

How Hilbert's attempt to unify gravitation and electromagnetism failed completely, and a plausible resolution

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Abstract

In the present paper, these authors argue on actual reasons why Hilbert's *axiomatic* program to unify gravitation theory and electromagnetism failed completely. An outline of plausible resolution of this problem is given here, based on: a) Gödel's incompleteness theorem, b) Newton's *aether stream* model. And in another paper we will present our calculation of receding Moon from Earth based on such a *matter creation* hypothesis. More experiments and observations are called to verify this new hypothesis, albeit it is inspired from Newton's theory himself.

We hear within ourselves the constant cry: There is the problem, seek the solution. You can find it through *pure thought*. –D. Hilbert, *The Problems of Mathematics*

Introduction

First of all, it is known that 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

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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.

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.

Enter Arthur Eddington

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. So famous is this experiment, and so dramatic was the impact on Einstein himself, that history tends not to recognize the controversy that surrounded the results at the time.[3]

To tell Eddington's role in observation regarding General Relativity, allow us to let Peter Coles spoke for that matter:[3]

“The story of the 1919 expeditions revolves around an astronomer by the name of Arthur Stanley Eddington. His life and work is described by Douglas (1957) and Chandrasekhar (1983). Eddington was born in Cumbria in 1882, but moved with his mother to Somerset in 1884 when his father died. He was brought up as a devout Quaker, a fact that plays an important role in the story of the eclipse expedition. In 1912, aged only 30, he became the Plumian Professor of Astronomy and Experimental Philosophy at the University of Cambridge, the most prestigious astronomy chair in Britain, and two years later he became director of the Cambridge observatories. Eddington had led an expedition to Brazil in 1912 to observe an eclipse, so his credentials made him an ideal candidate to measure the predicted bending of light. Eddington was in England when Einstein presented the general theory of relativity to the Prussian Academy of Sciences in 1915. Since Britain and Germany were at war at that time, there was no direct communication of scientific results between the two countries. But Eddington was fortunate in his friendship with the astronomer Willem De Sitter, later to become one of the founders of modern cosmology, and who was in neutral Holland at the time. De Sitter received copies of Einstein's papers, and wasted no time in passing them onto Eddington in 1916. 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 presented 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. Others, such as Ludwick Silberstein, admonished the audience. Silberstein pointed a finger at the portrait of Newton that hangs in the meeting room, and warned: 'We owe it to that great man to proceed very carefully in modifying or retouching his Law of Gravitation.' On the other hand, the eminent Professor J.J. Thomson, discoverer of the electron and Chair of the meeting, was convinced, stating

“This is the most important result obtained in connection with the theory of gravitation since Newton’s day.”[3]

We present this account of history by relying on Peter Coles’s paper, so readers will notice that perhaps what is displayed at “*Einstein and Eddington*” movie, which was publicly released on several TV channels, was not historically correct at least, or may be just plainly redacted.

Enter Gödel’s incompleteness theorem

Gödel’s groundbreaking 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]

To tell Godel’s monumental result, allow us to quote from Devlin:[4]

“In 1931, a young Austrian mathematician published a paper that sent shock waves through the mathematical community and forced mathematicians to take a fresh look at their discipline. The mathematician was Kurt Gödel, and the result proved in his paper became known as the Gödel Incompleteness Theorem, or more simply Gödel’s Theorem—although it was by no means the only major theorem he proved during his highly successful career. He is also known as one of the

inventors of the theory of recursive functions (which formed part of the foundation for computers).

Both of these major discoveries involved axiomatic systems, and neither can be properly understood without an appreciation of what mathematicians means by the word “axiom” and the role axioms play in mathematics. A misunderstanding of the nature of axioms is what lies behind a significant amount of nonsense that has been written about Gödel’s Theorem over the years.

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 Godel’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.” [4]

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

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

One of us (RNB) has an interpretation of Godel theorem in theoretical and mathematical physics:

“Without observations, experiences, and explorations and experiments, our mathematics and physics start to become non-physical fictions, fantasies, or lies. Physics concepts without physical evidence to support them, do not function well, in the engineering sense.

In the sense of Godel, we can never know everything there is to know, intellectually. But we can **experience** everything, directly. That is the way out of Godel's Law. Then, a new kind of intellect develops, based on direct experiences and observations, in the moment.

Experiential intellect is superior to the analytical intellect, because it is based on the physical facts, the way things actually are, now, rather than abstractions based on the past.

Nature functions based on experiential understandings, not abstractions.

Summarizing: The way out of Godel's Law is Direct Experience, which is keeping the attention only in the senses and sensitivities, without thinking. This is a form of meditation.”

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 (Godel 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]

Another source from Dublin recorded Newton's aether theory from letter published around 1744:

"It gathers all Newton's known queries into the aether. In the 1740s alone, there were at least half a dozen major efforts to explain the behavior of observable bodies by postulating a variety of invisible (and otherwise imperceptible) elastic fluids" (Laudan, *Science and Hypothesis*, 112). But for the most part, 18th c. natural philosophers thought that Newton "had always believed in, and had virtually demonstrated, the existence of an active, spring, non-material aether" (Heilbron, *Elements of Early Modern Physics*, 61). Bryan Robinson's work was one of the half dozen or so 18th century efforts to understand the aether; of those, it was particularly "influential" and had "considerable impact" (Brewer, *Consumption*, 496; Roos, *Natural Philosophy*, 137).

In 1744, a letter from Newton to Robert Boyle was published for the first time [and is reprinted in this volume]. "Although written sixty-five years earlier, it turned out to be of immediate scientific interest. [In it, Newton] describes an aether that lies in all bodies in amounts inversely proportional to their densities. The action of this aether derives primarily from the gradients set up in it across the interfaces between bodies of different densities; for example, the aether just outside the surface of a piece of glass surrounded by air gradually increases from that appropriate to glass to that characteristic of air. When pushing two smooth plates of glass together, one feels a resistance (or repulsion!) from the aether squeezed aside; but once the plates lie flat, the pressure from the circumambient aether holds them firmly together. The aether therefore is the principle both of cohesion and separation; once dissolved in it the particles of vapors 'endeavor to recede as far from one another, as the pressure of the incumbent atmosphere will let them.

"Although...the letter conflicted with much in Newton's public writings, including [his] *Opticks*' aether queries, and although it ended with the usual disclaimer ('I have so little fancy to things of this nature, that, had not your encouragement moved me to it, I should never, I think, have thus far set pen to paper about them'), British natural philosophers took it as evidence that Newton had always believed in, and had virtually demonstrated, the existence of an active, springy, non-material aether.

These were also the inferences drawn by Robinson who, while at Trinity, "taught that Newton's aether operated the nerves and muscles of the body. In 1743 Robinson published a pseudo-mathematical account of the attractive, repulsive, elastic, cohesive and miscellaneous activities of

the aether, most of which violate the laws of motion; and in 1745 he issued [this work] an aetherial chrestomathy [essentially an inclusive gathering of all Newton's queries into the aether] derived from the Opticks, the newly published letter to Boyle, and his own work on muscle action. [Robinson greatly admired Newton, and he tried to account for animal motions by Newton's principles and to apply the latter to the rational treatment of diseases. He attributed the production of muscular power to the vibration of an ethereal fluid pervading the animal body.] All this publicity had an effect, [and beginning with Robinson's 1745 work] all significant British electricians postulated a special electrical matter identical with, or similar to, the springy, subtle, universal Newtonian aether" (ibid).

Bryan Robinson graduated M.D. in 1711 from Trinity College, Dublin, where he later served as an anatomical lecturer and as Regius Professor of Physic from 1745. He was also thrice president of the Kings and Queen's College of Physicians in Ireland and of the Irish Royal College of Surgeons" (Roos, Natural Philosophy, 137). Item #727"[7]

c. Remark on Aether stream by RNB (especially on Yarkovsky's model)

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:

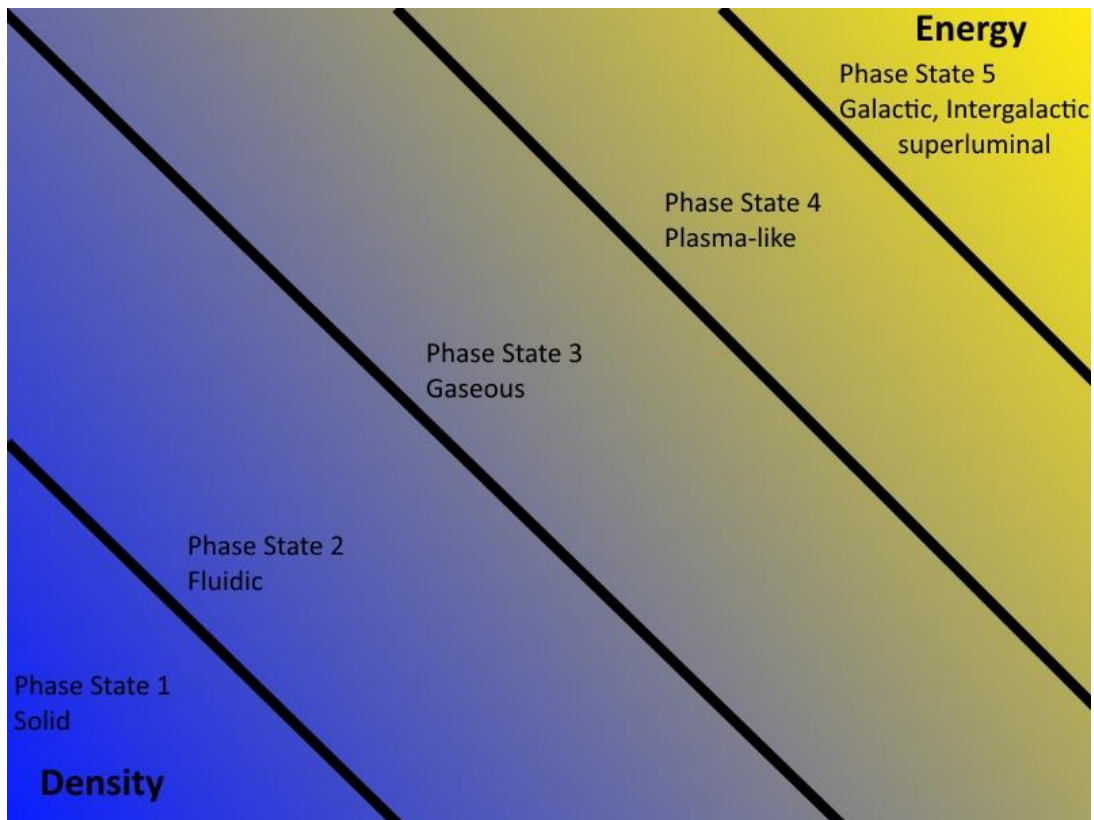


Figure 1. Aether phase states (Mishin), after R.N. Boyd

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.

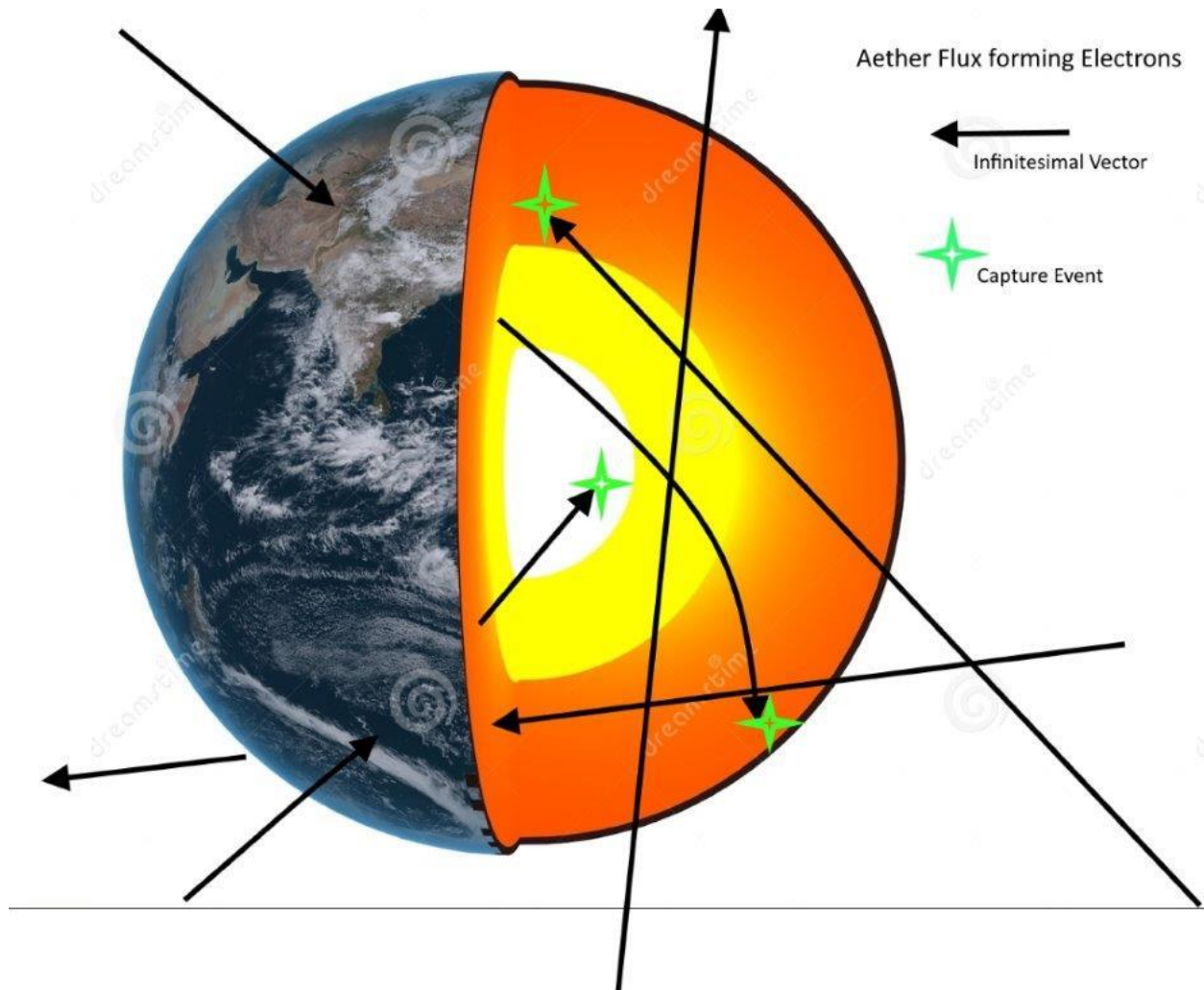


Figure 2. Illustration on how matter creation can take place in inner core of Earth

(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:

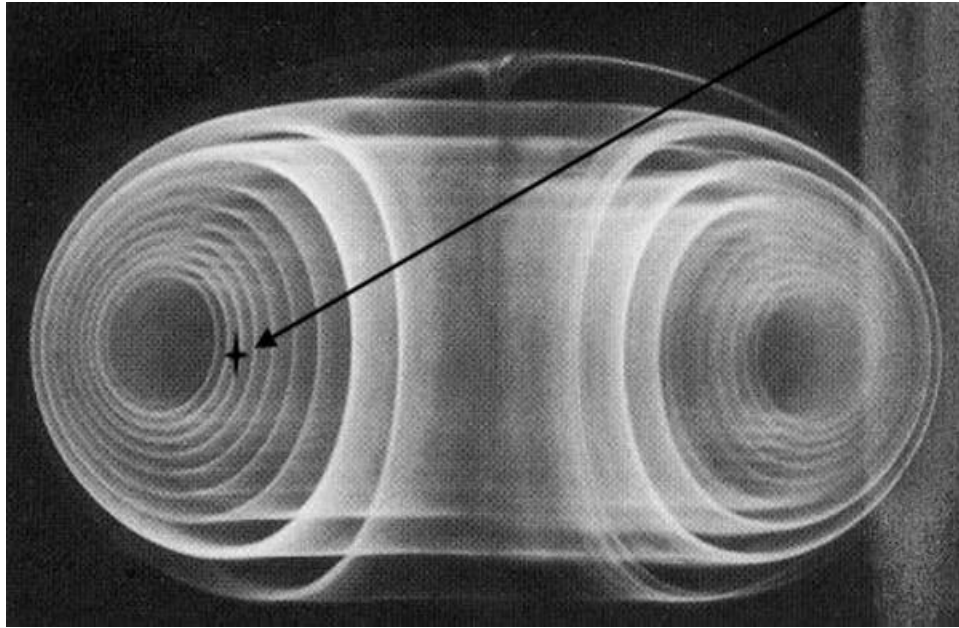


Figure 3. electron vortex capture event – Helmholtz electron vortex is *nearly indestructible* (after R.N. Boyd)

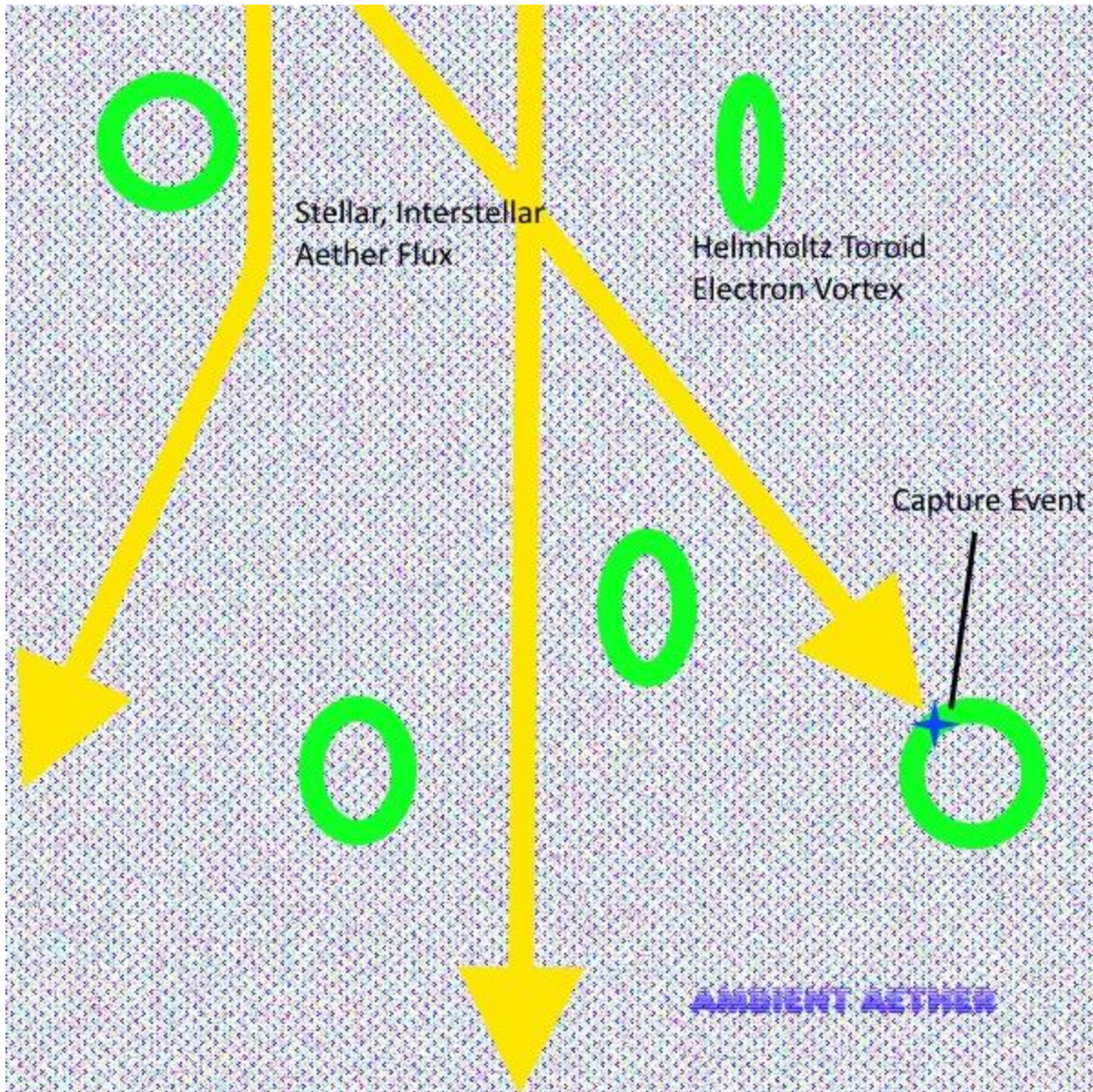


Figure 3a. electron vortex capture event(after R.N. Boyd)

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

$$r = \mathbf{a} \sin \Omega = \mathbf{a} \sin \Omega t,$$

where \mathbf{a} is a constant. The velocity components are

$$dr/dt = \mathbf{a} \Omega \cos \Omega t$$

and

$$r \, d\theta/dt = \mathbf{a} \Omega \sin \Omega t$$

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 \mathbf{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

$$\mathbf{a}/2 = p$$

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.

Moreover, for years, one of us (RNB) developed a novel theory of gravity based on an old theory of Le Sage/Laplace (it is known as Le Sage gravitation theory). An interesting remark on impetus to Le Sage gravitation theory can be found in article by the late Prof. Halton Arp on his work with Narlikar:

“Nevertheless the ball had started rolling down hill so to speak and in 1991, with Narlikar's help, I outlined in Apeiron the way in which particle masses growing with time would account for the array of accumulated extragalactic paradoxes. Later Narlikar and Arp (1993) published in the Astrophysical Journal Narlikar's original, 1977 solution of the basic dynamical equations along with the Apeiron applications to the quasar/galaxy observations.

...

The first insight came when I realized that the Friedmann solution of 1922 was based on the assumption that the masses of elementary particles were always and forever constant, $m = \text{const.}$ He had made an approximation in a differential equation and then solved it. This is an error in mathematical procedure. What Narlikar had done was solve the equations for $m = f(x,t)$. This a more general solution, what Tom Phipps calls a covering theory.

...

But Narlikar had overwhelmed me with the beauty of the variable mass solution by showing how the local dynamics could be recovered by the simple conformal transformation from t time (universal) to what we called τ time (our galaxy) time. The advertisement here was that our solution inherited all the physics triumphs much heralded in general relativity but also accounted for the non-local phenomena like quasar and extragalactic redshifts.”[16]

Summarizing, 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. We will explore this effect in receding Moon from Earth, in calculations to be presented in a sequel paper.

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 (E_1, E_2, E_3) of the electrical field-strength and the components (H_1, H_2, H_3) of the magnetic field-strength all satisfy the standard wave equation: [9]

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

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]:

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

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

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

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]

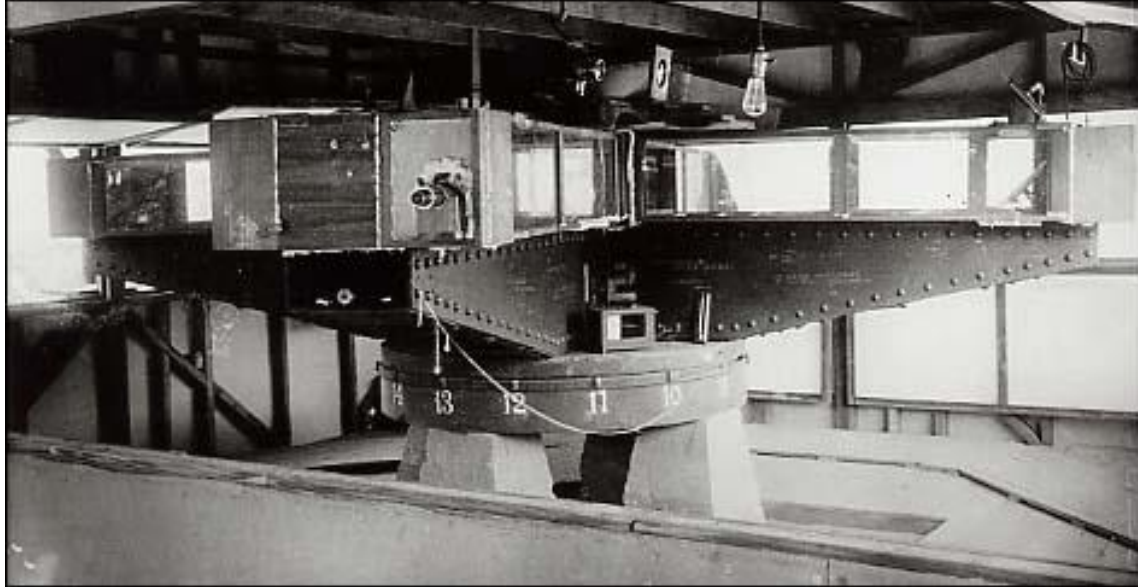


Figure 4. **Dayton Miller's light-beam interferometer**, at 4.3 meters across, was the largest and most sensitive of this type of apparatus ever constructed, with a mirror-reflected round-trip light-beam path of 64 meters. It was used in a definitive set of ether-drift experiments on Mt. Wilson, 1925-1926.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

The followings are quotes from Miller and Einstein as mentioned in DeMeo's article:[8]

"The effect [of ether-drift] has persisted throughout. After considering all the possible sources of error, there always remained a positive effect." — Dayton Miller (1928, p.399)

"My opinion about Miller's experiments is the following. ... Should the positive result be confirmed, then the special theory of relativity and with it the general theory of relativity, in its current form, would be invalid. Experimentum summus iudex. Only the equivalence of inertia and gravitation would remain, however, they would have to lead to a significantly different theory."
— Albert Einstein, in a letter to Edwin E. Slosson, 8 July 1925 (from copy in Hebrew University Archive, Jerusalem.) See citations below for Silberstein 1925 and Einstein 1926.

"I believe that I have really found the relationship between gravitation and electricity, assuming that the Miller experiments are based on a fundamental error. Otherwise, the whole relativity theory collapses like a house of cards."
— Albert Einstein, in a letter to Robert Millikan, June 1921 (in Clark 1971, p.328)

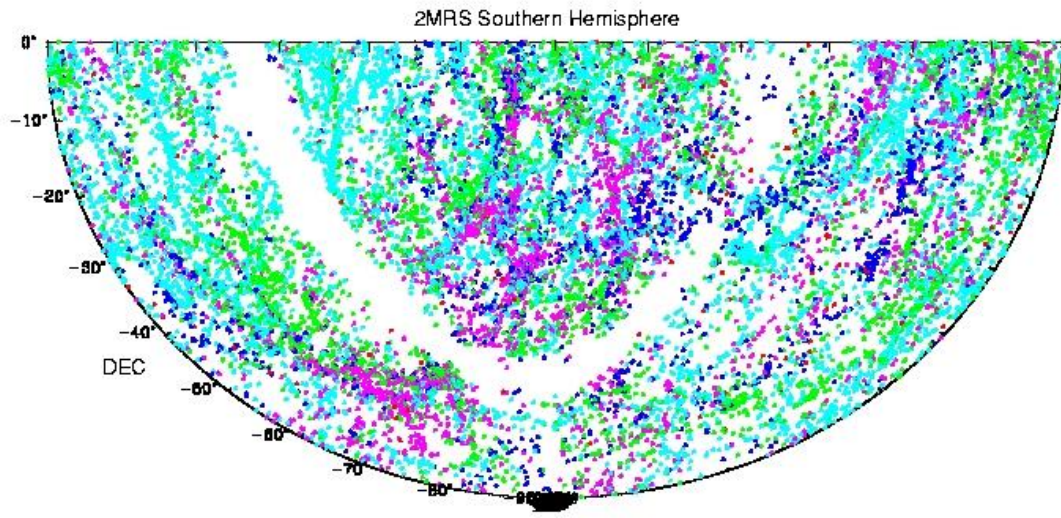
"You imagine that I look back on my life's work with calm satisfaction. But from nearby it looks quite different. There is not a single concept of which I am convinced that it will stand firm, and I feel uncertain whether I am in general on the right track."

— Albert Einstein, on his 70th birthday, in a letter to Maurice Solovine, 28 March 1949 (in B. Hoffman *Albert Einstein: Creator and Rebel* 1972, p.328)

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 Tiff's finding of rest background frame.[17]



Coordinates are J2000.0

Figure 5. The Great Attractor from Southern Hemisphere

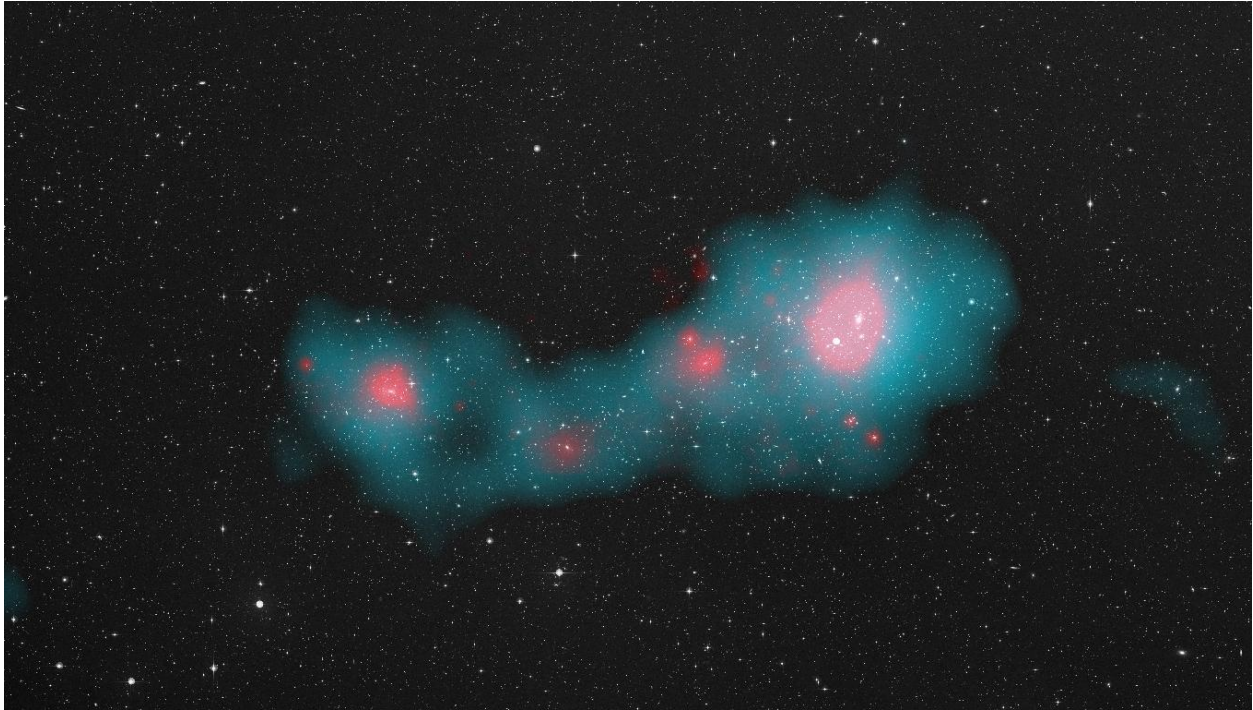


Figure 6. Shapley Supercluster

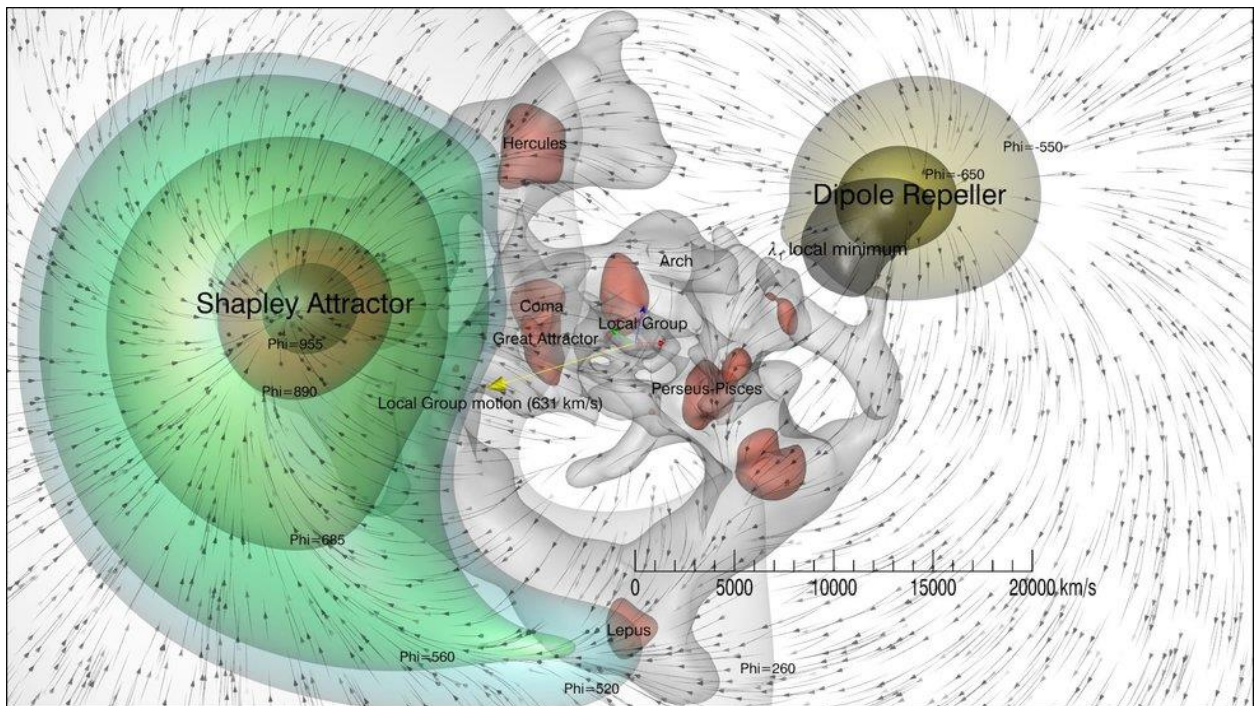


Figure 7. Shapley Supercluster

Concluding remarks

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

We also mentioned Eddington's observation, because this month is centenary celebration of that eclipse observation by Eddington in November 1918.

Summarizing, 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.

We will explore this effect in receding Moon from Earth, in calculations to be presented in a sequel paper.

We are also working out a book on this topic with Dr. Robert Neil Boyd and Dr. Slobodan Nedic, on Laplace model of gravitation and also aetherdynamics theory, so we can expect some new results. The title of the upcoming book is: Going beyond Tesla.

Acknowledgement

One of us (VC) would extend sincere gratitude to Prof. Akira Kanda, Arno Gorgels, Volodymyr Krasnoholovets, and last but not least: to Mr. Scott Adams, the creator of Dilbert comic series. (Dilbert has become an anti-hero for techies and mathematicians like us.) And special thanks to Prof. Thee Houw Liong for suggesting VC to look to J. Narlikar's works.

Lo, this only have I found, that God hath made man upright; but they have sought out many inventions. - Ecclesiastes 7:29

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Version 1.0: 9/11/2018, pk. 7:14

Version 1.1: 10/11/2018, pk. 21:40 (National Heroic Day, and also 100th anniversary of Eddington's observation bending of light during Eclipse)

Version 1.2: 11/11/2018, pk. 21:37

VC, FS, RNB

Appendix

Source: <http://www.newtonproject.ox.ac.uk/view/texts/normalized/NATP00275>

Letter from Newton to Robert Boyle, dated 28 February 1678/9

Author: Isaac Newton

Source: MS Add. 9597/2/18/62-65, Cambridge University Library, Cambridge, UK

Published online: February 2013

Honoured Sir

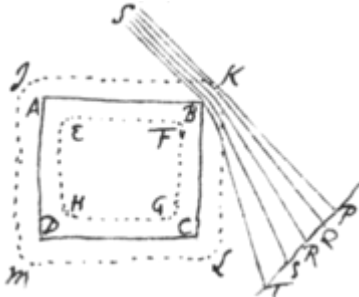
I have so long deferred to send you my thoughts about the Physicall qualities we spake of, that did I not esteem my self obliged by promise I think I should be ashamed to send them at all. The truth is my notions about things of this kind are so indigested that I am not well satisfied my self in them, & what I am not satisfied in I can scarce esteem fit to be communicated to others, especially in natural Philosophy where there is no end of fansying. But because I am indebted to you & yesterday met with a friend M^r Maulyverer, who told me he was going to London & intended to give you the trouble of a visit, I could not forbear to take the opportunity of conveying this to you by him.

It being only an explication of qualities which you desire of me, I shall set down my apprehensions in the form of suppositions as follows. And first I suppose that there is diffused through all places an æthereal substance capable of contraction & dilatation, strongly elastick, & in a word much like air in all respects, but far more subtile.

2 I suppose this æther pervades all gross bodies, but yet so as to stand rarer in their pores than in free spaces, & so much the rarer as their pores are less. And this I suppose (with others) to be the cause why light incident on those bodies is refracted towards the perpendicular; why two well polished metallis cohere in a Receiver exhausted of air: why Quicksilver stands sometimes up to the top of a glass pipe though much higher than 30 inches: & one of the main causes why the parts of all bodies cohere. Also the cause of philtration & of the rising of water in small glass pipes above the surface of the stagnating water they are dipt into: for I suspect the æther may stand rarer not only in the insensible pores of bodies, but even in the very sensible cavities of those pipes. And the same principle may cause Menstruums to pervade with violence the pores

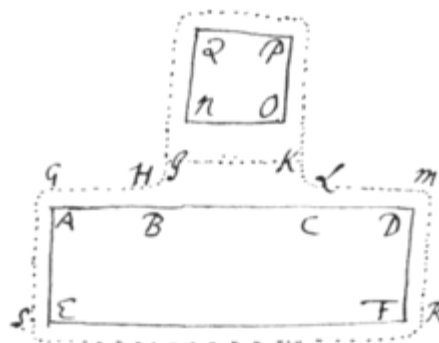
of the bodies they dissolve, the surrounding æther as well as the Atmosphere pressing them together.

3 I suppose the rarer æther within bodies & the denser without them, not to be terminated in a mathematical superficies but to grow gradually into one another: the external æther beginning to grow rarer, & the internal to grow denser at some little distance from the superficies of the body, & running through all intermediate degrees of density in the intermediate spaces. And this may be the cause why light in Grimaldo's experiment passing by the edge of a knife or other opaque body is turned aside & as it were refracted, & by that refraction makes several colours. Let



ABCD be a dense body whether opaque or transparent, EFGH the outside of the uniform æther which is within it, IKLM the inside of the uniform æther which is without it; & conceive the æther which is between EFGH and IKLM to run through all intermediate degrees of density between that of the two uniform æthers on either side. This being supposed, the rays of the sun SB, SK, which pass by the edge of this body between B & K, ought in their passage through the unequally dense æther there, to receive a ply from the denser æther which is on that side towards K, & that the more by how much they pass nearer to the body, & thereby to be scattered through the space PQRST, as by experience they are found to be. Now the space between the limits EFGH & IKLM I shall call the space of the æther's graduated rarity.

4 When two bodies moving towards one another come neare together I suppose the æther between them to grow rarer then before, & the spaces of its graduated rarity to extend further from the superficies of the bodies towards one another, & this by reason that the æther cannot move & play up & down so freely in the strait passage between the bodies as it could before they



came so neare together. Thus if the space of the æther's graduated rarity reach from the body ABCDFE only to the distance GHLMRS when no other body is neare it, yet may it reach farther, as to IK, when another body NOPQ approaches: & as the other body approaches more & more I suppose the æther between them will grow rarer & rarer.

These suppositions I have so described as if I thought the spaces of graduated æther had precise limits, as is exprest at IKLM in the first figure & GMRS in the second: for thus I thought I could better express my self. But really I do not think they have such precise limits but rather decay insensibly, & in so decaying extend to a much greater distance then can easily be beleived or need be supposed.

5 Now from the 4th supposition it follows that when two bodies approaching one another, come so neare together as to make the æther between them begin to rarefy, they will begin to have a reluctance from being brought nearer together, & an endeavour to recede from one another: which reluctance & endeavour will encrease as they come nearer together because thereby they cause the interjacent æther to rarefy more & more. But at length, when they come so neare together that the excess of pressure of the external æther which surrounds the bodies, above that of the rarefied æther which is between them, is so great as to overcome the reluctance which the bodies have from being brought together: then will that excess of pressure drive them with violence together & make them adhere strongly to one another, as was said in the second supposition. For instance in the second Figure when the bodies ED & NP are so neare together, that the spaces of the æthers graduated rarity begin to reach to one another & meet in the line IK; the æther between them will have suffered much rarefaction which rarefaction requires much force that is much pressing of the bodies together: & the endeavour which the æther between them has to return to its former natural state of condensation will cause the bodies to have an endeavour of receding from one another. But on the other hand to counterpoise this endeavour there will not yet be any excess of density of the æther which surrounds the bodies above that of the æther which is between them at the line IK. But if the bodies come nearer together so as <63r> to make the æther in the mid-way-line IK grow rarer then the surrounding æther, there will arise from the excess of density of the surrounding æther a compressure of the bodies towards one another: which when by the nearer approach of the bodies it becomes so great as to overcome the afforesaid endeavour the bodies have to recede from one another, they will then go towards one another & adhere together. And on the contrary if any power force them as under to that distance where the endeavour to recede begins to overcome the endeavour to accede, they will again leap from one another. Now hence I conceive it is chiefly that a fly walks on water without wetting her feet, & consequently without touching the water; that two polished pieces of glass are not without pressure brought to contact, no not though the one be plain, the other a little convex; that the particles of dust cannot by pressing be made to cohere, as they would do if they did but fully touch; that the particles of tinging substances & salts dissolved in water do not of their own accord concrete & fall to the bottom, but diffuse themselves all over the liquor, & expand still more if you ad more liquor to them. Also that the particles of vapors exhalations & air do stand at a distance from one another, & endeavour to recede as far from one another as the pressure of the incumbent atmosphere will let them: for I conceive the confused mass of vapors air & exhalations which we call the Atmosphere to be nothing els but the particles of all sorts of bodies of which the earth consists, separated from one another & kept at a distance by the said principle.

From these principles the actions of Menstruums upon bodies may be thus explained. Suppose any tinging body as Cochineel or Logwood be put into water, so soon as the water sinks into its pores & wets on all sides any particle, which adheres to the body only by the principle in second supposition: it takes of or at least much diminishes the efficacy of that principle to hold the

particle to the body because it makes the æther on all sides the particle to be of a more uniform density then before. And then the particle being shaken of by any little motion, flotes in the water, & with many such others makes a tincture; which tincture will be of some lively colour if the particles be all of the same size & density, otherwise of a dirty one. For the colours of all natural bodies whatever seem to depend on nothing but the various sizes & densities of their particles: as I think you have seen described by me more at large in another paper. If the particles be very small (as are those of salts Vitriols & gumms) they are transparent, & as they are supposed bigger & bigger they put on these colours in order black, white, yellow, red; violet, blew, pale green, yellow, orange, red; purple, blew, green, yellow, orange, red &c: as is discerned by the colours which appear at the several thicknesses of very thin plates of transparent bodies. Whence to know the causes of the changes of colours which are often made by the mixtures of several liquors, it is to be considered how the particles of any tincture may have their size or density altered by the infusion of another liquor.

When any metal is put into common water, the water cannot enter into its pores to act on it & dissolve it. Not that water consists of too gross parts for this purpose, but because it is unsociable to metal. For there is a certain secret principle in nature by which liquors are sociable to some things & unsociable to others. Thus water will not mix with oyle but readily with spirit of wine or with salts. It sinks also into wood which Quicksilver will not, but Quicksilvers sinks into metals, which, as I said, water will not. So Aqua fortis dissolves silver not gold; Aqua regis gold & not silver, &c. But a liquor which is of it self unsociable to a body may by the mixture of a convenient mediator be made sociable. So molten Lead which alone will not mix with copper or with Regulus of Mars, by the addition of Tin is made to mix with either. And water by the mediation of saline spirits <63v> will mix with metal. Now when any metal is put in water impregnated with such spirits, as into Aqua fortis, Aqua Regis, spirit of Vitriol or the like, the particles of the spirits as they in floting in the water, strike on the metal, will by their sociableness enter into its pores & gather round its outside particles, & by advantage of the continual tremor the particles of the metal are in, hitch themselves in by degrees between those particles & the body & loosen them from it, & the water entring into the pores together with the saline spirits, the particles of the metal will be thereby still more loosed, so as by that motion the solution puts them into, to be easily shaken of & made to Rote in the water: the saline particles still encompassing the metallick ones as a coat or shell does a kernell, after the manner expressed



in the annexed figure. In which figure I have made the particles round, though they may be cubical or of any other shape.

If into a solution of metal thus made, be poured a liquor abounding with particles, to which the former saline particles are more sociable then to the particles of the metal, (suppose with particles of salt of Tartar:) then so soon as they strike on one another in the liquor, the saline particles will adhere to those more firmly then to the metalline ones, & by degrees be wrought of from those to enclose these. Suppose A a metalline particle enclosed with saline ones of spirit of

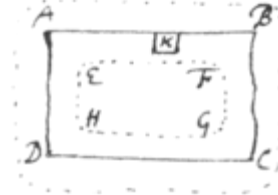


Nitre, & E a particle of salt of Tartar contiguous to two of the particles of spirit of nitre b & c, & suppose the particle E is impelled by any motion towards d so as to roll about the particle c till it touch the particle d: the particle b adhering more firmly to E then to A, will be forced off from A. And by the same means the particle E as it rolls about A will tear of the rest of the saline particles from A, one after another, till it has got them all or almost all about it self. And when the metallic particles are thus divested of the nitrous ones which as a mediator between them & the water held them floating in it: the Alcalizate ones crowding for the room the metallic ones took up before, will press these towards one another & make them come more easily together: so that by the motion they continually have in the water they shall be made to strike on one another, & then by means of the principle in the second supposition they will cohere & grow into clusters, & fall down by their weight to the bottom, which is called precipitation.

In the solution of metals, when a particle is loosing from the body, so soon as it gets to that distance from it where the principle of receding described in the 4th & 5^t suppositions begins to overcome the principle of acceding described in the second supposition: the receding of the particle will be thereby accelerated, so that the particle shall as were with violence leap from the body, & putting the liquor into a brisk agitation, beget & promote that heat we often find to be caused in solutions of Metals. And if any particle happen to leap of thus from the body before it be surrounded with water, or to leap of with that smartness as to get loos from the water: the water by the principle in the 4th & 5^t suppositions, will be kept of from the particle & stand round about it like a spherically hollow arch, not being able to come to a full contact with it any more. And severall of these particles afterwards gathering <64r> into a cluster, so as by the same principle to stand at a distance from one another without any water between them, will compose a bubble. Whence I suppose it is that in brisk solutions there usually happens an ebullition.

This is one way of transmuting gross compact substances into aerial ones. Another way is by heat. For as fast as the motion of heat can shake off the particles of water from the surface of it: those particles by the said principle will Rote up & down in the air at a distance both from one another & from the particles of air, & make that substance we call vapor. Thus I suppose it is when the particles of a body are very small (as I suppose those of water are) so that the action of heat alone may be sufficient to shake them asunder. But if the particles be much larger, they then require the greater force of dissolving Menstruums to separate them, unless by any means the particles can be first broken into smaller ones. For the most fixed bodies, even Gold it self, some have said will become volatile only by breaking their parts smaller. Thus may the volatility & fixedness of bodies depend on the different sizes of their parts.

And on the same difference of size may depend the more or less permanency of aerial substances in their state of rarefaction. To understand this let us suppose ABCD to be a large



piece of any metal, EFGH the limit of the interior uniform æther, & K a part of the metal at the superficies AB. If this part or particle K be so little that it reaches not to the limit EF, its plain that the æther at its center must be less rare then if the particle were greater, for were it greater, its center would be further from the superficies AB, that is, in a place where the æther (by supposition) is rarer. The less the particle K therefore, the denser the æther at its center, because its center comes nearer to the edge AB where the æther is denser then within the limit EFGH. And if the particle were divided from the body & removed to a distance from it where the æther is still denser, the æther within it must proportionally grow denser. If you consider this you may apprehend how by diminishing the particle, the rarity of the æther within it will be diminished, till between the density of the æther without & the density of the æther within it there be little difference, that is till the cause be almost taken away which should keep this & other such particles at a distance from one another. For that cause, explained in the 4th & 5^t suppositions, was the excess of density of the external æther above that of the internal. This may be the reason then why the small particles of vapors easily come together & are reduced back into water unless the heat which keeps them in agitation be so great as to dissipate them as fast as they come together: but the grosser particles of exhalations raised by fermentation keep their aerial form more obstinately, because the æther within them is rarer.

Nor does the size only but the density of the particles also conduce to the permanency of aerial substances. For the excess of density of the æther without such particles above that of the æther within them is still greater. Which has made me sometimes think that the true permanent Air may be of a <64v> metallic original: the particles of no substances being more dense then those of metals. This I think is also favoured by experience for I remember I once read in the Philosophical Transactions how M. Hugen at Paris found that the air made by dissolving salt of Tartar would in two or three days time condense & fall down again, but the air made by dissolving a metal continued without condensing or relenting in the least. If you consider then how by the continual fermentations made in the bowels of the earth there are aerial substances raised out of all kinds of bodies, all which together make the Atmosphere & that of all these the metallic are the most permanent, you will not perhaps think it absurd that the most permanent part of the Atmosphere, which is the true air, should be constituted of these: especially since they are the heaviest of all other & so must subside to the lower parts of the Atmosphere & float upon the surface of the earth, & buoy up the lighter exhalation & vapours to float in greatest plenty above them. Thus I say it ought to be with the metallic exhalations raised in the bowels of the earth by the action of acid menstruums, & thus it is with the true permanent air. For this as in reason it ought to be esteemed the most ponderous part of the Atmosphere because the lowest: so it betrays its ponderosity by making vapors ascend readily in it, by sustaining mists & clouds of snow, & by buoying up gross & ponderous smoke. The air also is the most gross unactive part of the Atmosphere affording living things no nourishment if deprived of the more tender exhalations & spirits that flote in it: & what more unactive & remote from nourishment then metallick bodies.

I shal set down one conjecture more which came into my mind now as I was writing this letter. It is about the cause of gravity. For this end I will suppose æther to consist of parts differing from one another in subtilty by indefinite degrees: That in the pores of bodies there is less of the grosser æther in proportion to the finer then in open spaces, & consequently that in the great body of the earth there is much less of the grosser æther in proportion to the finer then in the regions of the air: & that yet the grosser æther in the Air affects the upper regions of the earth & the finer æther in the earth the lower regions of the air, in such a manner that from the top of the air to the surface of the earth & again from the surface of the earth to the center thereof the æther is insensibly finer & finer. Imagin now any body suspended in the air or lying on the earth: & the æther being by the Hypothesis grosser in the pores which are in the upper parts of the body then in those which are in its lower parts, & that grosser æther being less apt to be lodged in those pores then the finer æther below, it will endeavour to get out & give way to the finer æther below, which cannot be without the bodies descending to make room above for it to go out into.

From this supposed gradual subtilty of the parts of æther some things above might be further illustrated & made more intelligible, but by what has been said you will easily discern whether in these conjectures there be any degree of probability, which is all I aim <65r> at. For my own part I have {so} little fancy to things of this nature that had not your encouragement moved me to it, I should never I think have thus far set pen to paper about them. What's amiss therefore I hope you will the more easily pardon in

Your most humble Servant & honourer

Is. Newton.

Cambridge Feb 28.
1678/9

<65v>

Philosophical Tract from M^r Isaac Newton. Cambridge. Feb. 28. 1678/9.