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Exploration

A Plausible Resolution to Hilbert's Failed Attempt to Unify Gravitation & Electromagnetism

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Abstract

In this paper, we explore the reasons why Hilbert's axiomatic program to unify gravitation theory and electromagnetism failed and outline a plausible resolution of this problem. The latter is based on Gödel's incompleteness theorem and Newton's aether stream model.

Keywords: Unification, gravitation, electromagnetism, Hilbert, resolution.

Introduction

Hilbert and Einstein were in race at 1915 to develop a new gravitation theory based on covariance principle [1]. While Einstein seemed to win the race at the time, Hilbert produced two communications which show that he was ahead of Einstein in term of unification of gravitation theory and electromagnetic theory. Hilbert started with Mie's electromagnetic theory. However, as Mie theory became completely failed, so was the Hilbert's *axiomatic* program to unify those two theories [1]. Einstein might be learning from such an early failure of Hilbert to unify those theories, and years later returned to Mie theory [1].

What we would say here is that Hilbert's axiomatic failure can be explained by virtue of Gödel's incompleteness theorem: which says essentially that any attempt to build a consistent theory based on axiomatic foundations can be shown to be inconsistent. Nonetheless only few physicists seem to grasp this result.

What can we learn from that story?

First of all, it leads us back to Newton's aether stream model as will be discussed in the following sections. Moreover, it may be not only that it is an elusive dream to unify gravitation and electromagnetic theories from pure thoughts, but it clearly shows that we ought to return to the old days of Maxwell and also Heaviside who have given hints on how to come up with a more realistic unification of gravitation and electromagnetic theories.

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To us, it also shows that we may need to re-read Maxwell's original papers, perhaps we should find out how he thought about cogwheel, molecular vortices etc...and they may lead us to a correct theory of gravitation (and also how to connect it with classical electrodynamics). In the meantime, it is worth noting here that Tesla and other experimenters have tried to come up with a simpler version of such unification theories, although most of them were not as familiar to many physicists unlike General Relativity theory.

Arthur Eddington's work

The modern era of cosmology began with the publication of Einstein's general theory of relativity in 1915. The first experimental test of this theory was Eddington's famous expedition to measure the bending of light at a total solar eclipse in 1919 [3].

According to Peter Coles's book [3]:

Eddington was impressed by the beauty of Einstein's work, and immediately began to promote it. In a report to the Royal Astronomical Society in early 1917, he particularly stressed the importance of testing the theory using measurements of light bending. A few weeks later, the Astronomer Royal, Sir Frank Watson Dyson, realised that the eclipse of 29 May 1919 was especially propitious for this task. Although the path of totality ran across the Atlantic ocean from Brazil to West Africa, the position of the Sun at the time would be right in front of a prominent grouping of stars known as the Hyades. When totality occurred, the sky behind the Sun would be glittering with bright stars whose positions could be measured. Dyson began immediately to investigate possible observing sites. It was decided to send not one, but two expeditions. One, led by Eddington, was to travel to the island of Principe off the coast of Spanish Guinea in West Africa, and the other, led by Andrew Crommelin (an astronomer at the Royal Greenwich Observatory), would travel to Sobral in northern Brazil. An application was made to the Government Grant Committee to fund the expeditions, £100 for instruments and £1000 for travel and other costs. Preparations began, but immediately ran into problems. Although Britain and Germany had been at war since 1914, conscription into the armed forces was not introduced in England until 1917. At the age of 34, Eddington was eligible for the draft, but as a Quaker he let it be known that he would refuse to serve. ...

There were other problems too. The light deflection expected was quite small: less than two seconds of arc. But other things could cause a shifting of the stars' position on a photographic plate. For one thing, photographic plates can expand and contract with changes in temperature. The emulsion used might not be particularly uniform. The eclipse plates might have been exposed under different conditions from the reference plates, and so on. The Sobral team in particular realised that, having risen during the morning, the temperature fell noticeably during totality, with the probable result that the photographic plates would shrink. The refractive properties of the atmosphere also change during an eclipse, leading to a false distortion of the images. And perhaps most critically of all, Eddington's expedition was hampered by bad luck even after the eclipse. Because of an imminent strike of the local steamship operators, his team was in danger of being completely stranded. He was therefore forced to leave early, before taking any

reference plates of the same region of the sky with the same equipment. Instead he relied on one check plate made at Principe and others taken previously at Oxford. These were better than nothing, but made it impossible to check fully for systematic errors and laid his results open to considerable criticism. All these problems had to be allowed for, and corrected if possible in the final stage of data analysis. Scientific observations are always subject to errors and uncertainty of this kind. The level of this uncertainty in any experimental result is usually communicated in the technical literature by giving not just one number as the answer, but attaching to it another number called the 'standard error', an estimate of the range of possible errors that could influence the result. If the light deflection measured was, say, 1 arc second, then this measurement would be totally unreliable if the standard error were as large as the measurement itself, 1 arc second. Such a result would be represented as 1 ± 1 arc second, and nobody would believe it because the measured deflection could well be produced entirely by instrumental errors. In fact, as a rule of thumb, physicists never usually believe anything unless the measured number is larger than two standard errors. The expedition teams analysed their data, with Eddington playing the leading role, cross-checked with the reference plates, checked and double-checked their standard errors. Finally, they were ready. ...

A special joint meeting of the Royal Astronomical Society and the Royal Society of London was convened on 6 November 1919. Dyson presented the main results, and was followed by contributions from Crommelin and Eddington. The results from Sobral, with measurements of seven stars in good visibility, gave the deflection as 1.98 ± 0.16 arc seconds. Principe was less convincing. Only five stars were included, and the conditions there led to a much larger error. Nevertheless, the value obtained by Eddington was 1.61 ± 0.40 . Both were within two standard errors of the Einstein value of 1.74 and more than two standard errors away from either zero or the Newtonian value of 0.87. The reaction from scientists at this special meeting was ambivalent. Some questioned the reliability of statistical evidence from such a small number of stars. This skepticism seems in retrospect to be entirely justified. Although the results from Sobral were consistent with Einstein's prediction, Eddington had been careful to remove from the analysis all measurements taken with the main equipment, the astrographic telescope and used only the results from the 4-inch. As I have explained, there were good grounds for this because of problems with the focus of the larger instrument. On the other hand, these plates yielded a value for the deflection of 0.93 seconds of arc, very close to the Newtonian prediction. Some suspected Eddington of cooking the books by leaving these measurements out.

Gödel's incompleteness theorem

Gödel's ground-breaking results were obtained against the backdrop of the foundational debate of the 1920s. In 1921, reacting in part to calls for a "revolution" in mathematics by the intuitionist L. E. J. Brouwer and his own student Hermann Weyl, Hilbert had proposed a program for a new foundation of mathematics. The program called for (i) a formalization of all of mathematics in an axiomatic systems followed by (ii) a demonstration that this formalization is consistent, i.e., that no contradiction can be derived from the axioms of mathematics. Partial

progress had been made by Wilhelm Ackermann and John von Neumann, and Hilbert in 1928 claimed that consistency proofs had been established for first-order number theory. Gödel's results would later show that this assessment was too optimistic; but he had himself set out to with the aim of contributing to this program.[5]

According to Devlin's book [4]:

Gödel's Theorem says that in any axiomatic mathematical system that is sufficiently rich to do elementary arithmetic, there will be some statements that are true but cannot be proved (from the axioms). In technical terminology, the axiom system must be incomplete. At the time Gödel proved this theorem, it was widely believed that, with sufficient effort, mathematicians would eventually be able to formulate axioms to support all of mathematics. The Incompleteness Theorem flew in the face of this expectation, and many took it to imply that there is a limit to the mathematical knowledge we may acquire. Few mathematicians think that way now, however. The change in our conception of mathematical truth that Gödel's theorem brought about was so complete, that today most of us view the result itself as merely a technical observation about the limitations of axiom systems.

To summarize: "Kurt Gödel's Incompleteness Theorem changed the concept of mathematical truth and showed the limitations of axiom-based systems." In other words, Gödel effectively put Hilbert's axiomatic program into ruins. And so was Hilbert's approach to unify gravitation and electromagnetic theory.

Now the hard question: is it possible to find a door outside such a Gödel's spider web?

A plausible resolution of the above problems

a. Why do we need a new approach?

Karl Popper's epistemology suggests that when the theory is refuted by observation, then it is time to look for a set of new approaches. Now, it is clear that Hilbert's axiomatic program has failed not only by experiment (Mie theory does not agree with experiment) but also in terms of logic (Gödel theorem). Therefore we set out a new approach, starting from an old theory of Isaac Newton.

b. Recalling Newton's aether stream model

Newton brought up his aether stream model in a letter to Robert Boyle, 1678. For interested readers, complete letter of Isaac Newton to Boyle can be found in Appendix section. Comments on Newton aether stream model by DeMeo go as follows:

The letter clearly shows the young Newton, who wrote this in 1679 when he was 37 years old, had a firm belief and working grasp of the ether of space as a thing of substance and

"ponderability", something which participated in the movement and ordering of the planets and universe, as a working force in optics, chemistry and gravitation. In this, Newton was continuing the conceptual ideas of Galileo, which had been such an irritant to the Vatican Bishops, who would tolerate no possibility of a motional force in nature other than God. The idea that ether and god might be identical descriptions for the "prime-mover" was equally intolerable, as while one could scientifically know and measure the ether, one could not by definition measure or know "the divine". The young Newton was not bothered by such conceptual difficulties as which bothered the Bishops of Rome, however, but the older Newton increasingly became preoccupied with theological matters, to the point that nearly all his biographers would agree he had become as much of a theologian as scientist in his last decades. Even only 20 years after penning this Letter to Boyle, he writes in the last query of his *Optics*, the following:

"Now by the help of these principles, all material things seem to have been composed of the hard and solid particles, above-mentioned, variously associated in the first creation by the counsel of an intelligent agent. For it became him who created them to set them in order. And if he did so, it's unphilosophical to seek for any other origin of the world, or to pretend that it might arise out of a chaos by the mere laws of nature; though being once formed, it may continue by those laws for many ages..." (quoted in Sullivan, p.125-126)

During those later periods, Newton would drop ideas such as a ponderable and moving cosmic ether in favor of more abstract concepts, such as the divine "prime mover" or deified "absolute space", which was foundational for most later astrophysical investigations into the nature of the cosmos. The most obvious result of this shift was, that in the original Michelson-Morley experiment for testing of ether-drift, everyone anticipated a very large ether-drift effect, based upon the assumption the Earth was racing through an intangible and substance-less static and immobile cosmic ether at very high speeds. No such intangible static ether has ever been demonstrated, nor could it be. But a material and substantive entrained ether, moving more slowly at lower altitudes and close to the speed of the earth itself, something quite similar to that proposed by the young Isaac Newton, was detected repeatedly.."[6]

c. Remark on Aether stream (by third author)

The higher the energy, the higher the velocity of the aether entities in the given place and time, and the lower the density. The phase states can exhibit turbulence, which is more marked at the higher densities, the way I am looking at this right now. The Kolmogorov Limit of $10e^{-58}$ meters plays a part here. Entities smaller than that will not exhibit much turbulence, primarily because they tend to be superluminal, so any turbulence will be hard to see.

The following figure is on Mishin's Aether phase states:

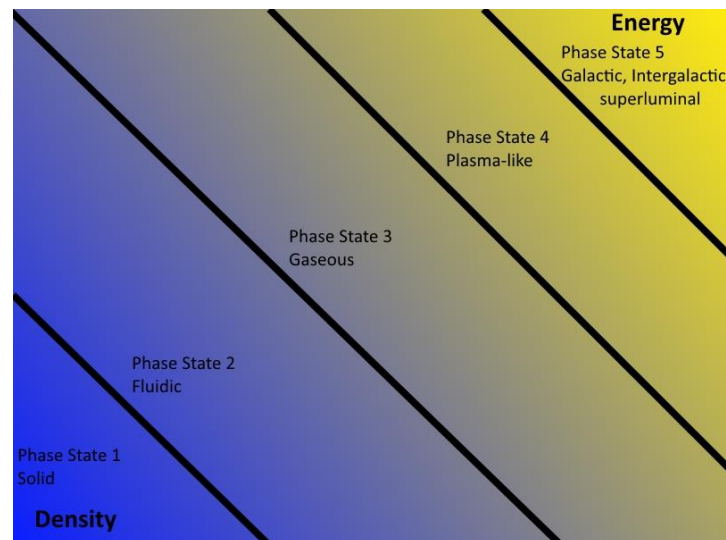


Figure 1. Aether phase states (Mishin)

There is an illustration of the process of aether particles being slowed by existing matter and eventually forming electron vortices as the local aether density and turbulence increases, while the energy drops due to interactions with existing matter, or aether in a denser phase state.

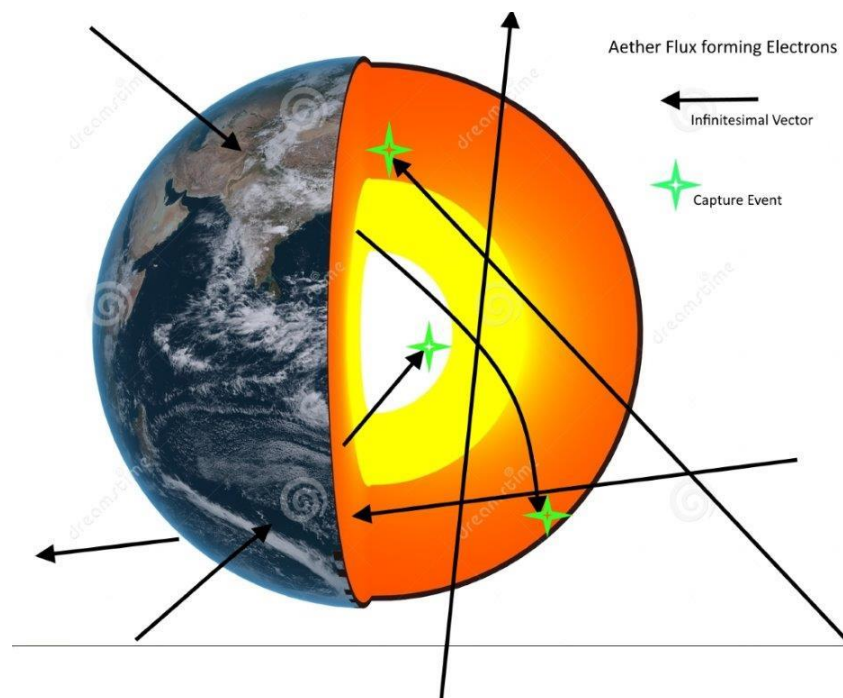


Figure 2. Illustration on how matter creation can take place in inner core of Earth
(Source: <https://www.dreamstime.com/royalty-free-stock-photography-earth-core-image1890727>)

The process of matter creation can be attributed to electron vortex capture event.

This illustration shows stellar and interstellar aether flows interacting with electron vortices. In some cases the stellar flux is diverted by the electron vortex. In other cases, the flux entity misses entirely, similar to a neutrino. In some unusual cases the flux is captured by an electron vortex and participates in it for a while.

Each electron which already exists, acts as a large rock in a moving stream, causing deflections of the normal aether flow, slowing down the flow-rate, and producing eddy currents and turbulence in the ambient aether near the given electron. When the turbulence becomes large enough, additional electrons form in the media, which act to choke off the interstellar aether flow even more and impede its normally unencumbered motion. This is similar to adding more and more rocks into the channel of a stream of water, so that the flow rate of the water slows down, as more and more rocks are added.

This process was discovered by Nikola Tesla during his experiments at his Colorado Springs laboratory, where my grandfather was employed by Tesla, during those days. It is a good thing this happens, or aether avalanches produced by Tesla's 100,000,000 volt explosive electrical discharge events could have burned away the very air we live in.

Tesla was relieved to find out the discharges were choked off, accompanied by vast numbers of newly created electrons. Tesla found the excess electricity resulting from the excess electrons to be a nuisance to his other experiments, so he dumped the excess electrical power into the earth's crust.

Helmholtz electron vortices can be destroyed by aether shock fronts resulting from high dv/dt electrical discharges which are approaching the ideal of a Dirac delta function. In that situation, the Helmholtz vortex is disintegrated. The aether which originally formed the particle vortex, becomes part of the shock front and is carried along with the aether shock wave at velocities similar to the shock front, until the shock front dissipates. At that point, all that remains is a propagating aether stream, diverging at the rate of $1/r$, relative to the source.

Everything is made of aether infinitesimals. Their group streaming motions precede the known forces, in the form of vector potentials. All matter is made from accumulations of infinitesimals. And all matter can be dissipated back into its constituent infinitesimals. See also figure below:

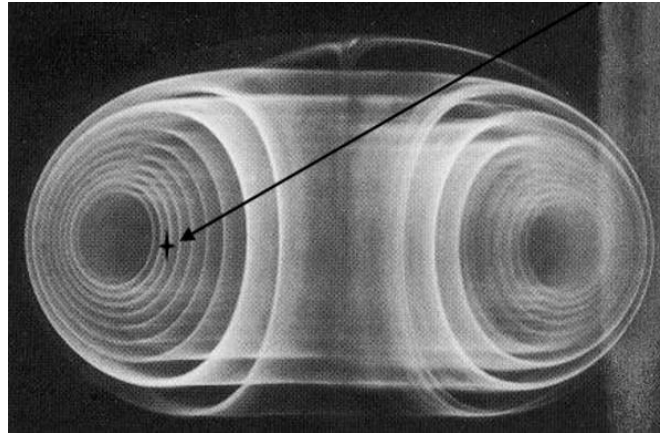


Figure 3. electron vortex capture event – Helmholtz electron vortex is *nearly indestructible* (after R.N. Boyd)

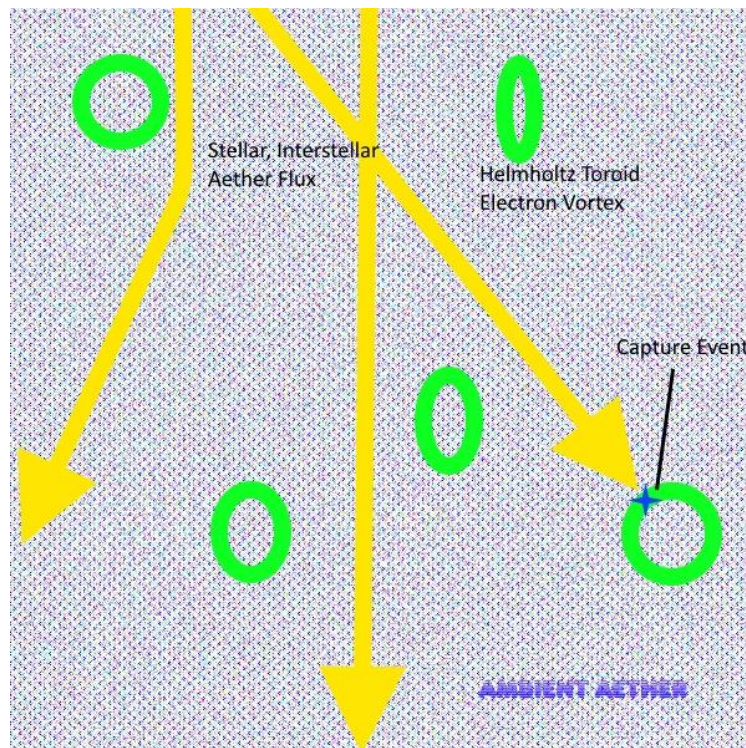


Figure 3a. electron vortex capture event(after R.N. Boyd)

The Helmholtz vortex model of the electron as illustrated in the photo of a Helmholtz vortex (Fig. 3), is a toroid made of nested concentric toroidal flows of smaller particles. Lines of constant flow are given by

$$r = a \sin \Omega = a \sin \Omega t,$$

where a is a constant. The velocity components are

$$dr/dt = a \Omega \cos \Omega t$$

and

$$r d\theta/dt = a \Omega \sin \Omega t$$

The Ωt implies that a characteristic wave function is associated with the vortex, but we haven't worked on it yet. This may be an indication of origin of the de Broglie wave of the electron, or it may have something to do with the Compton radius of the electron, or both.

The constant a may represent the outer limit of the vortex-particle, if the internal circulation velocity of smaller particles does not exceed light speed. If the circulation velocity is larger than c , at the outer shells of the nested vortex, there may be a species of sub-particles which is always being removed from the nested toroidal form, which must be replenished to the vortex which is living in an "atmosphere" made larger circulations of sub-particles. This is due to considering the electron as having a fixed mass, a fixed extent, and a fixed charge (which may not be the case for all time and in all circumstances).

There should be some set of equations which shows vortex sub-particle replacement activities from the ambient aether, but we haven't worked on it either.

The first equation is a circle tangent to the z axis at the origin, with a center located in the $X Y$ plane at the distance

$$a/2 = p$$

where p is the potential of the electron, and is independent of the orientation of the electron vortex.

Then the electron can be viewed as a toroid, with a volume

$$V = 2 \pi r \text{ times } \pi r^2 = 2 \pi^2 r^3$$

Three potentials are indicated here: Static potential, Spin potential, and a Dipole potential. Since the electron vortex has mass (which may change from its present value, according to the parameters of the ambient aether in the vicinity of the electron at the given place and time), a total of six potentials are implied.

d. Introducing acoustic model of space

With regards to spacetime metric which is conventionally attributed to Special Relativity, Thornhill has argued in favour of *acoustic nature of space* which conforms reality, instead of relativity with its notorious denial view on the existence of Aether stream. The following argument is derived from Thornhill.

In one of his remarkable papers, the late C.K. Thornhill wrote as follows:

“Relativists and cosmologists regularly refer to space-time without specifying precisely what they mean by this term. Here the two different forms of spacetime, real and imaginary, are introduced and contrasted. It is shown that, in real space-time (x, y, z, ct), Maxwell’s equations have the same wave surfaces as those for sound waves in any uniform fluid at rest, and thus that Maxwell’s equations are not general and invariant but, like the standard wave equation, only hold in one unique frame of reference. In other words, Maxwell’s equations only apply to electromagnetic waves in a uniform ether at rest. But both Maxwell’s equations and the standard wave equation, and their identical wave surfaces, transform quite properly, by Galilean transformation, into a general invariant form which applies to waves in any uniform medium moving at any constant velocity relative to the reference-frame. It was the mistaken idea, that Maxwell’s equations and the standard wave equation should be invariant, which led, by a mathematical freak, to the Lorentz transform (which demands the non-ether concept and a universally constant wave-speed) and to special relativity. The mistake was further compounded by misinterpreting the differential equation for the wave hypercone through any point as the quadratic differential form of a Riemannian metric in imaginary space-time (x, y, z, ict). Further complications ensued when this imaginary space-time was generalised to encompass gravitation in general relativity.”[9]

Acoustic Analogue of Space

In this section, we borrow some important ideas from C.K. Thornhill and also Tsutomu Kambe. According to Thornhill, real space-time is a four dimensional space consisting of three-dimensional space plus a fourth length dimension obtained by multiplying time by a constant speed. (This is usually taken as the constant wave-speed c of electromagnetic waves). If the four lengths, which define a four-dimensional metric (x, y, z, ict), are thought of as measured in directions mutually at right-angles, then the quadratic differential form of this metric is: [9]

$$(ds)^2 = (dx)^2 + (dy)^2 + (dz)^2 - \bar{c}^2 (dt)^2 \quad (1)$$

When the non-differential terms are removed from Maxwell’s equations, i.e. when there is no charge distribution or current density, it can easily be shown that the components (E1 ,E2 ,E3) of the electrical field-strength and the components (H1 ,H2 ,H3) of the magnetic field-strength all satisfy the standard wave equation: [9]

$$\nabla \phi = \left(\frac{1}{\bar{c}^2} \right) \frac{\partial^2 \phi}{\partial t^2} \quad (2)$$

It follows immediately, therefore, that the wave surfaces of Maxwell's equations are exactly the same as those for sound waves in any uniform fluid at rest, and that Maxwell's equations can only hold in one unique reference-frame and should not remain invariant when transformed into any other reference-frame. In particular, the equation for the envelope of all wave surfaces which pass through any point at any time is, for equation (2), and therefore also for Maxwell's equations [9],

$$(dx)^2 + (dy)^2 + (dz)^2 = \bar{c}^2 (dt)^2, \quad (3)$$

or

$$\frac{(dx)^2}{(dt)^2} + \frac{(dy)^2}{(dt)^2} + \frac{(dz)^2}{(dt)^2} = \bar{c}^2 \quad (4)$$

It is by no means trivial, but it is, nevertheless, not very difficult to show, by elementary standard methods, that the general integral of the differential equation (4), which passes through (x_1, y_1, z_1) at time t_1 , is the right spherical hypercone [9]

$$(x - x_1)^2 + (y - y_1)^2 + (z - z_1)^2 = \bar{c}^2 (t - t_1)^2 \quad (5)$$

In other words, both *Maxwell equations and space itself has the sound wave origin*.

It is also interesting to remark here that Maxwell equations can be cast in the language of vortex sound theory, as follows.

Prof. T. Kambe from University of Tokyo has made a connection between the equation of vortex sound and fluid Maxwell equations. He wrote that it would be no exaggeration to say that any vortex motion excites *acoustic* waves. He considers the equation of vortex sound of the form: [10]

$$\frac{1}{c^2} \partial_i^2 p - \nabla^2 p = \rho_0 \nabla \cdot L = \rho_0 \text{div}(\omega \times v) \quad (6)$$

He also wrote that dipolar emission by the vortex-body interaction is [11]:

$$p_F(x, t) = -\frac{P_0}{4\pi c} \ddot{\Pi}_i(t - \frac{x}{c}) \frac{x_i}{x^2} \quad (7)$$

Then he obtained an expression of fluid Maxwell equations as follows [12]:

$$\begin{aligned}
 \nabla \cdot H &= 0 \\
 \nabla \cdot E &= q \\
 \nabla \times E + \partial_t H &= 0 \\
 a_0^2 \nabla \times H - \partial_t E &= J
 \end{aligned}
 \tag{8}$$

Where [12] a_0 denotes the sound speed, and

$$\begin{aligned}
 q &= -\partial_t (\nabla \cdot v) - \nabla h, \\
 J &= \partial_t^2 v + \nabla \partial_t h + a_0^2 \nabla \times (\nabla \times v)
 \end{aligned}
 \tag{9}$$

In our opinion, this new expression of fluid Maxwell equations suggests that there is a deep connection between vortex sound and electromagnetic fields. However, it should be noted that the above expressions based on fluid dynamics need to be verified with experiments. We should note also that in (8) and (9), the speed of sound a_0 is analogous of the speed of light in Maxwell equations, whereas in equation (6), the speed of sound is designated "c" (as analogous to the light speed in EM wave equation). For alternative hydrodynamics expression of electromagnetic fields, see [14-15].

e. More proof: *Calculating matter creation in Earth and its effect*

One of us has performed a calculation to show that the observed receding Moon from Earth, should be properly attributed to increasing size of the Earth. The latter phenomenon could be attributed to "matter creation" as effect of aether stream (vortex). We will discuss this in a separate report.

f. More proof: *Dayton Miller's experiment*

DeMeo remark on Dayton Miller's experiment:

The history of science records the 1887 ether-drift experiment of Albert Michelson and Edward Morley as a pivotal turning point, where the energetic *ether of space* was discarded by mainstream physics. Thereafter, the postulate of "empty space" was embraced, along with related concepts which demanded constancy in light-speed, such as Albert Einstein's relativity theory. The now famous *Michelson-Morley experiment* is widely cited, in nearly every physics textbook, for its claimed "null" or "negative" results. Less known, however, is the far more significant and detailed work of Dayton Miller.

Dayton Miller's 1933 paper in *Reviews of Modern Physics* details the positive results from over 20 years of experimental research into the question of ether-drift, and remains *the most definitive body of work on the subject of light-beam interferometry*. Other positive ether-detection experiments have been undertaken, such as the work of Sagnac (1913) and Michelson and Gale (1925), documenting the existence in light-speed variations ($c+v > c-v$), but these were not adequately constructed for detection of a larger

cosmological *ether-drift*, of the Earth and Solar System moving through the background of space. Dayton Miller's work on ether-drift was so constructed, however, and yielded *consistently positive results*.

Miller's work, which ran from 1906 through the mid-1930s, most strongly supports the idea of an ether-drift, of the Earth moving through a cosmological medium, with calculations made of the actual direction and magnitude of drift. By 1933, Miller concluded that the Earth was drifting at a speed of 208 km/sec. towards an apex in the Southern Celestial Hemisphere, towards Dorado, the swordfish, right ascension 4 hrs 54 min., declination of $-70^{\circ} 33'$, in the middle of the Great Magellanic Cloud and 7° from the southern pole of the ecliptic. (Miller 1933, p.234)"[8]

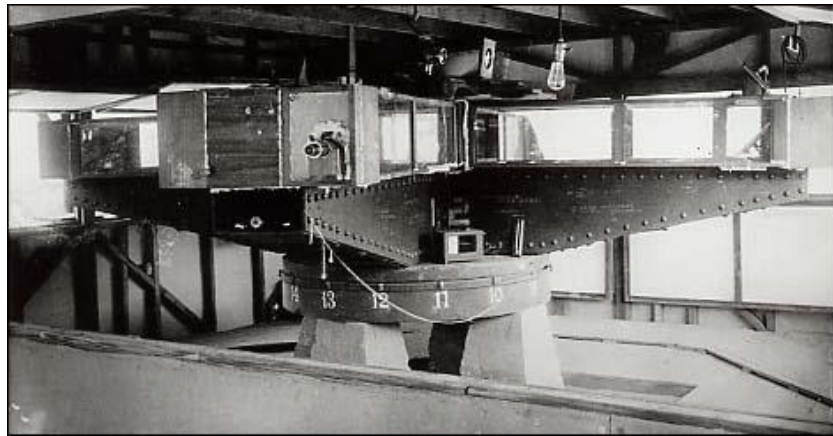


Figure 4. **Dayton Miller's light-beam interferometer**, at 4.3 meters across, was the largest and most sensitive of this type of apparatus ever constructed, with a mirror-reflected round-trip light-beam path of 64 meters. It was used in a definitive set of ether-drift experiments on Mt. Wilson, 1925-1926. Protective insulation is removed in this photograph, and windows were present all around the shelter at the level of the interferometer light-path. [8]

That Dayton Miller's experiment seems quite consistent with other experiments such as Michelson-Morley non-null result, which indicates solar system in motion. [21-22].

g. More proof: *preferred direction and Milky Way moving to The Great Attractor*

Another type of observations seems to suggest that there is preferred direction in the Universe at large scale, and especially that the Milky Way is moving at large speed toward the Great Attractor.[18-20] While this effect may be not detected in the Miller's days, two things are for sure: (a) no general relativity based theories can explain this effect, and (b) it makes Copernican Principle on question. This effect is seemingly consistent with Tifft's finding of rest background frame.[17]

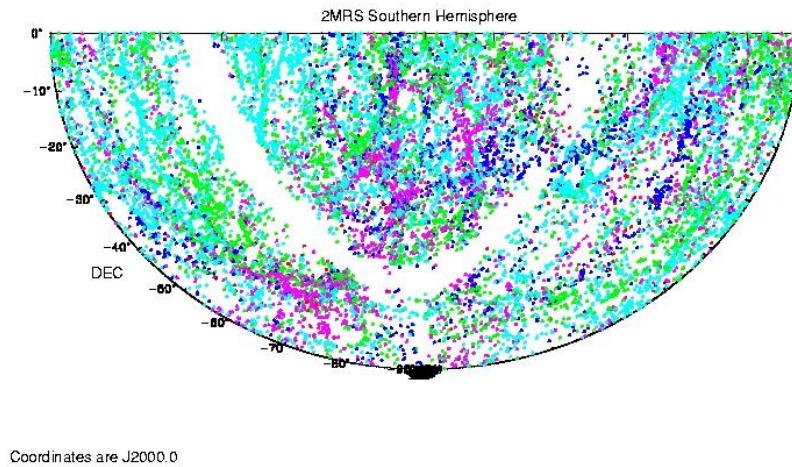


Figure 5. The Great Attractor from Southern Hemisphere

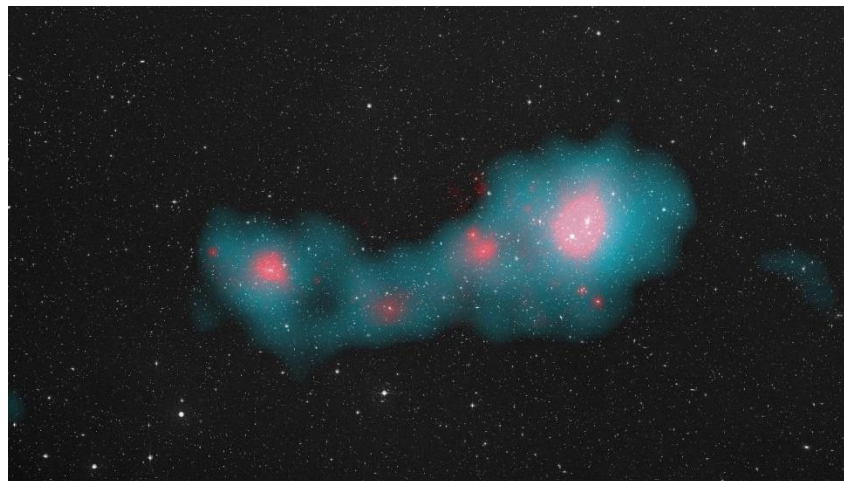


Figure 6. Shapley Supercluster

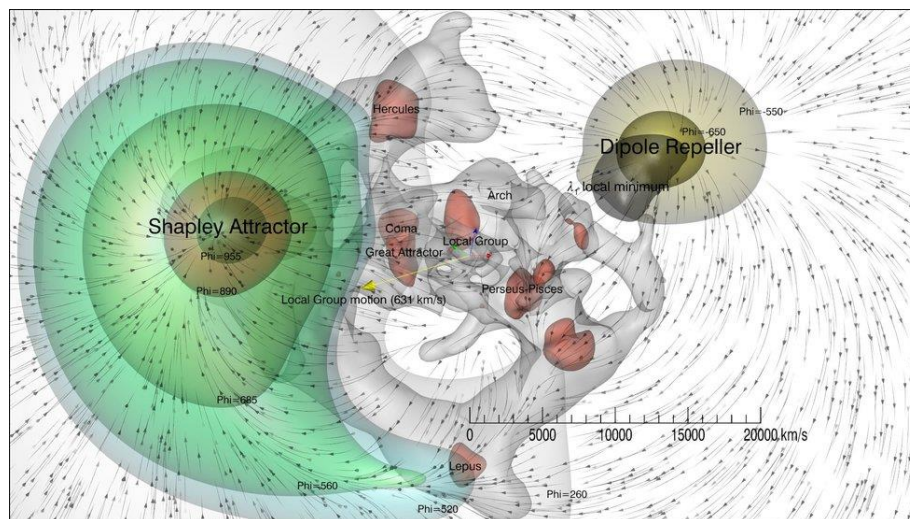


Figure 7. Shapley Supercluster

Conclusions

We begin with Hilbert's axiomatic program to unify electromagnetic and gravitation theory, and we remark that Gödel finding effectively put Hilbert program into ruins. We also mentioned Eddington's observation.

In summary, it is very significant to consider matter creation process in nature. For instance, one can begin by considering the correct presentation of Newton's third law is not $F=ma$, but $F=d(mv)/dt=v(dm/dt) + m(dv/dt)$. In other words, it is possible of matter creation (dm/dt), and this is consistent with Narlikar's work. This seems to be the essence of Le Sage gravity theory.

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