Keeping One's Eye on the Ball

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Previous work [1] defending the thesis that all physical phenomena may be explained in terms of Coulomb's law and Newton's universal law of gravitation is reviewed. In sum, matter is described as gradient fields of charge and mass inextricably connected in the proton and electron. Energy is described as mathematical constructs defining relative positions of charge and mass. Coulomb chain reactions, as defined herein, are considered necessary and sufficient to explain electromagnetic phenomena. Particular attention is paid in this paper to the implications of this view on Special Relativity Theory.

1. Introduction

To begin, it is important to discuss the nature of the atom. From a physical perspective, the universe consists of mass and charge. Chemists, biologists, and theologians admit the existence of additional properties, but they do not do anything to change the laws of physics themselves.

Matter is simply described as consisting of protons and electrons. Neutrons, admitting the mass deficit, appear to be some form of combination of proton and electron. Newton advised: We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances. Accordingly, a proton, undistorted by matter, should consist of two radially-symmetric potentials that decrease as the inverse square of distance from the center. One of the potentials is an attractive entity known as mass; the other, a monopolar entity known as charge. The electron, similarly, is two potentials. Its mass is 1/1830 that of the proton's, and its charge is equal and opposite to that of the proton.

In a universe of one particle, the potentials would extend forever. A point of diminished returns would not be realized by a second particle introduced into the system, no matter how far away. But once several particles enter the system, they work to create Lagrangian points, as it were, and other regions where the force of one particle, or a group of particles, becomes negligible.

Particles respond to each other by moving. The reestablishment of equilibrium of potentials after a shift in the position of one or more particles accounts for conservation laws. Since the mass of an electron is extremely lighter than that of a proton, a stable charge configuration is most easily accomplished, or at least most easily detected, by motions of the electron. No attempt is made in this work to quantify charge in the existence of mass or vice versa. Mass and charge exist inextricably in established quanta in what are known as electrons and protons.

The wavicle mystery is always a problem for students seeking a physical interpretation of undergraduate physics equations. It fails the common-sense test. In fact, the dictum advising against believing anything taught in 100- or 200-level college courses holds for many physics books in print. When atomic particles are viewed as described above, it is not necessary to rely upon the imperfect analogies used to convey principles of optics.

Of most importance to this article is consideration of the impact of the excitation of one electron. Suppose the electron in an atom is caused to move in one direction. Electrons, reportedly, move at speeds on the order of *c*. If one electron moves, it may or may not move enough for an electron in an adjacent atom to overcome the electrical inertia of other surrounding particles. Supposing the force is sufficient to cause a neighboring electron to move, a third atom may even be impacted.

Before continuing, it is important to note that even though the electrons move at near light speeds, they do not move instantaneously. Real-world matter can only move through space in finite amounts of time. Again, adhering to Newton's advice, wormholes will not be admitted until they become necessary. At present, the world of three dimensions plus time is sufficient to describe the macroscopic physical world.

Now, random electron shifts are likely to cause local jigglings until everything damps out and a new equilibrium configuration is achieved. However, a situation might be imagined in which an electron migrates away from its base nucleus and migrates back at such a velocity that the forces it feels from an adjacent atom's reaction are in phase. So, a line of atoms, rather than experiencing random pushes and shoves on each other, could set up a standing wave pattern. In a more or less homogeneous medium with more or less equally-spaced electron domains, it would be easy to see why some excitations of electrons propagate and others don't. This physical interpretation is less hand-wavy than speculation about electron "shells."

That light propagates linearly is no mystery, either. In a homogeneous medium, the force of one electron translating in a given direction is going to be greatest in its direction of motion, diminishing to zero in the orthogonal plane.

When we consider the electron as moving at the speed of light, it is conceivable that this amazing particle is capable of responding near-instantaneously to input from all directions. Such a feature would be necessary to explain how light reflecting off a tree and into the eye of an observer could pass through the space occupied by the very same atmospheric atom to reflect light off a wall into the eye of another observer, etc.

When one considers Coulomb's law and Newton's universal law of gravitation, the conclusion that electrons must respond to the motions of neighboring electrons is unavoidable. The question remains whether or not the force of an electron is sufficient to overcome the inertia of neighboring electrons and establish Coulomb chain reactions. Computer modeling should be able to reveal magnitudes necessary for this to occur. If those numbers are consistent with real-world empiricism, then the conjecture is worth pursuing further. For example, conditions of standing waves could be compared to wavelengths for the Lyman, Balmer, and Paschen series. Escape velocities could be explored to evaluate the feasibility of theories that claim the neutron is just a hydrogen atom in which the electron has landed.

On the flip-side, modern theories of light describe a wavicle that is sometimes though admittedly erroneously portrayed, whether undergraduate students catch this or not, as a physical sinusoid wiggling through space. These theories fail to account for the contribution of the Coulomb forces known to exist on charged particles on the electromagnetic fields of light as it wafts through Einsteinian spacetime.

2. Wave Talk

The present paper is intended to explain the implications modeling electrons and protons simply as potential fields will have on Einstein relativity. It is first important to put the work of Einstein in historical perspective. When his theory was advanced, it was not known that outer space was full of charged particles. The luminiferous aether was needed to explain how light travelled through a vacuum. Now that there is no vacuum, but every spot of space is occupied; no matter where a test charge is placed, it will be tugged by the gradient fields, no matter how diminished, of mass and charge. Space is not filled with "billiard-ball" particles configured so as to create a conglomerate with color, sheen, hardness, and tactile properties. It is, however, fully occupied by composite potential fields. Mechanically speaking, the composite mass gradients fully justify Mach's principle.

To understand the electrodynamic theory in historical perspective, it is important to examine the Michelson-Morley experiment. This experiment is mischaracterized in many undergraduate books that simply dumb-down Einstein's analogy of ships moving in water. The Michelson-Morley experiment was intended to test for the existence of aether drag. It was assumed the luminiferous aether knew new boundaries, but wafted in and through matter as well as empty space.

The Michelson-Morley experiment would have shown if there was a change in the velocity of light carried by the aether due to the motion of the earth about the sun. It did not take into consideration motion of the sun about the Milky Way nor the Milky Way about greater universal systems, and perhaps even greater and more unfathomable velocities for as-yet undiscovered realms.

In the context of the concept of light explained above, the Michelson-Morley experiment could only deal with the light carried by the molecules within the closed experiment. The air did not flow in a steady stream in one direction through the apparatus. By contrast, Fizeau's test of Fresnel's theory did investigate the effects of a light beam sent through water. In this case, the light would have been carried by Coulomb chain reactions along the medium of the water. The water itself was moving, and so the velocity of light should have increased. It did, by a factor of $(1 - 1/n^2)$, where n is the index of refraction. Historical inquiries note that instruments with the necessary precision would not have been available.

Another curiosity about the presentation of the Michelson-Morley experiment to undergraduate students is its relevance with respect to the speed of light. Interferometers measure distances in terms of wavelengths. Using monochromatic light sources, they determine intervals of constructive and destructive interference, thus determining wavelengths or perhaps distances in terms of "turns of the screw" on the experimental apparatus. It would seem the experiment was looking for a phase-shift, or perhaps a Doppler effect due to movement through the aether.

For waves other than the sinusoidal portrayals, thereof, the concept of wave velocity is often hand-waved. For purposes of illustration, a Coulomb chain reaction may be represented as a row of enthusiastic spectators in a sports coliseum wanting to do a faddish wave. The first stands and sits, the next stands and sits, etc. If a group of more-or-less equally-spaced fans were to time themselves to a metronome and stand and sit at appointed times, they could be used to model electromagnetic propagation. Since it has already been established that the maximum force is in the direction of displacement, the fans in this illustration will punch each other in the shoulder instead of standing and sitting.

Starting with a pulse, the force of each punch, or the distance each person extends his arm is the amplitude of the wave. The setting of the metronome determines the time for punching. A change in the metronome's setting would represent a change in the medium. The concepts of frequency and wavelength have no meaning for a pulse. They are defined after a source excites and de-excites multiple times. The time between successive punches from the source establishes the frequency. Each fan/molecule must sit out a whole interval between ticks of the metronome before transmitting an impulse received to the next fan/molecule. The frequency could be three times faster than the ticks of the metronome, but each punch must rest with each fan/molecule an entire tick before it is transmitted.

Due to recent experiments demonstrating superluminality, discussions of group and phase velocity have become popular. Since the Michelson-Morley experiment dealt only with monochromatic light, the group velocity must necessarily equal the phase velocity. The velocity in question, then, is just the velocity of the wavefront.

Now, the student taking an introductory physics course is likely to hear that the Michelson-Morley experiment inspired Einstein to invoke Lorentz contractions to explain the constancy of the speed of light in a situation in which erroneous beliefs of the day said it should not be constant. Einstein's proposal of special relativity, in fact, had nothing to do with the Michelson-Morley experiment, but was instead based on Maxwell's work which required a constant speed of light in vacuum.

Again, fan/molecules controlled by a law that says they must wait the interval between metronome ticks to punch the next fan/molecule, will transmit signals in accordance with the law. If the source who throws the first punch happens to be running away (because Mom never sees who throws the first punch), all the fan/molecules down the line will still obey the law and punch as the metronome directs. If the thrower of the first punch wants to throw his weight around and run into the first fan/molecule in the chain, the first few fan/molecules may be mashed into each other, but the rest of the chain will still obey the metronome and wait out the set time before transmitting the punch to the next guy.

The metronome, obviously, has a physical interpretation. It is the time required for an electron to sense sufficient changes in the ambient electric field to overcome a threshold of inertia and move. Motion takes time. The time between metronome ticks would be the time required for an electron to overcome inertia, move, and expose a neighboring electron to sufficient force to overcome its inertia.

3. Keep Your Eye on the Ball

Our fan/molecules would likely agree it is important to "keep one's eye on the ball." It is easy to get lost in Einstein's math, or hand-wavy interpretations thereof. The players are usually the source, the target, the observer, and the medium.

The Fizeau/Fresnel experiment demonstrated that the speed of light can be affected by changes in velocity of the medium. In accordance with the theory described above, if the stadium were on wheels and going somewhere, it makes perfect sense that the wave would transverse space more rapidly or more slowly, depending on the direction of motion of the stadium.

The motion of the source does not alter the velocity at which a signal is carried by a medium in a Coulomb chain reaction. In the classical physics illustration, the velocity of a man walking and that of the train in which he walks necessarily add relative to ground. The velocity output from the engine of a plane and the velocity of a tail wind necessarily add. Two sources of motion are acting on the same object. However, the velocity of a source running into a chain of fan/molecules, even if he is riding a train, as was mentioned, is not going to make the molecules disobey the law of the metronome, nor make it possible for the fan/molecules to translate to the appropriate thresholds any faster, nor alter any thresholds necessary to overcome inertia. Whether a person walks or drives a letter to the post office is not a factor in how fast the overnight express truck will travel. The law is established.

Boats leave behind a nice V-shape of waves, but in front the waters are undisturbed beyond the relatively thin scrambled mess in front of the boat. Waves propagate in the ocean with no compulsion to run swiftly ahead of a motorboat even if it moves swiftly upon the waters.

Suppose, however, that the target moves. Then, the fan/molecules will transmit the signal at the same rate. It may take more or less time for the signal to arrive at the target. An analogy would be a plane flying at 100 mph that departs from Los Angeles and flies to Chicago instead of Denver.

If the observer is in motion, due consideration should be given the changes in time required for information about changes in the position of the signal to reach the observer. However, the wanderings of this observer or that observer, and all observers in the universe combined, have no effect on the fan/molecules' programming to obey the law of the metronome.

It should now be obvious that a change in the speed of a sports fan wave, when all fans must obey the metronome, can be effected by moving the fans closer or further, representing a change in medium; or perhaps sitting some logical contortion like an endless loop of fans on a cruise ship so the signal will get from New York to Paris sooner than if fans were lined up across the ocean.

Concerning the photoelectric effect, it should suffice to state that the electron does not lose its mass as it changes position. Eventually, the last electron in a Coulomb chain reaction will move into an interface that should register both impacts of charge and mass from the intrusion of the gradient fields of the electron into the surface's space.

4. Confusion in the Textbooks

The treatment of relativity theory in a number of introductory undergraduate textbooks sampled cannot be taken literally. The presentations leave the reader with too many unknowns. An author will typically assert: When objects move at near light speed, they contract, and time dilates. The equations for Lorentz transformations are presented, and the student is presented with sample problems and exercises. The reader is left to speculate about attributions that would have been subscripted in a more rigorous analysis.

To sort things out, four, and possibly five, perspectives may be isolated. These reference frames, for simplicity, are named for a point in the space occupied by the frame and moving with the same velocity. Namely, the points in question may be referred to as the source (S), which emits an EM signal; the target (T), which intercepts the signal; an observer (O), who witnesses the event from any position including S or T; and the medium (M). A controversial fifth perspective, that of a Newtonian absolute space, representing a position with respect to a conceptual three-dimensional grid superimposed on the material space is very helpful in defining displacements and velocities. Its dismissal by relativists is likely not going to render it persuasive in arguments.

The purpose of this appendix is to outline the mathematics that would be required to write accurate equations for displacement, time, and velocity in reference frames moving relative to each other in the physical world described in the main paper. The concept of absolute space is invoked to avoid the sometimes insurmountable confusion of mind-bending alternatives. Theoretical, rigid measuring rods are used to avoid cumbersome calculations for feedback loops. For example, how does an observer in motion measure distance? Both points must be measured simultaneously, from the perspective O. For example, to eliminate errors in locating S first and then after some time delay T; O can flash a light and with a clock and vector algebra come up with a definition of the relative position of S and T. To do so, however, would require some a priori knowledge of the relative velocities of the systems in order to treat retardation of signals and time-dependent displacements of the reference frames.

Analyses may be conducted with the four moving pieces (S, T, O, and M), moving first one at a time, then two, then three. Some general rules will become evident.

Whereas a number of undergraduate explanations of relativity theory assume light is a projectile, this paper treats it as a wave. Subscripts are important. Given a velocity, they express what object is moving as viewed from what position and under what circumstances. To avoid confusion that would be introduced with three subscripts, or the awkwardness of using lengthy ones, the majority of parameterizations will be specified in the text. In the following conclusions drawn from basic algebra, s

is the distance the wave will have traveled to get from S to T, t is the time taken for the transit, and v is the velocity of the wave. Calculations are first made with reference to absolute space.

4.1. Assuming Absolute Space

Using the above definitions, if S, T, O, and M are at rest, the properties of a wave emitted from S and arriving at T are:

$$\begin{aligned} s &= s \\ v &= c \\ t &= s/c \end{aligned} \tag{1}$$

If source S is moving with velocity v when it emits an EM signal; the velocity of a wave will necessarily be c, the velocity with which the medium conducts. Using a bad analogy, the velocity of S is about as relevant as the speed of a dog on the car he is chasing (when the driver is oblivious). However, if light were a projectile, c, which now becomes a velocity characteristic of the particle but without a physical interpretation, would necessarily add to v. Two additive motions would be imparted to a single object. Experimentation has shown this latter interpretation to be false. Corrupting the intent of physics, the mainstream celebrated the finding as a conundrum rather than resuming a search for an internally-consistent paradigm.

Whatever S does after it releases the wave should have nothing to do with the wave's propagation – unless S is creating turbulence. In the case of a moving source, all other frames stationary with respect to absolute space:

$$\begin{aligned} s &= s \\ v &= c \\ t &= s/c \end{aligned} \tag{2}$$

If the target alone moves, the wave must travel a different distance to reach its target, but the velocity is unchanged:

$$\begin{aligned} s &= s + \Delta s \\ v &= c \\ t &= \left(s + \Delta s\right)/c \end{aligned} \tag{3}$$

If the source and target are fixed, but the medium moves, velocities will add. (Consider rows of people on one of Einstein's trains doing a stadium wave.)

$$\begin{aligned} s &= s \\ v &= c + v_{medium} \\ t &= s/\left(c + v_{medium}\right) \end{aligned} \tag{4}$$

4.2. Retarded Effects

Suppose an observer at some point in space O is used to replace absolute space, and that the observer operates an amazing device that allows it to calculate displacement without reference to absolute space, regardless of what uncertain, and in many cases iterative, situations the space-time continuum may be imposing. Not only do these broad assumptions introduce ample opportunities for calculations to miss the mark, retardation effects must be considered. Suppose when a signal is released in the direction of T from S, a signal is simultaneously released in the direction of O. A small explosion emitting an EM pulse radially in all directions could suffice as a source of near-simultaneous signals.

If all potentially moving parts are stationary, then the signal will travel from S to T. It will be detected at O as being released at a time t corresponding to an arc of the same distance drawn with center S and intercepting the route of transit to T. This time must be subtracted from the absolute time of transit calculated from the data in the previous paragraph as it is duplicated. Then, the time for news of the arrival at T to reach O must be added. In other words, all other factors being equal, O would clock the time the signal requires to travel from S to T to be $t = t_{ST} - t_{SO} + t_{TO}$. Here, the subscripts represent the respective line segments. Since the velocity of the wave is, of course, c, the properties of interest as viewed from O may be tabulated as:

$$\begin{aligned} s &= c\left(t_{ST} - t_{SO} + t_{TO}\right) \\ v &= c \\ t &= t_{ST} - t_{SO} + t_{TO} \end{aligned} \tag{5}$$

Now, suppose S moves. Once again, the answer is, "So what?" The results are the same as in the above scenario.

When T is the only moving element from the set of S, T, O, and M, the wave travels a distance between S and $T+\Delta T$, where ΔT is a change in position of T. The definitions then become:

$$\begin{aligned} s &= c\left(t_{S(T+\Delta T)} - t_{SO} + t_{(T+\Delta T)O}\right) \\ v &= c \\ t &= t_{S(T+\Delta T)} - t_{SO} + t_{(T+\Delta T)O} \end{aligned} \tag{6}$$

Should S and T both move, the results should be the same as for T alone moving, as S's motion once the signal is released has no influence on the signal, O, T, or M.

Things get messy when considering the scenario of a moving medium. Supposing S, T, and O are stationary, the three signal velocities in question become:

$$\begin{aligned} v_{\mathrm{ST}} &= c + v_{\mathrm{medium}}\cos\theta \\ v_{\mathrm{SO}} &= c + v_{\mathrm{medium}}\cos\phi \\ v_{\mathrm{TO}} &= c + v_{\mathrm{medium}}\cos\xi \end{aligned} \tag{7}$$

Further definitions would rely on the ability of O to clock times in accordance with some universal standards or to measure displacements fairly without resorting to absolute space. If the latter were possible, one might conclude the apparent time of the signal to pass from S to T as viewed from O would be:

$$t = \frac{\mathrm{ST}}{c + v_{\mathrm{medium}}\cos\theta} - \frac{\mathrm{SO}}{c + v_{\mathrm{medium}}\cos\theta} - \frac{\mathrm{TO}}{v_{\mathrm{medium}}\cos\xi} \tag{8}$$

If the former were possible:

$$s = \left(c + v_{\mathrm{medium}}\cos\theta\right)t_{\mathrm{ST}} - \left(c + v_{\mathrm{medium}}\cos\phi\right)t_{\mathrm{SO}} + \left(v_{\mathrm{medium}}\cos\xi\right)t_{\mathrm{TO}} \tag{9}$$

4.3. Materials Science

There are other considerations that may affect the speed of light as viewed from a number of perspectives. Following Einstein's lead, an attempt to define variables when the moving pieces are accelerating will not be attempted in this paper. Yet, one more important matter must be considered, and that is electrostatic and gravitational inertia that may be introduced as protons and electrons move relative to one another to create the light wave.

As was mentioned earlier, lightweight electrons are much more able to compensate for changes in the ambient field than massive protons. When one electron moves, it will eventually go far enough that its inverse-square Coulomb field will set a nearby electron in motion. It is assumed thresholds of motion are defined by Machian principles. The term Machian is used here to describe a universe where all electrostatic and gravitational forces of all electrons and protons contribute to the force defining the current position of all objects. Forces will be applied as things in the universe move about, but observable changes in position will take place until a threshold of motion is passed. These thresholds may only represent limits of detection rather than discrete quanta in a step function. In the latter scenario, inertia would behave analogously to static friction.

It is reasonable that in a Coulomb chain reaction, electrons do not move one-by-one. The threshold of motion would be achieved by each in succession, but a group of electrons is likely to be in various stages of reaction at any given time. Once forced, a material electron will require time to move through space to a maximum displacement. The speed at which an electron moves will be determined by such factors as the atomic number of its parent nucleus, the shell in which the electron resides, spacing from other matter Gm_1m_2/r^2 , and spacing from other charge kq_1q_2/r^2 .

5. Conclusion

To recap, Special Relativity was based on the erroneous assumption that light was carried by a luminiferous aether that was outside the realm of charge and mass, that are perfectly capable of defining all macroscopic physical phenomena. Again, free agency, life, and even chemical bonding are real-world phenomena whose explanations are outside the restricted body of knowledge covered by clockwork Newtonian physics. Introductory physics texts continue to teach, while dismissing the aether as a silly, outmoded sectarian notion, that light is a mystery that is a particle when convenient, but a wave when exigent. EM is treated as a sinusoidal phenomenon that transcends mass and charge to propagate through the universe; rather than as a phenomenon of mass and charge modeled in terms of transverse waves.

While the author knows of no computer modeling conducted to determine thresholds of motion, it is reasonable that light should be nothing but the natural reactions of particles obeying Coulomb's law and Newton's universal law of gravitation. Certain stimulations should establish standing waves that propagate, obviating the need for magical shells and energy levels with no explanation.

The velocity of waves, like waves on the ocean or fan waves at stadiums, will not be influenced by the motion of the source or the observer. Light is not a projectile, but a function of the medium impacted by a Planck excitation. Its velocity can change by changing media, the density of media, or the velocity of the propagating medium. It is necessary to keep concepts of velocity, wavelength, and frequency straight; as well as exactly what powers source, target, and observer are capable of exerting on the light-transmitting medium. Running around with a boom box blaring is not going to increase the speed of sound in air, although it may Doppler-shift the pitch of the tunes.

6. References

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