Can a non-obvious literal interpretation of the superposition principle explain how mass affects spacetime and lead to improved airplane safety?

Project Description

1. Introduction

This project seeks to answer questions about the fundamentals of physics that apparently may never have been conceptualized or documented. In the practice of patent law, a lack of something to cite is used as evidence of novelty and non-obviousness, two requirements that every patent must meet to be granted.

In the nineteenth century, it was assumed that for starlight to reach us, there must be a luminiferous aether acting as a medium for the transmission of this light. The famous Michelson-Morley experiment [1] was an attempt to determine how fast the earth is travelling through this supposed aether. It failed to detect any motion at all.

Even prior to this, classical field theory was well established explanation of electrical and magnetic fields. However, at this time not enough was known about particles to ask the right questions about how the particles related to the fields. The particles had not been discovered yet.

As a result, some experiments have never been performed. The technology for these experiments may have been out of reach at the time, but now they should be relatively simple and inexpensive. Depending on the outcome, they may change our understanding of what fundamental electric charges really are, how they really interact, and whether the vector fields **E**, **M**, and **G** are physical things in nature or just net forces that hide their various components that make them up. If this project obtains a positive result, it will also suggest new and non-obvious models of electric, magnetic and gravitational forces. The mathematics that currently describe these forces is not expected to change. We would just get a deeper understanding of nature and a few new ways to approach longstanding problems.

The proposed new theory shall be called fieldlet theory. It appears to be *almost* functionally equivalent to existing theory. *Almost* is the key word here because if it were fully functionally equivalent, then there could be no experiment to distinguish the theories. Because they are *almost* functionally equivalent, it is believed possible to contrive of unusual circumstance in which they can be distinguished. A positive result would mean that in these contrived circumstances the math should be applied a little differently.

It is difficult to construct a device that may show the difference. Several optical components have to be modified versions of what is available or have to be fabricated from scratch. These hurdles arise merely because there is no current market for such custom components. A positive result would likely create a market for new components that would be also be more sensitive and less costly than the prototypes.

A practical benefit of a positive result is that it will be possible to greatly improve the safety of airplanes by providing a sensor that reports the airplane's velocity relative to the surface of the earth. The most expensive airplane crash in history, a $1.4 billion loss of a B2 bomber with no fatalities [2], was exactly the type of thing such a velocimeter could have prevented. Its dozens of redundant sensors in its wings could not agree on what they were sensing, causing the airplane to override the pilot's commands. Currently, even modern airplanes have a difficult time computing their velocity in a reliable way. External signals, GPS, pitot tubes, and wing pressure sensors are not fully reliable. The trend is that newer airplanes are being programmed to be even more dependent on sensors and either fly autonomously or even override the pilot when dangers are sensed. This mean absolute sensor trustworthiness is becoming a more critical issue but there are no other solutions in sight. It is an objective of this project to not only advance understanding of science but also to make a practical contribution in aircraft safety.

2. Questions that have not been asked

The classical vector field theory predates the discovery of the electron, the proton and the neutron. It was believed, taught or implied then and to this day that these fields exist. Their presence and state can be convincingly measured.

It was and is taught by implication and mathematics that the positive and negative charges of an atom offset each other, such that at a distance, an atom is typically treated as being electrically neutral.

It was also taught that the state of the vector field **E** at any point in space can be found by considering every charge in the system as if it were alone, and calculating its effect at that point in space according to Coulomb's law, and summing these results by vector addition. This is the static electrical principle of superposition. Such vector sums for all points in space define the classical vector field **E**. Fig. 1 presents a typical drawing of how two charges influence this vector field **E**.

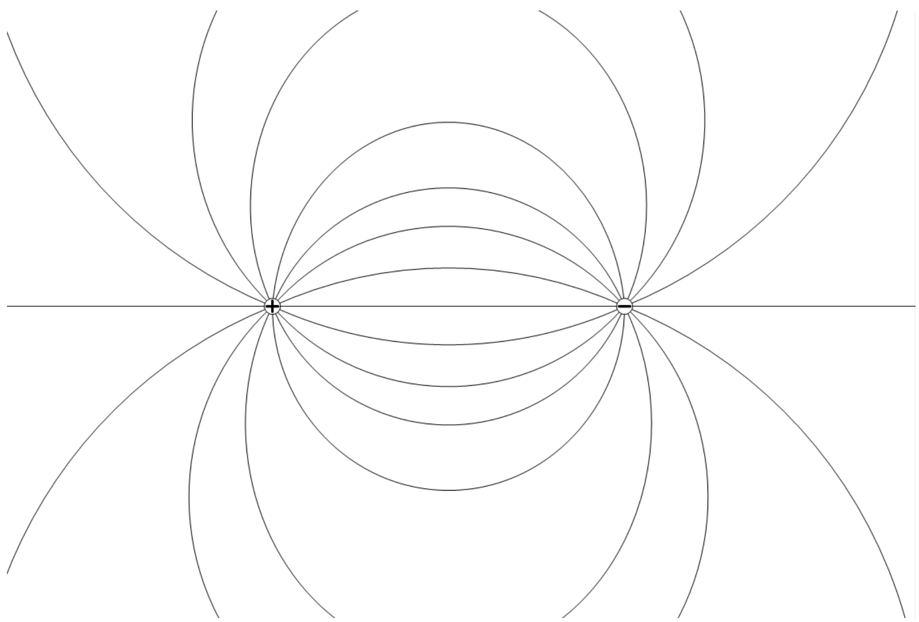

Fig. 1. The classical vector field as typically shown for a positive and negative charge. The lines represent the state of the field in locations even in a vacuum where there is no particle. The lines, and the state of the field, are controlled by all charges in the system. Sometime the lines have arrows from plus to minus.

But good mathematical formulas mirror something happening in nature. What if nature has nothing that corresponds to this vector addition in empty space? There does not seem to be any compelling evidence one way or the other.

Likewise, what if the electrical influence of every charge in the system really does reach every point in space in full force substantially according to Coulomb's law as if the other charges did not exist? What if nature's version of vector addition only happens upon charges? In summary, what if the principle of superposition works mathematically because it is telling us what really happens in nature, but we should not be assuming that it happens in empty space prior to a charge being there?

In other words, what if this principle is literally true as applied to charges because charges must respond to all of the Coulomb effects upon them but have only one acceleration with which to respond? The winning acceleration would naturally be the vector sum.

As to empty space, what if this principle should not be applied in empty space for lack of something that will add up or summarize all the various effects at play?

These questions cannot be answered by probing empty space. A probe would have to be made of particles and that would immediately mean that empty space is not what is being tested.

The answers to these questions appear to have been assumed and never really questioned. The assumed answer is that there is a classical electrical field **E** which has as a central characteristic the idea that opposing electrical fields annihilate each other to the extent they can and leave behind only a net field. Because it is an assumption it is unlikely that it has ever been stated quite this way.

These questions could use some rigorous thought and investigation. This is the purpose of this proposal.

In the practice of patent law, it is not uncommon for an inventor to have found something that could have been discovered long ago but no one else did. It is not out of neglect the inventions and discoveries remain hidden. We cannot live without assumptions that simplify our world. It is because of non-obviousness that these things remain hidden.

3. An Answer: A literal interpretation of the principle of superposition

A literal interpretation of the principle of superposition leads to a vastly different model of what fundamental electrical charges are and how they influence one another. Fortunately, it also leads to a way the theory can be tested, without having to probe empty space.

First, it means that every fundamental charge (whether lepton or quark) has a direct action upon every other fundamental charge without any intermediate classical vector field playing any role.

Second, it means that this direct action of charge A on charge B is not influenced by other charges in the system, regardless of their location. An important consequence of this is that this direct action cannot be blocked or shielded.

Third, it means that a charge feels the direct action of all other charges in the system. This includes attractive and repulsive forces from many directions and distances. The charge needs to respond to them all. Being fundamental, it cannot be destroyed or split, so it has only one acceleration with which to respond. All this pushing and pulling will result in a winning acceleration, which will be the vector sum of all the direct actions that it feels. This is how and why nature computes the vector sum. The charge thus plays an indispensable role in nature's computation of this vector sum.

3.1 Fieldlet theory

This interpretation of the principle of superposition requires that every fundamental electrical charge (leptons and quarks) casts its influence into the universe independently substantially according to Coulomb's law. This concept of a charge's independent influence will be called a fieldlet. In fieldlet theory, the principle of superposition requires that fieldlets can overlap each other without losing their identity, as shown in Fig. 2. A fieldlet can be thought of being as owned by its charge, or perhaps a fieldlet is just an extension of what the charge is.

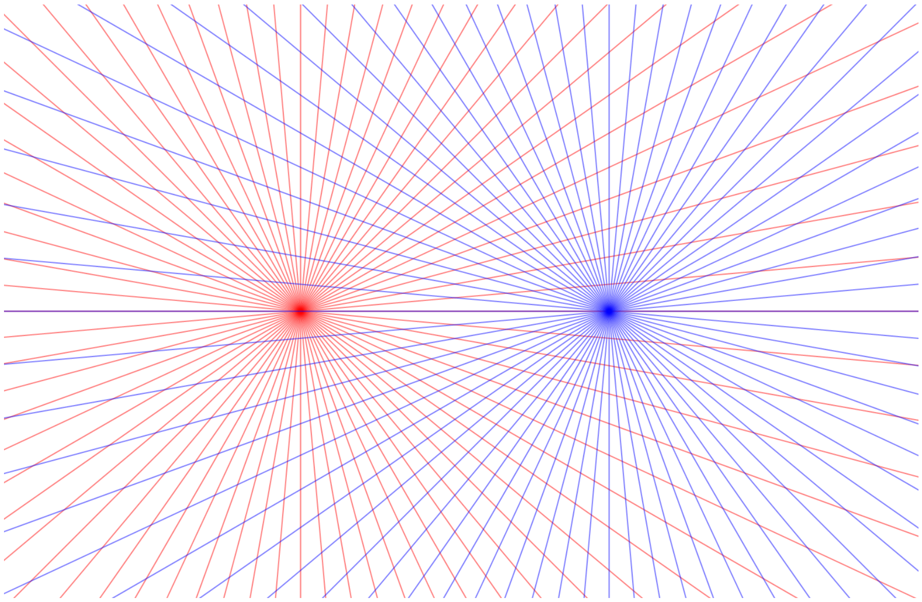

Fig. 2. A schematic cross section of a positron (red) on the left and an electron (blue) on the right, each casting its fieldlet into the Universe without regard to the presence of the other. Lines that are closer together represent stronger field strength according to Coulomb Law, but this strength depiction is not to scale.

Fieldlets are either positive or negative, always matching the charge from which they came. It must also be the case that they come in certain quantized intensities according to the charge from which they came. For ordinary matter this would typically be -1e, +2/3 e, and -1/3 e, as shown in Fig. 3.

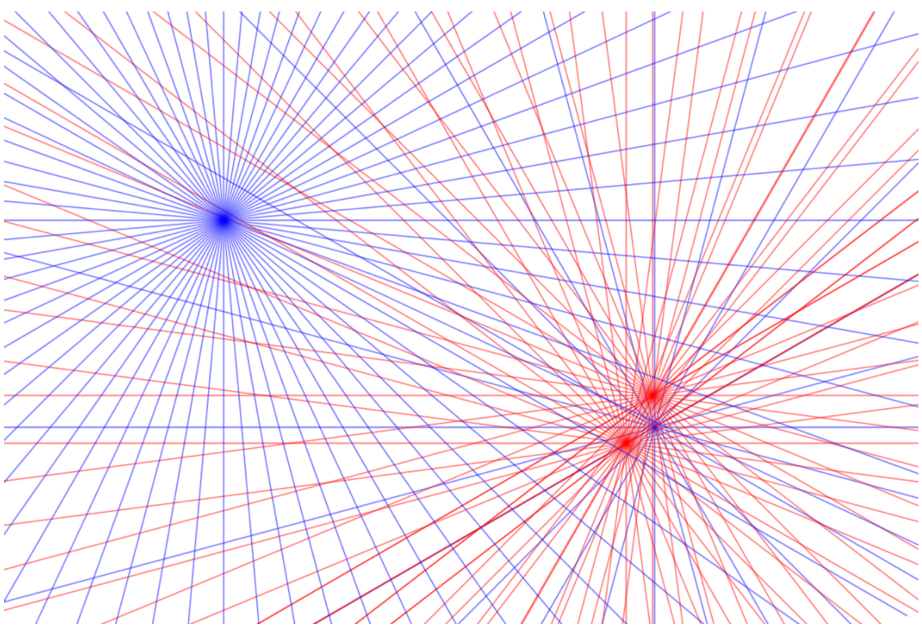

Fig. 3. A schematic cross section of an electron (blue) on the left and two up quarks (red) and a down quark (blue) on the right. The number of lines depicting each particle is proportional to the particle's absolute value charge.

Fig. 3 shows the three quarks of a proton. The absolute value sum of the charges is 5/3 e and that corresponds to the total fieldlet strength of the proton. The net charge of a neutron is zero, but according to fieldlet theory even neutrons cast their fieldlet into the Universe. The total fieldlet strength of the neutron's two down quarks and one up quark is 4/3 e.

3.2 Statics and dynamics of fieldlets

Every charge intersects an innumerable number of foreign fieldlets of both signs. If the vector sum of those intersected fieldlets is zero, then the charge is not accelerating because of electrostatic forces. It is at rest in its own frame of reference, even though it may have a velocity in another frame of reference. If the vector sum becomes non-zero, then the charge will accelerate according to the new vector sum.

When a charge accelerates, its own fieldlet needs to accelerate also but cannot do so all at once. The acceleration of the particle cannot be communicated to the entire fieldlet instantaneously because (at a minimum) such communication cannot exceed the speed of light. Charge acceleration must therefore cause a distortion in the shape, concentration, or intensity of the charge's own fieldlet. Proximate to the charge itself, at some fuzzy or sharp boundary of tiny dimensions, its fieldlet would have to be slightly concentrated in the direction of acceleration and slightly rarified in the opposite direction. This momentary fieldlet distortion may have certain consequences.

A first consequence is that the distortion must propagate through the fieldlet, creating a ripple that flies away from the charge in all directions. It may be that this speed of propagation is analogous to stiffness in solids and plays a role in determining the speed of light in a vacuum. Thus, lacking better evidence, it will be assumed herein that these distortions fly off at c.

Another consequence is that every particle's fieldlet is full of ripples flying out, the fieldlet in its entirety constitutes a history of the location, velocity and acceleration of the particle. While such a history would be difficult to tap into, it may have theoretical implications in that it is a preservation of information.

A more practical consequence of these fieldlet distortions flying off is that other particles that intersect the fieldlet would only be aware of the first particle's position and velocity as they were x/c seconds prior. This delay is bidirectional, so each particle see's the other particle's past.

Another possible consequence is that such acceleration may be resisted by the particle. At the point where the particle is transitioning to fieldlet, it may yet be close enough to be more repelled by a concentration of its own charge in its own fieldlet, and on the other side, less repelled by the rarefication of its own charge in its own fieldlet. This reaction to acceleration would have the appearance of inertia, and may have some commonalities with physicist Max Abraham's 1903 explanation of the inertia of the electron. The fact that the amount of inertia is not proportional to the net charge or even the absolute value sum of the charges in a particle does not negate this possibility, because we do not know enough about whether the electrons and quarks behave differently in this regard and we do not know anything about the potential contribution of sea quarks.

When fieldlets move against an intersecting charge, it could be said to create a fieldlet wind. Most of the time, this fieldlet wind would be balanced in charge because it arises from a neutral mass that is moving. However, an imbalanced fieldlet wind is also possible for such things as electric currents. In this case, it is proposed that an imbalanced fieldlet wind is another way to describe magnetism.

3.3 Intensity of overlapping fieldlets

Because fieldlets overlap in a way that can counteract their net electrical effect without compromising their presence, the seemingly empty space near a large mass would actually be a place of great cumulative intensity of overlapping fieldlets. An electron at the surface of the earth would have an individual relationship with every other charge of the planet, experiencing both intense repulsion from all the negative charges and almost perfectly matched attraction from all the positive charges of the planet.

Between planets and starts, the supposedly empty space is actually alive with the overlapping opposing fieldlets of all the matter in the Universe. The cumulative intensity of these overlapping fieldlets varies from point to point, and will be greatest near (and inside) celestial objects. It is proposed that the intensity of opposing fieldlets is related to, possibly in a causative way, to what Einstein called the spacetime-ether in 1919-20. Einstein is well known for having dealt the final blow to the old idea of a luminiferous aether, by showing that special relativity and general relativity work without it. However, after that was completed, he openly regretted that it had become impossible for scientists to discuss an ether [3]. In and around 1919-20, realizing that spacetime means that even empty space has properties that vary from place to place, he started referring to it as the spacetime-ether [3]. However, this terminology did not catch on.

3.4 Rotation of fieldlets with the earth

An object that is rotating with the earth will view almost all of the particles of the earth as always being in their same relative position. So, in the sense of relative origin, the fieldlets don't seem to be moving but are rock-solid steady. Also, the proximate fieldlets would have much stronger influence than distal fieldlets.

However, there is no reason to believe that the rotation of the earth means that its fieldlets are rotating in their own right. If so, even a slight rotation would mean that at some distance the distal parts of a fieldlet would exceed the speed of light. It is more reasonable to suppose that the fieldlets themselves are non-rotating and that the rotation of the earth merely means that the fieldlets are rotating around each other like a carousel.

At a significant distance from the earth, the difference between the effects of the earth's proximate fieldlets and distal fieldlets would be greatly reduced. For example, the Moon is about thirty earth-diameters from the earth and not in geosynchronous orbit. Therefore, it would be experiencing some fieldlet wind from the proximate side of the earth and some fieldlet wind in the opposite direction from the distal side of the earth. Because the difference in distance between the proximate side and distal sides is only 3.3%, the fieldlet winds mostly cancel out. In addition to that, there would be less wind from the interior of the earth, down to zero wind from the center. This also applies to other celestial objects that rotate.

3.5 Fieldlets have consequences

A natural medium for light. A consequence of this aggregate soup of fieldlets is that, being entirely electrical in nature, it could be the natural medium for the propagation of light and other electromagnetic waves. For fieldlets to propagate ripples or waves, there would have to be some kind of flexibility and stiffness. This requirement is close to what has already been discussed regarding what happens to a fieldlet when its charge accelerates, which is that the distortion in the fieldlet flies off in an ever-expanding spherical shell.

How starlight reaches us. The observation that starlight could reach the earth was one of main reasons for the assumption that there must be a luminiferous aether through which the earth was travelling. According to Coulomb's law, the electrical effect of charges theoretically extends to infinity. The application of this concept to only the net charge of matter implicitly limited the effect of the electrical force to little or nothing. In contrast, fieldlet theory asserts that this Coulomb effect extends out to infinity in full force from all matter, since even neutral atoms and neutrons contain charges that have fieldlets. Therefore, with every celestial body contributing fieldlets to the entire universe, there is a new explanation for how light can be transmitted great distances and yet each celestial body sees itself at rest within this medium.

Fieldlet ripple extinction. However, the speed of light is independent of its source. This observation suggests that the fieldlets may have some influence on each other such that ripples travelling on individual fieldlets can eventually be transferred to be carried by the aggregate soup. This transfer will be referred to herein as fieldlet ripple extinction. It would suggest one way the speed of light can be independent of its source. (Another way is via the effect of intervening matter such as air or even the measurement equipment itself.) It also suggests that it may take some unknown distance to happen, and that perhaps that distance depends on the thickness or intensity of the fieldlet soup. Experiments on this are far beyond the scope of this proposal.

Time dilation and the bending of light. The observations of gravitational lensing and time dilation are consistent with fieldlet theory, if extremely high cumulative intensely of field strengths in overlapping fieldlets has the effect of bogging down (slowing) light and motion, respectively. Light traveling though an extended transverse gradient of cumulative overlapping fieldlet strength would curve to the side that slows it down, just like a ball rolling along the side of a hill would tend to curve downhill.

3.6 Summary of fieldlet theory

Thus, fieldlet theory is possibly an explanation what Einstein's spacetime, or spacetime-ether, actually is. It may provide insight into what it is about matter that causes the perceived bending of spacetime elsewhere in empty space.

It also suggests that the with the proper experiment, it may be possible to determine how fast one is travelling through this fieldlet soup. Experiments of this type have consistently produced null results because they were conducted at a stationary point on the earth's surface and were counting on the earth to be the vehicle moving through space. Fieldlet theory suggests that non-null results are possible only if those experiments are moving relative to the surface of the earth. So now it is time to find a way detect the ground velocity of an automobile or airplane.

4.0 Experiments

4.1 Fieldlet theory is falsifiable

Fieldlet theory is not perfectly functionally equivalent to relativity because it proposes a medium for light that rotates with the surface of the earth. A consequence of this medium is that the speed of light is isotropic in the rotating frame of the earth. Furthermore, it predicts anisotropy of the speed of light for an experiment that is moving relative to the surface of the earth.

4.2 An updated mobile experiment

Many of the experiments testing relativity were performed in a laboratory that was in a building that was also rotating perfectly with the surface of the earth. Such experiments would not be able to distinguish between relativity and fieldlet theory. This includes the Michelson-Morley experiment and its many follow-up experiments.

If an experiment is moving relative to the earth's surface and relies upon a round-trip of a light, then it too would be incapable of detecting any anisotropy of the speed of light in a frame that is moving relative to the surface of the earth. Whatever gain or loss accrues in the first direction is lost in the return trip.

Tests of the one-way speed of light cannot be performed because it is impossible to determine the time required for light to travel in one direction when the timing signal is also subject to the same speed of light. Attempting to synchronize clocks to the required accuracy are also deemed theoretically impossible.

Thus, what is needed to detect anisotropy of the speed of light is an experiment that is in some ways similar to the Michelson-Morley experiment, but is both mobile across the surface of the earth and sensitive enough to detect normal vehicle speeds.

It is therefore proposed that Fresnel-Fizaeu dragging can be used create a velocity-dependent disparity between two beams that originate from the same laser. The use of a very high-index medium is preferred for two reasons: maximizing the effect and also to make the experiment more compact. Compactness also helps with both portability and stability. Stability is expected to be one of the greatest challenges in a mobile environment.

A Mach-Zehnder interferometer allows the high-index material in one arm of the split laser beam. Several of these were informally tested an optical breadboard, along with many solid-state lasers.

After the one arm of the split laser beam is run through the high-index material and the other arm is run past it though air, they can either be combined to form an interference pattern right there, or they can be swapped and sent back the laser end of the device. The advantage of switching them is that it may double the dragging effect of the glass. One arm of the laser will be moving with the direction of the vehicle while in the dragging material. When the other arm gets its turn, it is moving against the direction of the vehicle. This lets both of them have one pass through the dragging material.

In theory, this could be continued many times. However, each pass also causes many reflections and affects the apparent stability, so it is not easy to do.

Sometimes it is taught that obtaining interference requires that the two path lengths are exactly identical. This is true of lasers with short coherence lengths, or with incoherent light. However, when using a laser that has sufficient coherence length (such as a meter or more), the two paths can be quite different. Interference is easy to find (even automatic) so long as the beams are combined so that they are colinear and perfectly parallel. Even a tiny offset in parallelism is visible as many fringe lines. Too many fringe lines cause them to be invisible, but a beam expander can make them visible again.

4.3 Work done by others

The devices described appeared to be patentable subject matter, so a patent search was conducted. Among the search results, two items stood out as being exceptionally relevant:

1. US Pat. No. 6,813,006 to Professor Ruyong Wang et al for a "Stand-alone speedometer directly measuring the translational speed based on the difference between dispersive dragging effects of different media." [4]

2. US Pat. No. 9,983,005 to Marvin A. Biren for an "Optical accelerometer."[5]

Both of these patents contain the same major structural elements as the interferometers that are described above and that are the subject of this proposal. These two patents also overlap each other in the structure of the devices that they teach and claim. However, inventors Wang and Biren have a fundamental disagreement over what the common structure does. Wang says it is a velocimeter and Biren says it is an accelerometer.

The Wang patent discusses the theory behind why their device is a velocimeter and how sensitive it is. This explanation makes reference to a previous paper [6] that was included by reference in their patent, in which they have experimentally confirmed that there is a preferred frame for the propagation of light.

The preferred reference frame that they detected is in agreement with fieldlet theory, but these patents and the paper documents say nothing about the electric fields of particles causing the preferred reference frame. Their work is based on the phenomena of the linear Sagnac effect and dispersive dragging.

The Wang experiment described in their paper [6] involved moving optical fiber along with a light source and detector back and forth inside a stationary lab. They wrote that a "time-travel difference of two counter-propagating light beams has been observed in a uniformly and translationally moving fiber." They said this effect is independent of the index of refraction.

Their patented invention is structured differently, and includes "different media" having different "dispersive dragging effects" It is not fully clear whether they mean differences in index of refraction or in the rate of change of the index of refraction with wavelength. What is clear is that Wang predicts mathematically that a device with one optical path of 1 meter through SF56A glass and the other optical path through air or vacuum, when traveling at 40 m/s, would have a fringe shift of 0.107 of λ=0.532 um (green) laser light.

In contrast, the Biren [5] patent describes and claims essentially the same structure as Wang [4], and even mentions the Wang patent with the comment: "However, Wang's description of his device as a 'velocimeter' is believed to be incorrect, as his device is not sensitive to velocity. Instead, Wang's device is sensitive to acceleration, i.e., change in velocity between successive inertial velocity states." He provides no evidence other than his opinion.

In US patent law, it is not necessary to actually have built an invention to obtain a patent for it. Thus, many patents are for things that have never been tested, and it appears that these have not been built or tested either. Otherwise, at least one of them would have said so and there would not be a disagreement over what it does.

Thus, another aspect of the current proposed project is to determine which of these inventors views their invention correctly.

The Wang patent does seem better-reasoned. It was based on previous related experiments that claimed to already discover a preferred reference frame for light, which reference frame is stationary in the lab. This outcome is consistent with the Michelson-Morley experiments and goes beyond those experiments to get positive results with some motion. However, the uniform motion they measured was oscillatory in a lab, so it had to include acceleration to change direction. It would have been helpful for the paper to have pointed out how they separated the "uniform motion" from the acceleration to assure the reader that they are interpreting the results correctly.

The exclusive rights protected by these patents are not expected to be a problem because the Wang patent has expired and the Biren patent is for an accelerometer, which is not what is expected to be built. In addition, in order for a patent to be valid it must contain an enabling disclosure. In other words, it must teach someone of reasonable skill in the art how to build and use the invention without undue experimentation. The weakest part of both patents is that when one of the simpler embodiments is built as shown it does not get an interference pattern, which means that in that state it cannot be used to detect velocity or acceleration. It has taken considerable experimentation to actually build one that shows an interference pattern, and getting to that point required additional elements and their proper adjustments. The location and adjustments of these elements would have been trivial to include in the patent specifications if they had been known to the patentees. The absence of these elements in the patent specifications means there is at least an argument that these patents do not meet the enablement requirement and are therefore unenforceable, even if not expired.

Another way of looking at Wang's work, both experiments and the text, is that it should be possible to build a velocimeter even according to well-established theory. This means there is a conflict within well-established theory. Wang does not discuss this, not offer any explanation. Fieldlet theory offers an explanation.

4.4 Work completed by applicant

So far, several attempts have been made to create such an interferometer. All of these were done in spare time and funded at hobbyist levels.

All of them were attempts to implement the same basic structure of starting with a solid state laser diode with enough stability and coherence length to be useful in an interferometer. The beam was split and reflected so that both beams were essentially parallel. One traveled through the test material and the other traveled though air. At the distal end, they were reflected back such that they change mediums as well. The beam that had initially gone through the glass was sent back through air. The beam that started out in air was reflected back through the glass. Upon arriving back on the initial end of the material, the beams were combined to produce an interference pattern.

The first interferometer used acrylic as the optical medium. Acrylic was chosen for several reasons: It is affordable, machinable, stiff when thick enough, and it dampens vibrations. In spite of the advantages of acrylic it was too difficult to obtain a reliable interference pattern. The problem was that the optical path length ran transversely through the acrylic, orthogonal to the direction of light for which it was intended. The piece in question did not have sufficient uniformity of refractive index to be useful for a transverse beam of light.

The interferometer was sensitive enough to be disturbed by air blowing across a beam of light. The part that worked best is shown in Fig. 4. Two parallel channels were carved out of the acrylic to provide an path for the laser beams to travel though air while being protected from wind.

A second interferometer was another attempt at using acrylic as the optical medium. Nine blocks of nearly 2-inch-thick acrylic for windows were stacked. The many surfaces the laser had to pass through caused an unacceptable amount of reflections and distortion.

A third interferometer used nine blocks of K9 glass that were sold as laser-etching blanks. K9 glass is sold as the Chinese equivalent to N-BK7. It is transparent to UV light. The blocks were mounted to an optical rail and bonded with supposedly index-matched liquid optically-clear adhesive (LOCA). The optical rail was not stiff enough so it was reinforced with square metal bars, which helped but did not provide perfect stability. This rather long and heavy contraption was difficult to work with in a car. It still had stability problems, creating false signals (movement of interference fringes) and thus hiding any real signals that may have been there. The stability problems were caused by the glass and optics being mounted to the optical rail, which made the optical rail the backbone of the system. It was too flexible for that purpose. In addition, the LOCA did not seem to be perfectly matched as there were still too many reflections. Eventually, the LOCA to started to separate, making it unusable. After a few drives on the freeway (up to 80 MPH), no useful data could be obtained.

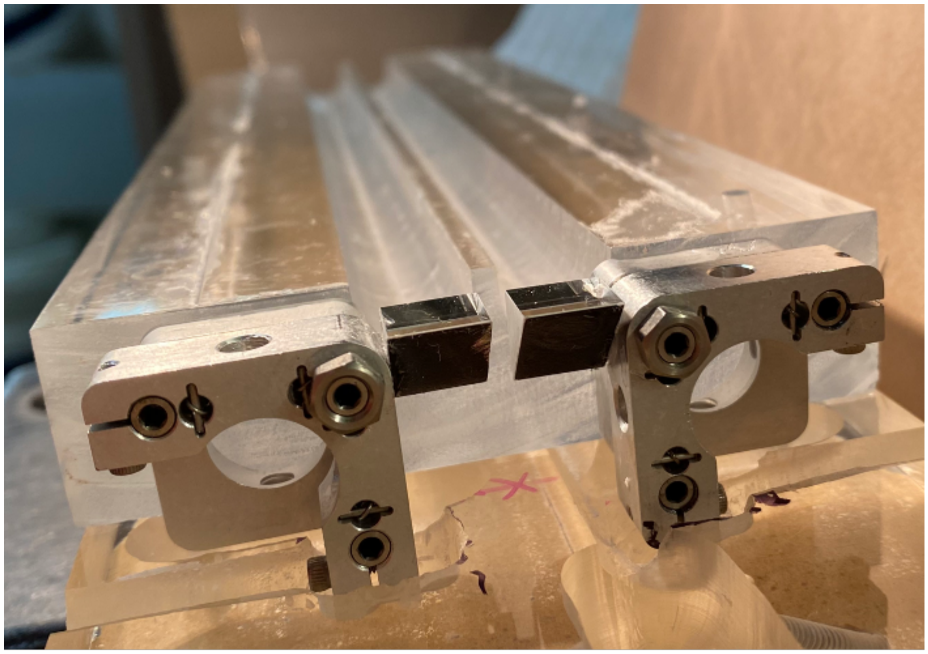

Fig. 4. One of three initially identical pieces of acrylic that were strapped together for stability. This one shows a pair of channels carved out for the laser beam's path through air.

A fourth attempt was to contract for the fabrication of a single custom block of K-9 glass that was large enough to be stable and serve as the backbone, yet not so large as to cause flexing problems. The chosen dimensions were 35x55x300 mm. Instead of mounting optics (the kinematic mounts and prisms and beam splitters) on a rail, they were mounted directly to the K9 glass block, as shown in Fig. 5.

This custom block and associated parts were designed according to FAA rules for what can be brought on an airplane as a "personal item" that can be stashed under a seat during takeoffs and landings. It was put in ordinary carry-on luggage.

The block was surrounded by thick sheets of acrylic for stabilization and to prevent air currents from distorting the interference pattern. Another reason for choosing acrylic again is that it made the device transparent, which was hoped would help it get past airport security.

A first version of this used a retroreflector at the distal end. This did not work. It was impossible to get an interference pattern at all. Polarizers would likely have helped but there was little room at that point. So the retroreflector was removed and replaced with a mirrored prism. This required carving a V-shaped channel in the acrylic where there had been two parallel channels. Then it was able to get an interference pattern.

Before this was finished, a family need required unexpected air travel to Albany. The almost-finished device was taken along and many things were learned in the process. Airport security at both Salt Lake City and Albany airports X-rayed it, examined it visually, asked questions about it and then allowed it on the airplanes. In Albany the officer was mostly concerned with the possibility of eye damage in case the laser got out. (He had experience with high power infrared lasers in the military.) Seeing the entire device was powered by three AA batteries helped. The fact that it was a low power visible light laser also helped.

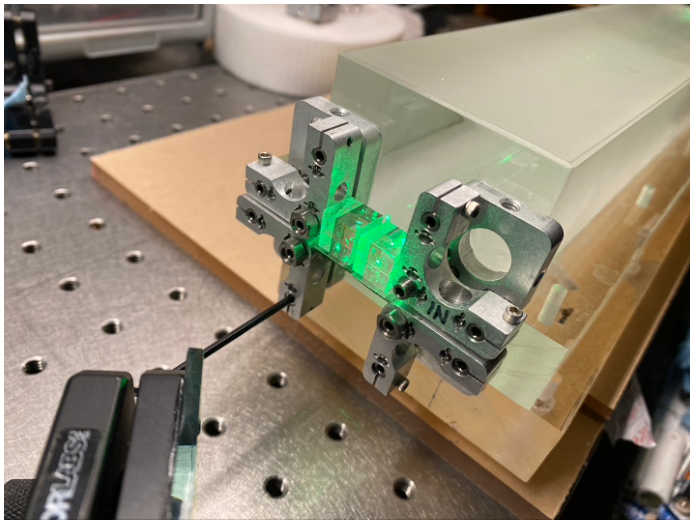

Fig. 5. A custom block of K9 glass with kinematic mounts.

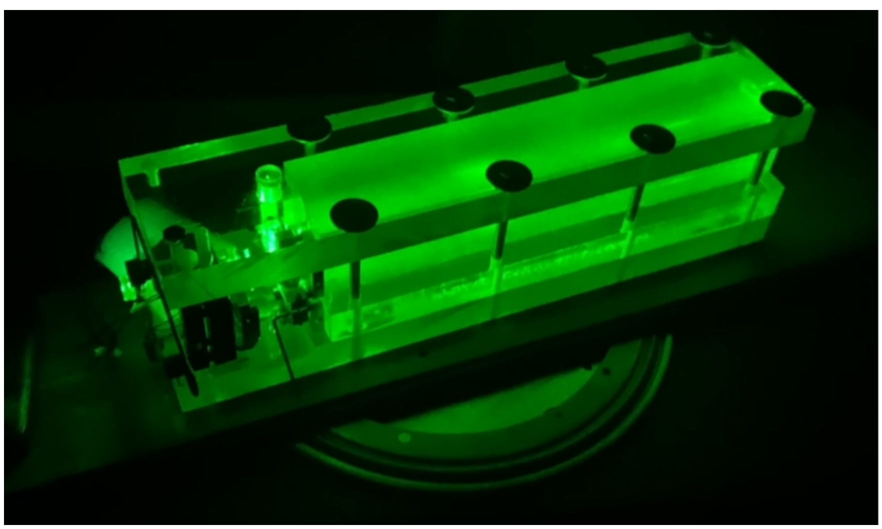

Fig. 6. The custom block inside part of its acrylic casing, before acrylic side panels were attached all the way around.

During the trip to Albany, it became clear that it needed more sophisticated method of collecting data. I had one of two laser outputs illuminating a solar cell in the dark. The idea was that there would be two solar cells to detect the opposite effects of infringement in the two output beams, looking for an increase in one while there is a drop in the other. During takeoff, observing only one solar cell, there was a progressive increase in current as the airplane increased its airspeed. A phone app was used to monitor the airplane's speed according to GPS, which was accessible near a window. However, the results were not consistent enough to be scientifically useful. Too many things needed to be adjusted and the fact that the device wasn't even ready was showing. The laser interference pattern also was not as clean as it should have been.

On the return flight to Salt Lake City, it was changed to allow for visually watching the expanded interference pattern. However, in the airport, the device fell to the ground and that dislodged something, ruining the possibility of getting any measurements.

Nevertheless, I did learn many things which will be useful for repeating these experiments with proper funding.

I do not believe that the index of refraction of K9 glass is high enough to get data just by inspecting the interference pattern visually. For objectivity and sensitivity, it needs a sensor that will gather numeric data. It would also help to use glass with a higher index of refraction.

4.7 Future experiments for which funding is needed

Upon funding, the project will commence by searching for and commissioning the fabrication of higher-index specimens. Currently, the most desirable candidate is zinc selenide with a refractive index of about 2.6. I have received two quotes for usable blocks. Both are for laser grade ZnSe, polished on the ends only.

Minimum size version:
100x10x10 mm: $625 plus tooling of $1500

Maximum size version:
298x10x10 mm: $20,000 (2+ months lead time)

Cubic zirconia with an index of about 2.16 is also a candidate. There are also various types of glass with an index in the range of 1.8-1.9 that should be available as well from Schott AG and its competitors.

All of these materials are difficult to obtain in the required sizes, but the higher index will make smaller, more portable and more stable interferometers possible, such as the single-pass version shown in Fig. 7. It uses Fresnel-Fizeau dragging in only one branch of a Mach-Zehnder interferometer.

Another desirable approach is to create a fiber optic interferometer. Fiber comes with advantage of almost automatic stability even in the turbulent of conditions if done right. The disadvantage is very limited range of refractive index. The only real option is to use ordinary single-mode fiber for one branch and hollow core fiber for the other branch. Hollow core fiber would be the "in air" branch. Hollow core fiber is exceptionally expensive, ranging in price from several hundred dollars to a thousand dollars per meter. For this work, a one to two meters should be enough.

Another advantage of fiber that is hard to test in commercial flights but would be most useful when built into airplanes is that longer stretches fiber can tucked away without occupying space that would normally be used for something. For testing in commercial flights, it is possible to join regular fiber to hollow core fiber and back with acceptable loss of laser brightness.

Because of lead time and availability and the advantage of testing multiple versions in the same flight or trip, the plan is to work on obtaining the special materials immediately, and build both fiber and discrete optics interferometers at the same time. With funding it will also be possible to purchase a seat for the interferometers themselves, which will be much better than limiting their size to a “personal item” that can be stored under a seat.

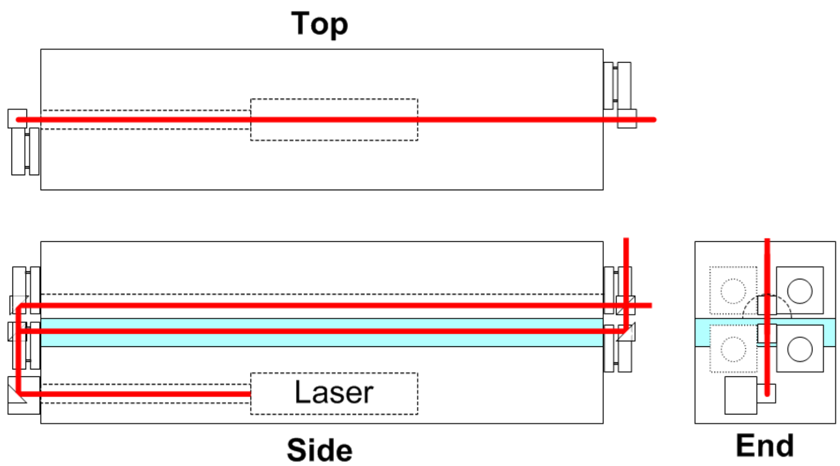

Fig. 7. A plan for one of the most hopeful interferometers that has not yet been tested. The split laser beam makes one pass through the high-index material (light blue) and is recombined on the other end, producing two beams that will show opposite interference effects.

It is the nature of the inventive process to not know what twists and turns lie ahead. It can be expected that each iteration of interferometers will provide more details and direction.

The goal is not just to attempt to falsify fieldlet theory. The more important goal is to provide a way for airplanes to accurately and reliably know their ground speed.

5.0 Dissemination

The challenge of being persuasive is a guiding factor in the current project. Just another paper claiming to have found a preferred reference frame will likely not have much impact. To meet these challenges, the current project seeks to build a velocimeter that clearly reports its velocity without requiring any statistical processing to remove noise in the data. It is a goal of this project that the velocimeter is accessible at many levels, so that anyone who cares can test it in a vehicle and examine how it works. It should also be offered as a “do it yourself” project so that the doubtful will know exactly what it has and does not have inside.

One of the important characteristics predicted for this velocimeter, which arises from the inability to shield against fieldlets, is that it would function correctly even inside a Faraday cage.

The availability of velocimeters that can be shown to be self-contained, working independent of any form of GPS, even if tucked away inside a Faraday cage and powered up while in motion, should make dissemination easier.

All reasonable forms of dissemination will be sought. Beyond publication in a peer reviewed journal with open access, websites, YouTube, social media will be used. In addition, upon success, this project will likely be of interest to mass media as well.

6.0 Broader impact

The proposed work presents a theory that starts out as a literal interpretation of the long-known electrostatic principle of superposition. This literal interpretation is that all electric charges act upon each other directly according to Coulomb's law regardless of other charges in the system and that it takes the presence of an electric charge for nature to add up the electrical effects of all other charges. This concept disposes of the vector field **E** as being superfluous. In its place, every charge is said to generate, own or be part of a fieldlet, which is defined as that single charge's electrical influence on the universe. The fieldlets of all charges in the universe overlap each other without negating each other or merging or allowing themselves to be shielded.

In exploring the logical consequences of this literal interpretation, one finds that these overlapping fieldlets are also generated by neutral atoms and even the fractional charges in neutrons, making the overlapping fieldlets much more of an influence than the old electric vector field that was based on net charges. In particular, it was proposed that the absolute value sum of these fieldlets in any point in space is important and causes phenomena to emerge. It was proposed that this may be the ontic reality behind what Einstein called the spacetime-ether in 1919. Being electrical, these overlapping fieldlets make a natural medium for light, and may play a role in the phenomena of gravity and gravitational time dilation.

Another aspect of the proposed work is to assert that the Michelson-Morley experiment's consistent null results come from seeking the wrong ether. If every celestial body contributes fieldlets to the universe's medium for light, then a planet's fieldlets will dominate on its surface and rotate with it. This provides a medium for light that rotates with the planet and assures null results for all fixed-to-surface experiments that seek to detect isotropy of the speed of light. To get a positive result, a Michelson-Morley type of experiment needs to get mobile relative to the surface of the earth. By changing the interferometer so that it detects Fresnel-Fizeau-like dragging, it can be made sensitive enough to act as a velocimeter in an airplane or even an automobile.

This work seeks to build such velocimeters, not merely to test fieldlet theory, but to also to disseminate the results and most importantly to offer to airplane manufacturers a new way to improve the safety of airplanes. As more airplanes are controlled in part or entirely by computers, the trustworthiness of sensors is becoming more important. Yet the pitot tubes and pressure sensors that are currently used to detect airplane speed are mechanical devices that must operate at locations that are subject to the airplane's harsh exterior environment. Even with redundancy, sensor failure has been the cause of the $1.4 billion loss of a B2 bomber in 2008. A self-contained velocimeter could have helped that flight control computer to determine which of its sensors was sending the correct information and thus prevented the crash.

Sagnac interferometers have been in use in vehicles of all types for the purpose of sensing rotation. Before fieldlet theory, it was believed that it is impossible to sense velocity in a like manner. With sufficient effort, the success of this project may lead to such interferometers becoming common-place in aircraft, especially those with automated controls.