ON THE ELECTRODYNAMICS OF MOVING BODIES

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Abstract

Interest arose in relativity in the early 90's when experimenting with Infra-red transmission which produced incompatible results with relativity which was put down to inaccuracies in measurement. These earlier experiments were discarded until 2007 when more accurate and advanced equipment was used which produced the identical anomalies seen previously. Consequently investigation was undertaken to ascertain if indeed the relativistic theory of Einstein held up to scrutiny. It was found upon investigation that there is no actual confirmed repeatable experiment which could be performed to prove the existence of relativity. There also appears to be extreme difficulty establishing compatibility with theories of quantum physics appearing to be diametrically opposed to one another. Suspicions have arisen that seem to suggest that one of the theories is in fact incorrect. In the first section of Einstein's paper "On the Electrodynamics of Moving Bodies" 1905 the model is presented upon which his whole paper is structured namely the commonplace relationship between time, distance and velocity. A fundamental problem appears in the second section of his paper whereby the equations no longer use distances but rather lengths. It would appear to be an error that has evaded physicists and mathematicians for in excess of a century. In mathematics it is common that distance and length are used interchangeably which may or may not be justifiable within different contexts, however there is without doubt a significant difference. Length is a measure of a solid object between two endpoints, whereas distance is the measurement of the space between two points and possesses an additional property of direction. The interchangeable use of length and distance by Einstein has created inconsistencies with fatal results on the paper itself. The theory is a work upon which significant amounts of current theoretical physics is based. It has been analyzed and certain inconsistencies have been discovered which affects the complete theory.

Introduction

This is an attempt to analyze the mathematical errors and to present a corrected version free from contradiction. In order to correct these errors mathematical proof is provided displaying that indeed the interchangeability of these core parameters is unjustified. In order to maintain consistency and in the interests of clarity, identical thought experiments as employed by Einstein in his original paper will be used. In parts of this paper the original text translation and equations are used which are corrected to reflect the mathematical errors.

§ 1. Definition of Simultaneity

Let there be a system of coordinates in which the equations of Newtonian mechanics hold well. In order to render the presentation more precise and to distinguish the system of coordinates from others to be introduced hereafter let it be named the “stationary system”. In this system of coordinates a dimensionless point is established, the position of which can be expressed in Cartesian coordinates. It is noted that in this proposed description a point is a mathematical abstraction which does not possess direction considering that notional motion is proposed, the system is inherently a hybrid between Cartesian and Euclidian geometry, but nonetheless serves the purpose of this paper.

It is required that the notional motion of this point is described and that the values of its coordinates can be expressed as functions of time, consequently in the interests of clarity a definition of time must be defined. When describing two simultaneous events it is clear that this definition is vague. If it is imagined that a train arrives at the station at 7 O’clock it can be seen that this can only be an “apparent” simultaneous event as the light from the train and the face of the clock will take a finite amount of time to arrive at the eye of the observer. It is difficult for an observer to ascertain with absolute confidence that the events represented by the arrival of the train and the time shown on the display of the clock are simultaneous. It can be seen that without taking into consideration the distances of the observer from both of the objects in question, the difficulty of establishing the simultaneity of events between them increases proportionately with the distance of the observer from the said objects and consequently must defined as being a subjective opinion.

It might appear possible to overcome all the difficulties attending the definition of "time" by substituting "the position of the small hand of a watch" for "time." And in fact such a definition is satisfactory when we are concerned with defining a time exclusively for the place where the watch and observer are located. But it is no longer satisfactory when connecting in time a series of events occurring at different places, or, what amounts to the same thing, to evaluate the times of events occurring at places where the observer is remote from the clock.

It may be considered sufficient to settle for value of time determined by an observer stationed together with the clock at the origin of the coordinates, and coordinating the corresponding positions of the hands with light signals, given out by every event to be timed, reaching the observer through empty space. But this co-ordination has the disadvantage that it is not independent of the standpoint of the observer with the clock. A much more practical determination can be arrived at by the elimination of the observer and the system being expressed as an unambiguous mathematical construct. In the following thought exercise the observer may be mentioned but only in the interests of clarity as all subjective views made by the observer are effectively ignored.

If at the point A of space there is a clock, an observer at A can determine the time values of events in the immediate proximity of A by finding the positions of the hands which are simultaneous with these events. If there is at the point B of space another clock in all respects resembling the one at A, it is possible for an observer at B to determine the time values of events in the immediate neighborhood of B. But it is not possible without further assumption to compare, in respect of time, an event at A with an event at B. Only an "A time" and a "B time." has been defined, however a common "time" for A and B, cannot be defined at all unless it is established *by definition* that the "time" required by light to travel from A to B equals the "time" it requires to travel from B to A independently of the observer.

Let a photon starting at the "A time" t_A travel from A towards B, let it at the "B time" t_B be reflected at B in the direction of A, and arrive back again at A at the "A time" t'_A. In accordance with definition, independent of any observer, the two clocks will be considered synchronized if;

$$t_B - t_A = t'_A - t_B$$

It is assumed that this definition of synchronism is free from contradictions, and possible for any number of points; and that the following relations are universally valid:

(a) If the clock at B synchronizes with the clock at A, the clock at A synchronizes with the clock at B.
(b) If the clock at A synchronizes with the clock at B and also with the clock at C, the clocks at B and C also synchronize with each other.

Thus with the help of certain imaginary physical experiments it has been settled what is to be understood by synchronous stationary clocks located at different places, and have evidently obtained a definition of "simultaneous," or "synchronous," and of "time." The "time" of an event is that which is given simultaneously with the event by a stationary clock located at the place of the event, this clock being synchronous, and indeed synchronous for all time determinations, with a specified stationary clock. The representation is also a system free from the inclusion of observers and clocks which as mentioned previously impose a subjective view upon the results. In agreement with current knowledge and experiment, it can further be assumed that the context of a ray of light or object travelling at the speed of light, the following is true;

$$\frac{2AB}{t'_A - t_A} = c$$

And that c when expressed as a universal constant, the velocity of light in empty space, as currently considered by the scientific community to be valid assumption.

$$\text{time} = \frac{\text{light path}}{\text{velocity}}$$

It is essential to have time defined with reference to a stationary source in the stationary system, and now that this has been established it is appropriate to refer to it thereafter as the time in the "stationary system."

§ 2. On the Relativity of Lengths and Times

The following reflections are based upon the current theory of relativity and also on the assumption of the constancy of the velocity of light. These two principles are defined as follows:

(a) The laws by which the states of physical systems undergo change are not affected, whether these changes of state are referred to the one or the other of two systems of co-ordinates in uniform translated motion.
(b) Any ray of light moves in the “stationary” system of co-ordinates with the determined velocity *c*, whether the ray is emitted by a stationary or by a moving body.

Hence;

$$\text{velocity} = \frac{\text{light path}}{\text{time interval}}$$

Where “time interval” and “light path” are to be taken in the sense of the definition in § 1

Let there be given a stationary rigid rod; and let its length be *l* as measured by a measuring-rod which is also stationary. It can now be imagined that the axis of the rod lying along the x-axis of the stationary system of coordinates, and that a uniform motion of parallel translation with velocity *v* along the x-axis in the direction of increasing *x* is then imparted to the rod. Inquiries can now be made as to the length of the moving rod, and imagine its length to be ascertained by the following two operations:

The observer moves together with the given measuring-rod and the rod to be measured, and measures the length of the rod directly by superposing the measuring-rod, in just the same way as if all three were at rest.

By means of stationary clocks set up in the stationary system and synchronizing in accordance with § 1, the observer ascertains at what points of the stationary system the two ends of the rod to be measured are located at a definite time. The distance between these two points, measured by the measuring-rod already employed, which in this case is at rest, is also a length which may be designated “the length of the rod.”

It can be seen that the imaginary experiment now includes an additional element namely an observer and from definition § 1 care must be taken with regard to the location and experiences of the observer,

It is also immediately apparent that in principle

The moving observer is unable to express with any degree of confidence the length of the rod. Both the rod under inspection and the measuring device are moving in concert with the observer. Any notional effects or forces which may affect the length of the rod must implicitly also affect the mechanism used to measure the rod. As a result this principle cannot be held to be valid.

It has been acknowledged that the inclusion of observers creates ambiguity when the observer is in a remote location to the object being observed, creating results which may be subjective as such this statement must also be considered with caution.

In accordance with the current theory of relativity the length to be discovered by the operation (a) will be referred to as the length of the rod in the “moving system” and must be equal to the length of the stationary rod. The length to be discovered by the operation (b) will be referred to as the length of the “moving” rod in the “stationary system”. This can be determined on the basis of the two principles. Current relativistic theories tacitly assume that the lengths determined by these two operations are not precisely equal, or in other words, that a moving rigid body at the epoch t may not in geometrical respects be perfectly represented by *the same* body *at rest* in a definite position but becomes shortened. Furthermore, it can be imagined that at the two ends A and B of the rod, clocks can be placed which synchronize with the clocks of the stationary system, that is to say that their indications correspond at any instant to the “time of the stationary system” at the places where they happen to be. These clocks can therefore be considered synchronous in the “stationary system”. It can be imagined further, that with each clock there is a moving observer, and that these observers apply to both clocks the criterion established in § 1 for the synchronization of two clocks. Once more in the interests of consistency, the subjective experiences and limitations of the two additional observers which have been included in the thought experiment must be taken into account.

Let a ray of light depart from A at the time t_A and let it be reflected at B at the time t_B , and reach A again at the time t'_A. Taking into consideration the principle of the constancy of the velocity of light we find that;

$$t_B - t_A = \frac{r_{AB}}{c - v} \text{ and } t'_A - t_B = \frac{r_{AB}}{c + v}$$

Whereas is assumed in current relativistic theories that r_{AB} denotes the length of the moving rod measured in the stationary system. It is also shown that the two equations are not equivalent and undoubtedly represent two distinct events.

By analyzing the aforementioned imaginary scenario certain parameters need to be clarified. The foundation of this thought experiment is based upon an everyday relationship according to section § 1;

$$\text{time inverval} = \frac{\text{light path}}{\text{velocity}}$$

The parameters of the two former equations can thus be seen to represent;

$t_B - t_A$ and $t'_A - t_B$ = Time for the rod travelling between a path A and B

$c - v$ and $c + v$ = Velocities of the rod travelling between a path A and B

r_{AB} = Length of the rod

It becomes immediately apparent that the variable r_{AB} does not conform to the relationship established in section § 1 in one critical aspect, namely the distance of the path travelled by the rod, but rather the length of the rod itself, the distance travelled remains unmentioned. Consequently it is necessary to establish whether a valid relationship exists between the length of the rod and the movement imparted upon it. In both of the latter equations it can be seen that;

$$r_{AB} = (t_B - t_A) \cdot (c - v) \text{ and } r_{AB} = (t'_A - t_B) \cdot (c + v)$$

To establish the validity of the two equations primarily the length of the rod at rest (which is at a velocity of zero) must be considered, as such because no movement has been imparted on the rod, the travel time between A and B must also be zero, likewise the velocity v must also be zero which results in;

$$t_B = t_A = 0 \text{ and } c - 0 = c$$

Substituting all zero values into the left hand equation results in;

$$r_{AB} = (t_B - t_A) \cdot (c - v)$$

$$r_{AB} = 0 \cdot (c - 0)$$

$$r_{AB} = 0$$

It has been established without contradiction that utilizing currently accepted relativistic equations to calculate the length of the rod r_{AB} for the "stationary system" will result in a rod length of zero.

Turning to the second equation taken to represent the length the rod r_{AB} on the return journey from B to A;

$$r_{AB} = (t'_A - t_B) \cdot (c + v)$$

If the velocity of the bar is considered to be c (the maximum theoretical value) the distance travelled by the bar and the time taken is unknown then the time may be expressed from the velocity of the rod as follows;

$$t_B = \frac{d}{c} \text{ and } t'_A = 2\frac{d}{c}$$

Substituting these values in the equation becomes;

$$r_{AB} = (t'_A - t_B) \cdot (c + v)$$

$$r_{AB} = \frac{d}{c} * 2c$$

$$r_{AB} = 2d$$

It can be seen that the length of the bar r_{AB} as calculated becomes twice the distance actually travelled, which represents an absurd answer.

From the prior simple calculations it has been established that both equations as presented by Einstein represent impossible situations whereby the rod being measured is mathematically shown to be zero length at rest which increases to a multiple of twice the distance travelled depending upon the velocity imparted upon it. This being the case, it is implicit that at the moment of reflection at B, when velocity is zero, the rod length would also be reduced to a value of zero for an instant in time whereby the rod would essentially disappear out of existence. Subsequent to this, upon the reversal of direction of the rod it would thus instantly expand back into existence up to a maximum of double the length it had actually travelled.

It is notable that both the equations and thought experiment used are identical to those used in current relativistic theories whose results are in direct contradiction with the currently accepted results obtained by these very theories themselves. The results display a flaw in the hypothesis which can be attributed directly to the fact that distance travelled by the rod is inaccurately represented to be the length of the rod in the numerators of both of the equations.

It has been proven without contradiction that no acceptable logical relationship exists between r_{AB} and the distance travelled within the context of the equations. Secondly it is consistent with section § 1 and current thinking that the velocity c is a constant and cannot be exceeded which suggests with some certainty the fact that $c + v$ cannot physically be attained. As such, in the interests of absolute accuracy the correct form of the equations could be represented as;

$$t_B - t_A = \frac{d}{v} = \; t'_A - t_B = \frac{d}{v}$$

It is noted now the two latter equations as opposed to the currently accepted relativistic equations which have been proven to be incorrect, can now be recognized as being mathematically equivalent conforming to both sections § 1 and § 2. The use of v also ensures that the equations are universally applicable with one condition being that the value of v does not exceed c.

§ 3. Theory of the Transformation of coordinates and times from a Stationary System to another System in Uniform Motion of Translation Relatively to the Former

Let there be in a hypothetical "stationary" space two systems of co-ordinates, i.e. two systems, each represented by three lines, perpendicular to one another, which issuing from a point of origin. Let the x-axis of the two systems coincide, and their axis of Y and Z respectively be parallel. Let each system be provided with a measuring rod and a number of clocks, and let the measuring rods, and likewise all the clocks of the two systems, be in all respects alike.

Now to the origin of one of the two systems k let a constant velocity v be imparted in the direction of the increasing x of the other stationary system K, and let this velocity be communicated to the axis of the co-ordinates, the relevant measuring rod, and the clocks. To any time of the stationary system K there then will correspond a definite position of the axis of the moving system, and from reasons of symmetry it can be assumed that the motion of k may be such that the axis of the moving system are at the time t (this "t" always denotes a time of the stationary system) parallel to the axis of the stationary system.

Current relativistic theory suggests that; "It can now be imagined that the space can be measured from the stationary system K by means of the stationary measuring rod, and also from the moving system k by means of the measuring rod moving with it and that the coordinates $x, y, z \ and \ \xi, \eta, \zeta$ respectively can be obtained".

In the interests of clarity it is proposed that the "distance" from the origin of $k \ and \ K$ is measured with the moving measuring rod and also the coordinates $x, y, z \ and \ \xi, \eta, \zeta$ are obtained in a similar manner. In the absence of mention of the observer and that all of the dimensions are being obtained from a moving frame it is assumed that the observer taking the measurement is actually the moving observer.

Further, let the time t of the stationary system be determined for all points thereof at which there are located clocks by means of light signals in the manner indicated in § 1; similarly let the time τ of the moving system be determined for all points of the moving system from clocks at rest relatively to that system by applying the method, given in § 1, of light signals between the points at which the latter clocks are located. Once more in the currently accepted form of relativistic experiment the observer is not mentioned which can be assumed as being the stationary observer, the "stationary system" being the system under enquiry. This presents as explained in section § 1 a certain level of ambiguity in the results obtained when observers are included.

To any system of values x, y, z, t which completely defines the place and time of an event in the stationary system, there belongs a system of values ξ, η, ζ, τ determining that event relatively to the system k, and the task is now to find the system of equations connecting these quantities.

Current relativistic theory tacitly suggests that $x' = x - vt$, it is clear that a point at rest in the system k must have a system of values $x', y, z,$ independent of time. An error immediately becomes evident when the frames of reference are considered individually. According to current relativistic theory, both of these frames have the same origin of zero. Upon K being imparted a velocity over time represented by vt, "the origin has not moved", and as such this value of vt is without contradiction simply equal to the distance;

$$\text{Distance} = \text{Velocity} \cdot \text{Time}$$

$$x' = \text{Distance } or\ x' = vt$$

Consequently, showing that $x' = x - vt$ is without a shadow of doubt an invalid assumption. In the subsequent calculation however the introduction of the equation $x' = x - vt$ bears no influence whatsoever on the final result.

From the origin of system k let a ray of light be emitted at the time t_0 along the x-axis to x', and at the time t_1 be reflected thence to the origin of the co-ordinates, arriving there at the time t_2.

The original variables τ_0, τ_1 and τ_2 have been replaced with t_1, t_2 and t_3 in order to remove any ambiguity that may be caused by the use of identical symbols for function names and variables of time. It is worthy of note that the equations presented below contained small inconsistencies and misplacing of variables which have been corrected in the interests of consistency;

An equation representing this must then be;

$$t_0 + ½(t_2) = t_1$$

Let there be a function defined τ representing the values of $x', y, z,$ and t where p represents the parameters (arguments) of the functions;

$$\tau(p_x, p_y, p_z, p_t);$$

This can be simplified as the coordinates $y \, and \, z$ are not being used and p_y, p_z serve no purpose other than to represent an attempt at a Lorentz transformation rather than a simple resolution of prior defined functions;

$$\tau(p_x, p_t);$$

The bodies of these functions can be represented as the data of clocks at rest in system *k*;

$$\tau(p_x, p_t)\{p_t\};$$

$$\tau(p_x, p_t)\left\{p_t + \frac{1}{2}\left[\frac{p_x}{v} + \frac{p_x}{v}\right]\right\};$$

$$\tau(p_x, p_t)\left\{p_t + \frac{p_x}{v}\right\};$$

It becomes immediately apparent that the results of the function may or may not return consistent values due to the function bodies consisting of three entirely different formulations and consequently care must be taken in assigning the correct methods.

By inserting the arguments of the function τ and applying the principle of the constancy of the velocity of light in the stationary system the equation representing the events in the system can be expanded as follows;

$$\tau(0, t) + \tau\left(x', t + \frac{1}{2}\left[\frac{x'}{v} + \frac{x'}{v}\right]\right) = \tau\left(x', t + \frac{x'}{v}\right)$$

It should be noted that in accordance with section § 2 the coordinates are now actually represented correctly by distances between coordinates expressed as $x^{'}$ and not mistakenly as lengths as expressed in current relativistic theory.

Simplifying, this expanded representation results in;

$$\tau\left(x', t + \frac{1}{2}\left[\frac{x'}{v} + \frac{x'}{v}\right]\right) = \tau\left(x^{'}, t + \frac{x'}{v}\right)$$

Hence, if $x^{'}$ be chosen infinitesimally small,

$$t + \frac{1}{2}\left[\frac{1}{v} + \frac{1}{v}\right] = t + \frac{1}{v}$$

In accordance with current relativistic theory, it has been established that, the value of t is clearly the "data of the clocks at rest in system x" which will result in a value of $t = 0$ and being common to both sides of the equation can be eliminated resulting in;

$$\frac{1}{2}\left[\frac{1}{v} + \frac{1}{v}\right] = \frac{1}{v}$$

$$\frac{1}{v} = \frac{1}{v}$$

Consequently, the relationship between both sides of the equation commonly referred to as gamma is simply;

$$\gamma = 1:1$$

It has therefore been established that the distances in the moving frame when viewed from the stationary frame are in a direct proportion of $1:1$ which in all respects is identical to a Galilean transformation. It has therefore been proven without contradiction that the transformation between coordinates of time, distance and velocity using the identical relativistic models reveals no significant difference from Galilean transformations in direct contradiction to what has been tacitly assumed in modern relativistic theories.

§ 4. Dynamics of the Electron

Let there be in motion in an electromagnetic field an electrically charged particle (in the sequel called an "electron"). Where x denotes the displacement of the electron, and m the mass of the electron. Secondly, let the velocity of the electron at a given epoch be v. We seek the law of motion of the electron in the immediately ensuing instants of time. Without affecting the general character of our considerations, we may and will assume that the electron, at the moment when we give it our attention, is at the origin of the coordinates, and moves with the velocity v along the x-axis of the system. It is then clear that at the given moment $(t = 0)$ the electron is at rest. It is advantageous now to demonstrate the methods of calculation of energy of an electron under these conditions. The work done accelerating an electron during an infinitesimal time interval of dt is given by the dot product of force and displacement and can be derived as;

$$\varepsilon X \cdot dx = \varepsilon X \cdot vdt = \frac{dp}{dt} \cdot vdt = v \cdot dp = v \cdot d(mv)$$

The relationship between momentum, mass and velocity is undoubtedly,

$$p = mv$$

By applying the product rule it can be seen that;

$$d(v \cdot v) = (dv) \cdot v + v \cdot (dv) = 2(v \cdot dv)$$

Therefore assuming that the mass of the electron is constant will result in;

$$v \cdot d(mv) = \frac{m}{2} d(v \cdot v) = \frac{m}{2} dv^2 = d\left(\frac{mv^2}{2}\right)$$

Since this is a total differential, that is, it only depends upon the final state, not how the electron arrived at its destination, it can be integrated which will result in the kinetic energy;

$$E_k = \int \varepsilon X \cdot dx = m \int v \cdot d(v) = \int d\left(\frac{mv^2}{2}\right) = \frac{mv^2}{2}$$

As the work is equivalent to the total kinetic energy;

$$W = \int \varepsilon X dx = m \int_0^v v dv = \int d\left(\frac{mv^2}{2}\right) = \frac{mv^2}{2}$$

This equation shows that the kinetic energy E_k is equal to the integral of the dot product of the velocity v of an electron and the infinitesimal change of the electrons momentum p. It is assumed that the electron starts with zero kinetic energy when at rest. Thus the total kinetic energy of the system is a quantity which is both invariant and conserved.

Results

It is therefore been proven that the theory of simultaneity as proposed by Einstein has been proven mathematically inconsistent. Due to the reliance of the remaining sections of his paper on the first premise a cascade effect occurs which inevitably means that all sections must be discounted. An alternative theory has been provided which conforms to Einstein's own thought experiments and utilizes his original formulations, resulting in the classical interpretation of time and space.

Discussion

It is apparent that the discovery of this error raises significant questions in the area of theoretical physics. Many theoretical physicists may choose to treat the results with a degree of skepticism the presented mathematical proof however is undeniable. Reconciliation or amendment of the theory of relativity is thought to be impossible due to the nature of the error and that results predicted by Einstein are specific, which do not conform to the actual results when calculated correctly.

References

Einstein. A. 1905 "*On the Electrodynamics of Moving Bodies*". Online English Translation