whose instinctive attitude was the correct one."

Yet, it is logical to revise the probabalistic methods and incorporate the new knowledge we found. It just take time, but you're well aware of that.

All that's needed are a few dedicated people who are willing to cooperate and take the next steps, based upon our work. There is little doubt in my mind that will happen some day, it is a mere question of time.

Always has been.

-:-

WR:

Helmholtz decomposition allows us to write a L^2 3 dimensional vector field as the sum of a curl-free and divergence-free vector field. The curl-free {Correction via edit: delete "curl-free"} field can be expressed as the sum of the curl of a vector potential field $\mathbf{A}$ and divergence of a scalar potential field φ:

∇×**A** -∇φ

Where is there a problem?

Me:

https://en.wikipedia.org/wiki/Helmholtz_decomposition

"The term "Helmholtz theorem" can also refer to the following. Let C be a solenoidal vector field and d a scalar field on R3 which are sufficiently smooth and which vanish faster than 1/r2 at infinity. Then there exists a vector field F such that..."

Where's your definition for F?
What units of measurement does it have?

Well, THAT's the problem.

The whole idea of "gauge freedom" exists exactly because F has not been defined by Maxwell. It is the very reason the magnetic vector potential field [A] has not been uniquely defined.

And that's what gauge theories including QFT have been built upon.

Really, it's a theory developed within an aetheric paradigm that has "gauge freedom" that makes no sense.

Either way, THIS is the issue that defines the difference between a simple theory of everything and 150+ years of trying to build upon a broken foundation.

-:-

"The curl-free field can be expressed as the sum of the curl of a vector potential field **A** and divergence of a scalar potential field φ:
∇×**A** -∇φ

Where is there a problem?"

It's not the curl-free field that van be described as the sum of.., btw. But I assume that's a typo.

Either way, this establishes a fundamental distinction between the two components of the field, whereby the operators are derivative operators that all have a unit of measurement in per meter [/m]. Note the fact that these are derivatives and also note that the Helmholtz decomposition is an integral part of the vector Laplace operator and note:

https://en.wikipedia.org/wiki/Laplace_operator

"Solutions of the equation Δf = 0, now called Laplace's equation, are the so-called harmonic functions and represent the possible gravitational fields in regions of vacuum."

In essence, the vector Laplace operator is a generalisation of this 1D concept, whereby the Helmholtz decomposition is essential. Taken together, we get harmonic solutions, both in 1D and in 3D.

So, this math is vital and needs to be correct all the way. All three steps need to be defined in such a way that we get a consistent whole.

-:-

I now realize I made a mistake in my paper by insisting there should be a volumetric flow velocity field that is not zero, which is undoubtly confusing. However:

"Solutions of the equation Δf = 0, now called Laplace's equation, are the so-called harmonic functions."

So it's totally ok to have the null vector (field) as the field on which one applies the Helmholtz decomposition c.q. the Laplace vector operator.

However, units of measurement for the vector potential field [A] and scalar potential must match for this to work.

So, we can forget about the need for discrete vector fields in my paper and I have some re-writing to do, but the important point remains: In Maxwell's equations the units of measurement for the vector potential and scalar potential nor the ones for E and B match, and therefore one cannot come to an integrated vector equivalent of the Laplace equation.

This is the fundamental problem with the current model.

-:-

"I agree that equation, and all others, must be dimensionally homogeneous to make any sense. "

Yep, that's the point. The math is totally ok.

The problems are with the application thereof by Maxwell et al, which becomes obvious by checking the units of measurement. From my paper: "Now let us consider the units of measurement involved in these fields, whereby the three vector operators used all have a unit of measurement in per meter [/m]. The magnetic field B has a unit of measurement in Tesla [T], which is defined in SI units as [kg/s2-A]. So, for the magnetic vector potential A we obtain a unit of [kg-m/s2-A] and for dA/dt we obtain a unit of [kg-m/s3- A]. The electric field E has a unit of measurement in volt per meter, which is defined in SI units as [kg-m/s3-A], which matches that for dA/dt. So, for the electric scalar potential Φ we obtain a unit of [kg-m2/s3-A].

Obviously, however, neither the units of measurement for E and B are the same, nor are the units of measurements for Φ and A."

-:-

WR:

As I mentioned the **F** I used is a general vector meeting the criteria I mentioned. It the just vector maths but not applied to any particular vector field.

You can replace **F** by any vector field meeting the criteria and the rest follows for that vector field.

In Maxwell's case and making use of vector identities we have

$\nabla\cdot B = 0 = \nabla\cdot(\nabla\times\mathbf{A})$
$\nabla\times E = -\partial B/\partial t = -\partial\{\nabla\cdot(\nabla\times\mathbf{A})\}/\partial t = -\nabla\times(\nabla\varphi + \partial\mathbf{A}/\partial t)$

Hope I didn't confuse by giving the general case.

Me:

No, that was not confusing to me.

Again, the point is that **F** is well defined in the general case, but not in Maxwell's case because neither the units of measurement for E/B nor **A**/φ match.

Where's the $\mathbf{F} = \nabla\times\mathbf{A} - \nabla\varphi$ in Maxwell's case?

This is what causes all the problems.

On the one hand, this leads to the need for the Lorentz transform with its demand for a universally constant speed of light and on the other hand it leads to the need to resort to probabilistic methods (QM) in order to straighten things out, thus creating a paradox as the resulting theories are mutually exclusive; they cannot both be correct.

Remove the $-\partial B/\partial t$, which denotes the macroscopic Faraday law, from:

$\nabla\times E = -\partial B/\partial t = -\partial\{\nabla\cdot(\nabla\times\mathbf{A})\}/\partial t = -\nabla\times (\nabla\varphi + \partial\mathbf{A}/\partial t)$

And one obtains: $\nabla\times E = 0$

Then it all fits together like a glove, apart from the units of measurement, that is.

In fluid dynamics, one's **F** is well defined and one can write:

$\nabla^2\mathbf{F} = 0$

to obtain the generalized 3D form of the Laplace equation and the Helmholtz decomposition works out, etc.

Hence, the argument one should not entangle a sub-nanoscale model for the medium with the macroscopic Faraday law and the notion that we should revise our definitions for charge/current.

-:-

Always liked Dr. Cantrell's argument about the existence of a physical medium called aether question:

"Given that the nothingness of a perfect absolute vacuum is bestowed with the physical properties of a permittivity, e_o of 8.854 pF/m, a permeability, m_o of 4pi x 10-7 H/m, and a characteristic impedance of 377 ohms, is the concept of an aether really that outlandish?"

Quite a good read about the arguments against Einsteinan relativity:

http://www.infinite-energy.com/iemagazine/issue59/adissidentview.html

-:-

Stowe:

In defense of Einstein "Einsteinian Relativity" today is not how Einstein himself viewed it. Einstein was an aetherist. To be politically correct for his time he called it just the primal field.

Me:

Yep, he definitely was an aetherist and said some very interesting things. Wrote a background article a couple of years ago, wherein I included many of his quotes:

"Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity space without ether is unthinkable".

"The quanta really are a hopeless mess."

"All my attempts to adapt the theoretical foundation of physics to this new type of knowledge (Quantum Theory) failed completely. It was as if the ground had been pulled out from under one, with no firm foundation to be seen anywhere, upon which one could have built."

"Even the great initial success of the Quantum Theory does not make me believe in the fundamental dice-game, although I am well aware that our younger colleagues interpret this as a consequence of senility. No doubt the day will come when we will see whose instinctive attitude was the correct one."

http://www.tuks.nl/wiki/index.php/Main/OnSpaceTimeAndTheFabricOfNature

-:-

WR:

Yes, in Maxwell's EM in SI units:
Electric field strength vector
$[\mathbf{E}] \Rightarrow kg \cdot m \cdot A^{-1} \cdot s^{-3}$
Electric scalar potential
$[\Phi] \Rightarrow kg \cdot m^2 \cdot A^{-1} \cdot s^{-3}$
Magnetic flux density vector
$[\mathbf{B}] \Rightarrow kg \cdot A^{-1} \cdot s^{-2}$
Magnetic vector potential
$[\mathbf{A}] \Rightarrow kg \cdot m \cdot A^{-1} \cdot s^{-2}$
Magnetic scalar potential
$[\varphi] \Rightarrow kg \cdot m^2 \cdot A^{-1} \cdot s^{-2}$

$[\mathbf{E}]$ and $[\mathbf{B}]$ are not the same nor should they be. If they were the same Maxwell–Faraday law
$\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$
would be inconsistent.

From Maxwell's Gauss law for magnetism and the vector identity $0 = \nabla \cdot (\nabla \times \mathbf{A})$ we get
$\nabla \cdot \mathbf{B} = 0 = \nabla \cdot (\nabla \times \mathbf{A})$

So if $[\mathbf{B}]$ and $[\mathbf{A}]$ were not as they are there would be an inconsistency. Since the above equation holds always
$\nabla \cdot \mathbf{B} = \nabla \cdot (\nabla \times \mathbf{A})$
and we can write
$\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t = -\partial(\nabla \cdot (\nabla \times \mathbf{A}))/\partial t = -\nabla \times (\nabla \Phi + \partial \mathbf{A}/\partial t)$ All the terms have SI units $kg \cdot A^{-1} \cdot s^{-3}$. So if $[\Phi]$ and $[\mathbf{A}]$ were not as they are there would be an inconsistency.

-:-

"$[\mathbf{E}]$ and $[\mathbf{B}]$ are not the same nor should they be."

Interestingly, here the discussion changes from mathematical quantifiability / consistency towards the question of whether or not it makes sense from a philosophical point of view.

I think we agree the Laplace operator defines a mathematical construct which also defines a fundamental decomposition of a given field into two components, namely a rotational part and a translational part. This is also reflected in the significance of the A-B effect:

https://en.wikipedia.org/wiki/Aharonov–Bohm_effect#Significance

And I think we also agree that solutions to the Laplace equation $\nabla^2\mathbf{F} = 0$ yields harmonic results and that the units of measurement for the potential fields are the same in a fluid dynamics model, which would include a model wherein the aether is modelled as a fluid, in our case an ideal Newtonian fluid.

I think we also agree that in Maxwell's equations, there are sources for the fields, which are the electric charge density ρ and electric current density J, while in fluid dynamics there are no sources for the field itself.

So far, so good.

That brings us to the Nature of charge and it's relation to causing electromagnetic radiation:

https://en.wikipedia.org/wiki/Electromagnetic_radiation

"Electromagnetic waves are emitted by electrically charged particles undergoing acceleration."
Now let's consider the wave-particle duality:

https://en.wikipedia.org/wiki/Wave–particle_duality

"Wave–particle duality is the concept in quantum mechanics that every particle or quantum entity may be described as either a particle or a wave. […] Wave–particle duality is an ongoing conundrum in modern physics. Most physicists accept wave-particle duality as the best explanation for a broad range of observed phenomena; however, it is not without controversy."

https://en.wikipedia.org/wiki/Photon

"The photon is a type of elementary particle. It is the quantum of the electromagnetic field including electromagnetic radiation such as light and radio waves, and the force carrier for the electromagnetic force (even when static via virtual particles)."

Now let's substitute this into the sentence about the nature of EM radiation:

"Electromagnetic waves are emitted by (electrically charged) quanta of electromagnetic radiation (undergoing acceleration)."

So, the next problem is that when you define charge to be a fundamental quantity that is on the one hand the source for the field and on the other a property of "charged particles", you introduce circular logic into the model.

Given that in the analog case in fluid dynamics there are no sources for the fields themselves but only sources that can emit disturbances into the field and the fact that the current definition leads to the introduction of circular logic, in my opinion it makes no sense to insist that $[\mathbf{E}]$ and $[\mathbf{B}]$ should have different units of measurement.

It seems to me that the way out of the conundrum would be to fundamentally separate the model for the medium from the particle model that comes on top of it and therefore to remove "charge" as a source for the fields, completely analogous to the description of the fields in any fluid-like medium.

-:-

Stowe:

Yes Arend, that begs the question, what the hell is charge (other than an arbitrary label, placed, to give a name to an unknown).

Me:

Totally understandable Maxwell did it this way, but given that Tesla reported a "mean velocity of about four hundred and seventy-one thousand two hundred and forty kilometers per second" in 1905 one would have expected Einstein to have payed attention.

https://teslauniverse.com/nikola-tesla/patents/us-patent-787412-art-transmitting-electrical-energy-through-natural-mediums

And by the time the 21cm hydrogen line was discovered, one would have expected someone to have started scratching his head:

https://en.wikipedia.org/wiki/Hydrogen_line

I mean, how on Earth one can possibly maintain that a single atom with a Bohr radius of about 5.3×10^−11 m is able to emit a photon with a wavelength of no less than 21 cm because of the transition of a single electron between the two hyperfine levels of the atom is beyond me.

Obviously, the whole randomness idea has to go and should be replaced by resonance. I happen to agree with Einstein that the old one does not roll dice.

Fortunately, the solutions to the Laplace equation are the harmonic functions....

-:-

WR "So you are now OK with Maxwell's EM being mathematically consistent and there is no problem with dimensional (units), correct? "

Yes, it is mathematically self-consistent. In that sense, there is no problem with dimensional units, I agree to that.

However, the dimensional analysis does reveal that Maxwell's construct is incompatible with the construct defined by the Laplace operator, which is essentially one and the same as the Helmholtz decomposition. This is significant, IMHO.

"The next issue is whether Maxwell's EM makes good postdictions and predictions when used to quantitatively describe bulk electric and magnetic behaviors. I think you agree that is works well when used to describe the physical phenomena for which it was intended."

This is what's debatable. Sure, there is no argument that it is very useful and describes the behaviors well, but only up to a certain degree. However, it was intended to describe the complete behavior of the electromagnetic domain and that would include Tesla's longitudinal wave, should it exist.

Obviously, I believe that to be the case and I believe it propagates faster than light.

With regards to the question of how fast it propagates, there are two factors one can find. The first one is sqrt(3), as proposed by **Paul Stowe**, which originates at the factor between longitudinal and transverse wave speeds in an isotropic material. The other one is pi/2, which originates at the analysis of coils and antenna, which has to do with series and parallel LC resonance modes.

However, a more important question is whether or not it exists. Obviously, Tesla believed that to be the case and he reported a propagation speed much faster than light for the waves he transmitted trough the interior of the Earth. And there's Wheatstone's historical experiment, measuring the propagation speed of electricity:

http://www.tuks.nl/wiki/index.php/Main/WheatstoneExperimentsToMeasureTheVelocityOfElectricity

And there's various anomalies regarding experiments with optical fibers, which do show propagation speeds faster than light and are quite interesting, especially the discussion about causality. You can find the references in my paper. I also found some papers with anomalous faster than light signal propagation with regards to near field phenomena.

So, there are quite a number of sources which support the idea that faster than light longitudinal waves do exist.

Needless to say, if someone succeeds in experimentally proving the existence of longitudinal waves, there is no longer any argument with regards to the complete correctness of Maxwell's construct and recourse must be taken to Laplace and an aetheric medium model and the world of physics will never be the same.

It should be doable, because of the faster-than-light propagation speed the wavelength should be longer. Still working on that, so far no postive result, but I'm confident someone will eventually succeed. After all, Tesla already did.

So, my point is not that there are analogies, my point is that there are quite a lot of sources which support the idea of the existence of longitudinal waves and that these are not being described by Maxwell because it's incompatible with the Laplace operator.

Take that together with the circular logic we found, the problems with current gravity theory ("dark matter") and the fact we still don't have an integrated "theory of everything" and it becomes obvious something is terribly wrong somewhere, which I attribute to the incompatibilty between Maxwell and Laplace.

-:-

"I cannot understand how you conclude there is an "incompatibility" with Maxwell and the Laplace operator.
I assume you mean the vector Laplace operator on an arbitrary vector:
$\nabla^2\mathbf{F} = \nabla(\nabla\cdot\mathbf{F}) - \nabla\times(\nabla\times\mathbf{F})$
So where is the problem?"

One cannot over-estimate the importance and fundamental significance of this equation. This should be our guiding principle, the foundation for all field theories, because it fundamentally defines two potential fields that are fundamentally related to one another and one should not break those relationships.

Note how this is reflected here:
https://en.wikipedia.org/wiki/Aharonov–Bohm_effect#Significance

"Eventually, a description arose according to which charges, currents and magnets acted as local sources of propagating force fields, which then acted on other charges and currents locally through the Lorentz force law. In this framework, because one of the observed properties of the electric field was that it was irrotational, and one of the observed properties of the magnetic field was that it was divergenceless, it was possible to express an electrostatic field as the gradient of a scalar potential [..] and a stationary magnetic field as the curl of a vector potential."

Obvously, the potential fields defined by Maxwell are not the same as one would obtain from this equation.

May be the word "incompatible" is not the right word, but at the end of the day it is clear that the fundamental relationship between the E and B fields as established by Laplace is broken^H^H not the same in Maxwell, because of the introduction of Faraday's law to the model.

That's why I argue Maxwell's equations should be revised such that the definition for the E and B fields align with Laplace. And the way to do that would be to describe Faraday's law and the concept of charge at a higher level in the model, which is logical given that charge is a property of certain particles and should therefore result from the particle model and should therefore not be included in the medium/field model itself.

Don't you see it's totally illogical to have a fundamental decomposition into a rotation-free component and a divergence-free component and then see that Maxwell adds the time-derivative of the divergence-free component to the rotation-free component? Don't you see that this messes things up and creates all kinds of problems?

WR:

No, I don't see why you think the vector Laplace operator
$\nabla^2\mathbf{F} = \nabla(\nabla\cdot\mathbf{F}) - \nabla\times(\nabla\times\mathbf{F})$
and Maxwell's theory are incompatible, broken or messes thing up as you state. The Laplace operator is not some sacred physical law of the universe, it is a mathematical relation (an identity actually) formed in a mathematically consistent way from the definition
$\nabla = \partial/\partial x\ x' + \partial/\partial y)\ y' + \partial/\partial z)\ z'$
and the rules of vector calculus. ∇^2 is essentially a second derivative operator and if it is useful in describing some phenomena in the universe then we use it. Yes, it has found many uses.

But, that aside, it doesn't tell me anything about why you think
$\nabla^2\mathbf{F} = \nabla(\nabla\cdot\mathbf{F}) - \nabla\times(\nabla\times\mathbf{F})$
is incompatible with Maxwell or breaks something. So please explain by showing your maths.

Me:

"The Laplace operator is not some sacred physical law of the universe, it is a mathematical relation".

Yes, it's a relation of which the correctness is pretty much undisputable, like 1+1=2.

Equate this equation to zero and one obtains the 3D Laplace equation of which the solutions are the harmonic functions, which (when worked out) describe all possible (harmonic) wave phenomena in 3D:

$\nabla^2\mathbf{F} = \nabla(\nabla\cdot\mathbf{F}) - \nabla\times(\nabla\times\mathbf{F}) = 0.$

This can be re-written as:

$-\nabla^2\mathbf{F} = - \nabla(\nabla\cdot\mathbf{F}) + \nabla\times(\nabla\times\mathbf{F}) = 0.$

Then, the terms in this equation can be written out as follows:

$\mathbf{A} = \nabla\times\mathbf{F}$
$\Phi = \nabla\cdot\mathbf{F}$
$\mathbf{B} = \nabla\times\mathbf{A} = \nabla\times(\nabla\times\mathbf{F})$
$\mathbf{E} =-\nabla\Phi = -\nabla(\nabla\cdot\mathbf{F})$

And because of vector identities, one can also write:

$\nabla\times\mathbf{E} = 0$
$\nabla\cdot\mathbf{B} = 0$

So, any given vector field $\mathbf{F}$ can be decomposed like this into a rotation free component $\mathbf{E}$ and a divergence free component $\mathbf{B}$.

There is no argument this is mathematically consistent, nor that the solutions to the equation $-\nabla^2\mathbf{F} = 0$ are the harmonic wave functions in 3D.

Now compare this to Maxwell's:

$\mathbf{E} = -\nabla\Phi - \partial\mathbf{A}/\partial t$

Take the rotation at both sides of the equation and we obtain the Maxwell-Faraday equation:

$\nabla\times\mathbf{E} = - \partial\mathbf{B}/\partial t$

WP: "Faraday's law of induction (briefly, Faraday's law) is a basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF)—a phenomenon known as electromagnetic induction."

This is a circuit law, which predicts how a magnetic field will interact with electrons moving trough a wire. Since this involves moving charge carriers, which are particles, it is illogical to introduce this law at the medium/field modelling level. Because of the wave-particle duality principle, it is known that particles are manifestations of the EM field. So, by including this law in the medium/field model one introduces circular logic.

Not only that, it breaks the fundamental separation of the fields into a divergence free component and a rotation free component.

As is well known, this model eventually leads to two mutually exclusive theories, which cannot both be correct.

In other words: what you are doing by introducing Faraday's law at this level in the model is you are insisting 1+1 is not 2, but something else.

And you end up with 150+ years of trying to find additional equations to straighten things out, but the bottom line is: 1+1=2, NOT something else.

-:-

"Where do you get "Because of the wave-particle duality principle, it is known that particles are manifestations of the EM field. So, by including this law [I assume Maxwell-Faraday, $\nabla\times\mathbf{E} = -\partial\mathbf{B}/\partial t$ law] in the medium/field model one introduces circular logic." "

As you know, the wave-particle duality is an ongoing conundrum, so it is very important to resolve this.

IMHO, the logical approach would be to start with a model for the medium, which is characterized by a permittivity ε of 8.854 pF/m, a permeability μ of 4π x 10^-7 H/m and a characteristic impedance of 377 Ω. This matches to the characteristics of a fluid, hence the idea of the existence of a physical aether.

Since in my view, there can only be one aether and we can define fields using the Laplace equation in order to describe it's *dynamics*, we can conclude that ALL physical phenomena are manifestations of the thus described EM fields, which can be detailed by the harmonic wave functions that are the solutions for this equation.

Because a fluid cannot sustain transverse waves and there are significant differences between the near and far fields, the logical conclusion is that the far field must be some kind of vortex or vortex ring.

It is not hard to see that vortex rings can be combined into complex structures and that these show both attributes of particles as well as waves:

http://www.tuks.nl/img/dualtorus.gif

Given the fact that charge is a property of certain particles, the nature of what charge is should follow from the particle model and should not be taken as a fundamental quantity.

According to **Paul Stowe**, one can indeed compute the value for e, elemental charge, from a ring vortex topology, hence the idea that the electron should be modelled as a vortex ring.

So, IMHO, the concept of charge should fundamentally follow from the particle model, which should be described on top of the medium model.

Otherwise, one irrevocably runs into circular logic problems, as also illustrated earlier around the cause for EM radiation.

In a nutshell:

Either particles are caused by the EM fields OR the EM fields are caused by particles, but NOT both at the same time!

I just think the idea that particles are caused by the EM fields is the best answer.

-:-

"Which "medium/field model " do you mean and how does it "eventually leads to two mutually exclusive theories... ." and what are those theories?"

Yep, this is a bit ambiguous, since it is debatable what it is that is currently being described by Maxwell's equations. In my view, there should be a model for the medium and on top of that a particle model, but currently that is not the case.

Because the wave equations resulting from the current Maxwell equations are not invariant to the Galilean transform, this eventually leads to General Relativity:

http://www.etherphysics.net/CKT4.pdf

That's the first one.

And because the current Maxwell equations do not adhere to the vector Laplace equation, there's gauge freedom in the model, which is what eventually leads to gauge theory and QFT.

That's the second one.

It is well known that these theories are mutually exclusive. They cannot both be correct.

-:-

"How does it break "the fundamental separation of the fields into a divergence free component and a rotation free component."? "

As shown, the 3D vector Laplace equation defines two components, one of which is divergence free and one of which is rotation free.

Since the 3D vector Laplace equaton is nothing but a 3D generalization of the lower dimensional Laplace equation and results in harmonic solutions, which is all well established undisputable math, it follows that the decomposition into a divergence free component and a rotation free component is fundamental and is therefore the only correct way to derive wave functions in 3D for any given vector field.

There is no argument that with equating the rotation of the rotation free component $\mathbf{E}$ to the time derivative of the divergence free (and therefore rotational) component $\mathbf{B}$ by Maxwell results in $\mathbf{E}$ remaining to be rotation free and therefore such breaks said fundamental separation of said components.

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