Relativity by rectifying anomalies of Newton's theory

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Extract
There are two anomalies associated with Newton's theory: (1) it allows acceleration to exceed speed of light and (2) whereas, momentum is derived directly, kinetic energy is derived indirectly. Rectifying these anomalies leads to simple alternative to Einstein's theory of Relativity.

Background

Isaac Newton's laws have underpinned mechanics ever since he formulated them in the 17^{th} century and continue to do so, rightly so, because they are simple and can be used accurately in the range of velocities encountered normally in mechanics. However, in the late 19^{th} century, it was discovered by James Clerk Maxwell that light travels at a speed that is not relative but is absolute. This absoluteness did not make sense because speed makes sense only as relative to another body; it was generally inferred that speed of light must be nature's speed limit as a way to make sense of this; but, as Newton's theory allows an object to be accelerated to exceed the speed of light, something must be wrong with Newton's laws.

The premise of this manuscript is that, Newton's second law is a simplified form of a *primary law* and in the simplified form, it seemed to be perfect, until an anomaly, that Newton's law allows speed to exceed the speed of light, surfaced. The aim of this thesis is to discover the primary law. The narrative of this thesis is to: *assert* first and *derive* afterward. The asserted primary law, of which Newton's second law is its simplified form, is: $(F * t) = (m * u) = - (m * c) * \log_e (1 – v/c)$

The lefthand side term (F * t) is the product of a constant force F and time (t) for which it acts and is called impulse of the force. The term (m * u) is the same impulse where (m) is mass of the body upon which the force acts and (u) is a *new* notation for "impulse per unit mass"; (u) is related to velocity (v) by the relationship: $(u) = - c * \log_e (1 – v/c)$ where (c) is speed of light; the relationships that flow from it are:

(1) (m * v) = Momentum . . . [by definition of Momentum]
(2) (m)*(u - v) = (Kinetic Energy ÷ c) . . . [by assertion here but justified below]

Deriving: $[u = - c * \log_e (1 – v/c)]$

Newton's second law of motion can be stated mathematically as: (dv/dt) = (F/m) where (dv/dt) is acceleration of velocity (v) with respect to time (t) and F is a constant force applied on a body of mass (m). In this thesis, this is amended, by addition of negative feedback that limits speed, so that the maximum that can be reached is velocity of light (c), as follows:

(dv/dt) = a * (1- v/c) where a = (F ÷ m). Explanation is: acceleration, (dv/dt), must satisfy boundary conditions that the acceleration (dv/dt) = (a) when (v) = 0, and (dv/dt) = 0 when (v) = (c). The feedback, - (a * v)/c, is linear because, intuitively, rate of change in *acceleration* with respect to change in *velocity* must stay constant.

Solution of differential equation: (dv/dt) = a * (1- v/c).

Rearrange the above equation → (dv/dt) + v*(a/c) = a. Such equations can be solved by using Integrating factor method. For this equation, the Integrating factor is $e^{at/c}$. Multiply the equation throughout by the integrating factor. The equation turns into:

$(dv/dt) * e^{at/c} + v * (a/c) * e^{at/c} = a * e^{at/c}$

Now self-question/answer: "what is the differential of $(v * e^{at/c})$ with respect to t?"
Answer: $e^{at/c} * (dv/dt) + v * (a/c) * e^{at/c}$ which is lefthand side of the above equation. So, the equation can be solved by integrating the righthand side:
$(v * e^{at/c}) = \int a * e^{at/c}\, dt$

$= c * e^{at/c} + k_1$ . . . [k_1 is constant of integration]

$= c * (e^{at/c} - 1)$ . . . [$k_1 = -(c)$ because v = 0 when t = 0)]

$v = [c * (e^{at/c} - 1)] \div (e^{at/c}) = c * (1 - e^{-at/c})$

Replace (at/c) with (u/c) and rearrange as: $v = c * (1 - e^{-at/c}) \rightarrow v = c * (1 - e^{-u/c}) \rightarrow [e^{-u/c} = (1- v/c)]$

Convert (u/c) from index form to logarithmic form thus:
$e^{-u/c} = (1- v/c) \rightarrow -u/c = \log_e (1- v/c)] \rightarrow [u/c = -\log_e (1- v/c)] \rightarrow [u = -c * \log_e (1- v/c)]$

Justification for the assertion: (m) * (u - v) = (Kinetic energy ÷ c)

In mechanics, Kinetic Energy (KE) is defined as the capacity of a body to do work by virtue of its motion. KE of a body of mass (m) and velocity (v) is equal to the work done by a force (F) to increase its velocity from rest to (v). The work done by a force (F) is defined as the magnitude of the force multiplied by distance moved; distance moved (S) is integral of velocity with respect to time (from: v=0 at t=0 to: general v at general time t).

$S = \int v\, dt$

$= \int c * (1 - e^{-at/c})\, dt$

$= c * t + (c^2/a) * e^{-at/c} + k_2$ . . . [k_2 is constant of integration]

$= c * t + (c^2/a) * e^{-at/c} - (c^2/a)$ . . . $k_2 = -(c^2/a)$ as S = 0 at t = 0

$= (c^2/a) * [(e^{-at/c} - 1) + at/c)]$

$= (c^2/a) * [-v/c + at/c)]$

$= (c^2/a) * [(u/c) - (v/c)]$ . . . because at/c = u/c

$KE = F * S = F * (c^2/a) * [(u/c) - (v/c)] = m * c * (u - v)$ . . . as F ÷ a = m

(m) * (u - v) = (Kinetic Energy ÷ c) . . . QED

$KE = m * c^2 (u/c - v/c)$

Implication of the primary law

With primary law theory, kinetic energy is not the same as in Newtonian mechanics, where it is derived indirectly. The primary law is: (F * t) = (m * u) where $u = -c * \log_e (1 - v/c)$. By a method called Maclaurin's series, $-[\log_e (1 - v/c)]$ can be expanded to an infinite series of terms of ascending powers of (v/c):

$-[\log_e (1 - v/c)] = (v/c) + \frac{1}{2}(v^2/c^2) + \frac{1}{3}(v^3/c^3) + \frac{1}{4}(v^4/c^4) + . . . + \frac{1}{n}(v^n/c^n) + . . .$

The first term (v/c), multiplied by (m*c) = (m*v) = Momentum, in line with its definition.

$KE = m * c^2 (u/c - v/c) = m*c^2 [\frac{1}{2}(v^2/c^2) + \frac{1}{3}(v^3/c^3) + \frac{1}{4}(v^4/c^4) + . . . + \frac{1}{n}(v^n/c^n) + . . .]$

The first approximation of KE is $\frac{1}{2}mv^2$ which is the same as with Newton's theory.

For most applications, the first approximation is sufficiently accurate. But in some high-speed applications such as orbital speeds of inner planets of the solar system, inclusion of one more term: KE = ($\frac{1}{2}mv^2 + \frac{1}{3}mv^3/c$) can explain precession of their orbits as due to extra KE.

<u>Evidence in support of the primary law</u>
In a nutshell, primary law theory means that Impulse divides into momentum and kinetic energy; how it divides is determined by <u>$(u) = - c * \log_e (1 – v/c)$</u> and <u>$v = c * (1 - e^{-u/c})$</u> where (u) = Impulse ÷ mass; when (u) is low, share of momentum is high and the share of momentum decreases as (u) increases; when (u) is so high that (v) is almost the speed of light, momentum plateaus at value m*c and virtually all of extra impulse leads to increase in (KE ÷ c).
Plateauing of momentum means that speed of light appears to be absolute and change in impulse leads, mostly, to change in (KE ÷ c) which in turn leads to the following observed phenomenon.

Suppose that the observed frequency of a photon is (f) when the relative velocity between the source of the light and observer is zero. What would the observer see if the said relative velocity is increased to v moving towards each other? The observer would see that virtually all of the momentum due to v goes to increase in (KE ÷ c); therefore, increase in KE = $m*v*c = m*c^2(v/c)$ where m is mass of the photon *(in Primary law theory, photon has mass)*. As $m*c^2$ is constant, KE is proportional to v/c where v is a variable. This connects directly with the related fact (Doppler effect) that $\Delta f/f = v/c$ where f is frequency of photon and its energy is $E = h*f$ where h is plank's constant.

<u>Is the primary law theory testable</u>?
Consider two bodies A and B, each of 1 kg mass and velocities 100 ms^{-1} and 200 ms^{-1} (in same direction) respectively. Consider that they collide and coalesce to become one body (A+B), via an ideal buffer that absorbs and restores momentum and kinetic energy (KE). Calculate momentum and kinetic energies of the bodies, before collision and after collision, as per Newton's law. Draw conclusions.

	mass	v	Momentum = m*v	KE (pre-collision) = $\frac{1}{2}mv^2$	KE (post-collision) = $\frac{1}{2}mv^2$
A	1 kg	100 ms^{-1}	100 kg m s^{-1}	5000 Joules	
B	1 kg	200 ms^{-1}	200 kg m s^{-1}	20000 Joules	
A+B	2 kg	150 ms^{-1}	300 kg m s^{-1}	25000 Joules	22500 Joules

Above table shows the calculated values of momentum and KE for the above exercise. Notice that the post-collision KE is less than pre-collision KE by 2500 Joules. Why is this so? The traditional explanation is that real life collisions are not perfectly elastic. That may be so, but this is theoretical prediction of Newton's theory that it would be lost regardless of precautions taken to contain loss. Any loss due to collision being inelastic would be additional to the theoretical loss.

Primary law, too, predicts the same loss because, for low velocities, primary law is virtually identical with Newton's law, except that, the primary law has built-in counter balance which is absent in Newton's theory; the primary law theory predicts that the loss in KE is balanced by post-collision increase in momentum equal to $(2500 \div c) = 2500 \div (3*10^8) = 8.33*10^{-6}$ kg m s^{-1}.

"*Why do we not notice such an effect?"* The answer probably is as follows: proportional increase is $8.33*10^{-6}$ in 300 i.e., 2.78 in 10^8. To notice such small proportional difference would require ultrahigh precision experiment.

I bow to everyone who supported me in my early years in various homes and in various centers of learning.