An Origin for Inertia

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The Lorentz transform indicates that the emition and absorption of a photon occur when events separate in real time are synchronous in complex time. Photons only exist as separate entities from the point perspective of real time. Cumulative fields of time dilation act within complex time also. If this is true then electromagnetic fields do not contain any energy. An explanation for inertia as the consequence of electromagnetic force is then in harmony with both relativity and quantum mechanics.

Inertia may be an interaction with matter in the distant universe. Gravity may be a geometric imbalance between electromagnetic attraction and repulsion due to the distribution of charges. The results of recent propulsion experiments can then be explained.

Insights into the relevance of complex time to our relationship with the distant universe may be gained from both Einstein and Landau. Einstein proposed that the photon has momentum, or at least conveys momentum, which is an important distinction because the photon has no observable existence independent of the matter with which it interacts. He describes the role of imaginary time within special relativity, in the lectures he delivered at Princeton in 1921. In lecture II, he introduces light-time,

$$l = \mathrm{ct}$$

in place of time, t, to avoid the use of the inflexible ratio, c, between light speed and the passage of time in the description of curvilinear space. The Lorentz transformation can then be defined as,

$$\Delta l^2 = \Delta x_1^2 + \Delta x_2^2 + \Delta x_3^2 \qquad \ldots(22b)$$

which is co-variant, satisfied in every inertial system for any emission/absorption event pair where,

$$\mathrm{r} = \mathrm{c}\cdot\Delta\mathrm{t}$$

He then states the imaginary time co-ordinate which replaces the real time co-ordinate,

$$x_4 = il = i\mathrm{ct}$$

where $i = \sqrt{-1}$

This allows the propagation of light to be described as co-variant with respect to the Lorentz transformation,

$$\sum \Delta x_\upsilon^2 = \Delta x_1^2 + \Delta x_2^2 + \Delta x_3^2 + + \Delta x_4^2 = 0 \qquad \ldots(22c)$$

always satisfied over distance, s, where,

$$\mathrm{s}^2 = \Delta x_1^2 + \Delta x_2^2 + \Delta x_3^2 + + \Delta x_4^2 \qquad \ldots(23)$$

This states the Lorentz transform succinctly but requires the expansion of the last term for the description to be complete. This transform includes the relation between emission and absorption where the traverse cannot be charted in four dimensional spacetime. The actual path of interaction can only be resolved within complex time.

The relation,

$$\mathrm{r} = \mathrm{c}\cdot\Delta\mathrm{t}$$

is a pair of locations, the origin separate from the destination when they describe the path of a photon, but these locations do not have separable co-ordinates in complex time.

This then is our fundamental misunderstanding of space; that it is a separation between material objects. Separation exists from the perspective of an individual location moving through real time at a specific rate but the perspective of other locations is then impossible to resolve. Complex time allows simultaneous resolution of a multiple perspective. Charges can then exist as influences upon the shape of spacetime without their influence being neutralised by the other charges with which they interact.

Motion in real time transforms the cumulative field of time dilations so that it can be resolved into separate electric and magnetic fields but from the co-variant perspective of complex time, charges retain their individual contribution to the structure of spacetime without investing energy in it. Gravity and inertia may be analysed as interactions within complex time and both their local influence and their distant consequence can be resolved because there is no energy present in the fields responsible for their interaction. To discover

an intuitive appreciation of this situation we can turn to Lev Landau who does not mince his words in this Morton Hamermesh translation of Lifshitz fine stenography.

"… if the interval between two events is timelike, then there exists a system of reference in which the two events occur in one and the same place… If two events occur in one and the same body, then the interval between them is always timelike, for the distance which the body moves between the two events cannot be greater than ct, since the velocity of the body cannot exceed c."

"Let us now ask whether or not we can find a system of reference in which the two events occur at one and the same time… the required system can be found only for when the interval… between the two events is an imaginary number. Imaginary intervals are said to be spacelike… if the interval between two events is spacelike, there exists a system of reference in which the two events occur simultaneously."

"The division of intervals into space- and timelike intervals is, because of their invariance, an absolute concept. This means that the timelike or spacelike character of an interval is independent of the reference system."

The suggestion is that components of complex time are always necessary to completely describe the propagation electromagnetic energy from more than one perspective. In the description of particles, quantum mechanics has already made these solutions familiar. The coincidence of points in complex time which are separate in real time allow electromagnetic forces to interact across the universe and the sum of their interactions have force proportional to the inverse of the square of their distances in real time.

This is not intended as, and is not adequate as a philosophical discussion, it is only an attempt to discover the mechanism of inertia so that it may be employed in spacecraft propulsion. Charge is the fundamental mechanism of electromagnetic interaction. Like charges repel and opposite charges attract and this could account for both gravity and inertia in the same way that it accounts for Van de Waals forces. The role of time dilation in electromagnetic interaction is already described by the dilation of time which must be present in order to account for the interaction which occurs when an electron is captured into an atomic orbital. Investigations by Llewellyn Thomas leave little doubt of this.

In the case of inertia the geometry of these forces, between any one atom and the matter of the rest of the universe, is altered by acceleration. This can account for resistance to inertial change as being an inductive relationship with the universe. For this description of inertia to be considered it is necessary to examine the geometry within which it must be resolved. The volume of a sphere is,

$$V = \frac{4}{3}\pi r^3$$

the volume of a spherical shell of constant thickness, $r_2 - r_1$, is,

$$V_s = \frac{4}{3}\pi r_2^3 - \frac{4}{3}\pi r_1^3$$

$$V_s \propto (r_2^3 - r_1^3)$$

and at large distances where density is constant, the mass within a shell,

$$m_s \propto (r_2^3 - r_1^3)$$

In SI units, electrical force between charges,

$$F = +/- k q^2/r^2$$

where, k, is the electromagnetic constant and, q, is measured in Coulomb. Then for a neutral mass, any force induced by acceleration of its charges due to their uneven distribution,

$$F \propto (m_2 m_1)/r^2$$

Where, m_1 is constant and

$$m_2 = m_s$$

we can state, using these arguments,

$$F \propto (r_2^3 - r_1^3)/r^2$$

$$F \propto (r_2 - r_1)$$

$$F \propto t$$

where, t, is the thickness of the shell. There being a greater number of shells of equal thickness in the distant universe than there are nearby, it is reasonable to presume that any inductive relationship due to the acceleration of neutral mass will be dominated by interaction with the remote universe irrespective of the density of local masses.

From Einstein's Princeton Lecture III "In the immediate neighbourhood of an observer, falling freely in a gravitational field, there is no gravitational field."

The only acceleration relative to the distant universe may be acceleration which is different to the local acceleration due to gravity. That gravity could be an electromagnetic interaction is indicated by the similarity between kinetic energy gained during a fall and the quantity of energy resulting from a multiplication of, the time dilation experienced during that fall and the total atomic energy within the falling mass. If you multiply the total atomic energy,

$$E = mc^2$$

within a mass which is falling, by the time dilation,

$$(\Delta T_{max} - \Delta T_{min}) / \Delta T_{min}$$

that it falls through, you get a result in Joules of energy which is the same as the kinetic energy gained from the fall,

$$KE = mv^2/2$$

Over a given distance, through a known dilation of time, in a vacuum, there is a balance between the atomic energy exposed to time dilation and the energy of motion generated,

$((\Delta T_{max} - \Delta T_{min}) / \Delta T_{min})E = KE$

This is a most unlikely co-incidence and could be considered to indicate that gravitational acceleration is powered by the electromagnetic energy within the atom.

Electron separations between distant atoms have a greater range than the proton separations between those same atoms. Electron repulsions and proton repulsions account for all of the repulsive forces between them. The electron to proton separations between those same atoms have a range somewhere between the electron separations and the proton separations but it may be wrong to assume that these all sum to zero over large distances, their imbalance needs to be near one part in 10^{36} for gravity to be fully resolved as a mild electromagnetic force.

The geometry is not simple but if charges have distinct location then the force between them is not just proportional to the inverse square of their separation but is also dependent upon the details of their distribution. This cannot be proven mathematically because the errors in the calculation completely swamp the result but it can be shown that the balance of attraction and repulsion between the charges of separate atoms is within eight orders of magnitude of the gravitational force between them. This error may seem large but it is just a small fraction of the difference of scale between gravitational and electrical forces.

Consideration of the possibility that time dilation is the mechanism of electromagnetic interaction, may be all that is required to unite gravity and electromagnetism. Clear visualisation of force relationships within complex time cannot fail to assist such a study. Mach proposed the distant universe as the origin of inertia more than a century ago. If Roger Shawyers emdrive experiments continue to be successfully repeated it may become necessary to revisit those ideas to discover an adequate explanation.

References:

Maxwell J.C. 'A Treatise on Electricity and Magnetism'
(Oxford University Press 1873).

Einstein A. 'The Meaning of Relativity' Princeton lectures 1921, translated by Prof. E.P. Adams (Princeton University Press 1922).

Landau L. & Lifshitz E. 'The Classical Theory of Fields'
USSR Academy of Science 1967, English Translation by Moreton Hamermesh
(Pergamon Press 1971).

Connor F. 'Waves' 2nd Edition (Edward Arnold 1972).

Tomonaga S. 'The Story of Spin' (University of Chicago Press 1998).