A Step Toward Translocation Technologies

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Abstract
Future propulsion technologies may have the opportunity to ask the question, how far do you want Alpha Centauri to be?

This paper takes a fresh look at the effects of Special Theory of Relativity, with the objective of finding new approaches to developing future propulsion technologies. In particular a translocation technology where any distance can be measured as zero distance. Finding this approach requires three steps.

The first step is to present a more detailed conceptual rendition of the Principle of Relativity that the laws of physics are the same anywhere in the Universe for an inertia frame of reference. The extended version of this axiom is termed Continuity of Frames of Reference. The Continuity of Frames of Reference has four properties, Net Cumulative, Path Independence, Reversibility, and Preservation.

When the first three properties are true, a physical process is said to be consistent with respect to space (location) or time. All known physical processes are consistent with respect to space. However, since time travel is not possible, physical processes are inconsistent with respect to time.

The Preservation Property must always hold. If an event occurred, it occurred. One cannot have the situation where a group of observers, within the light cone, disagree about what they observed. They may disagree about when and where, but not what.

The second step is the Box Paradox. In this scenario an event based location is measured differently, independent of relative simultaneity. This is not new. The paper, however, presents a new interpretation. It is our measurement of distance, and not the distance, that is different.

The third step is to propose some of the characteristics and properties of this future translocation technology. With some knowledge of what to look for, we are then able to focus and direct our efforts in a concerted manner, to hasten the development of this possible technology.

1 Introduction

1.1 Definition of Frame of Reference

"Events are primary, the essential stuff of Nature. Reference frames are secondary, devised by humans for locating and comparing events. A given event occurs in both frames – and in all possible frames moving in all possible directions and with all possible constant relative speeds through the region of spacetime in which the event occurs. The apparatus that 'causes' the event may be at rest in one free-float frame; another apparatus that 'causes' a second event may be at rest in a second free-float frame in motion relative to the first. No matter. Each event has its own unique existence. Neither is 'owned' by any frame at all."(Taylor, Wheeler, 1992a)

"A frame of reference is the perspective from which a system is observed. In physics, it provides a set of axes relative to which an observer can measure the position and motion of all points in a system, as well as the orientation of objects in it. There are two types of reference frames: inertial and non-inertial. An inertial frame of reference travels at a constant velocity, which means that Newton's first law (inertia) holds true. A non-inertial frame of reference, such as a moving car or a rotating carousel, accelerates. Therefore, Newton's first law does not hold true, as objects appear to accelerate without the appropriate forces." (Wikipedia, 2006)

"A reference frame is said to be an 'inertia' or 'free-float' or 'Lorentz' reference frame in a certain region of space and time when, throughout that region of spacetime – and within some specified accuracy – every free test particle initially in motion with respect to that frame continues its motion without change in speed or direction" (Taylor, Wheeler, 1992b)

Einstein had stated the Principle of Relativity as "All laws of physics are the same in every free-float (inertia) reference frame" (Taylor, Wheeler, 1992c)

It is important to note that the above four paragraphs sum up the contemporary view and knowledge of frames of references, and that frames of references are not of primary significance or importance to the pursuit of science (their roles are secondary).

This paper restates the frame of reference as two axioms. The first is the Frame of Reference Properties Axiom. This axiom requires that a frame of reference is the grid within spacetime in which an observer is immersed in; that provides location, time and property determination with respect to the laws of physics. Or, a frame of reference i, F_i , is a universal set of grid properties, as follows,

$$F_i = D_i \cup P_i \tag{1.1.1}$$

Where F_i = frame of reference i
$\cup$ = union of two sets
D_i = set of dimensions, t, x, y, z, and may be more, that are in grid i
P_i = set of physical properties, known and unknown, associated with grid i

Such that the set of dimensions, D_i, contains both, the set of known dimensions, and the set of unknown dimensions,

Set $D_i = D_{i,k} \cup D_{i,u}$ (1.1.2)

Where $D_{i,k}$ = known dimensions within grid i
$D_{i,u}$ = unknown dimensions within grid i

Similarly, the set of properties, P_i, contains both, the set of known properties and laws of physics, and the set of unknown properties and laws of physics,

Set $P_i = P_{i,k} \cup P_{i,u}$ (1.1.3)

Where $P_{i,k}$ = known dimensions within grid i
$P_{i,u}$ = unknown dimensions within grid i

It should be noted that in this paper, dimensions and properties are associated with the frame of reference rather than the observer, as these are present even if an observer is not. An observer experiences the world through the transformations applied to one's frame of reference.

The second axiom is the Null Frame of Reference. This axiom requires that when an observer has non-zero energy, the observer is associated with a frame of reference that defines how the observer experiences the world.

When, energy, $E(O_i)$, of observer, O_i , is not zero,

$E(O_i) \neq 0$

Then, the measure of the frame of reference, F_i , e is not zero

If $F_i = D_i \cup P_i$ (1.1.1)

Then $e(F_i) \neq 0$ (1.1.4)

And if,

$E(O_i) = 0$

Then $e(F_i) = 0$ (1.1.5)

Where $E(Oi)$ = measure of the energy of observe, i, O_i.

1.2 Dissection of a Collision

When a particle is in motion several constructs exists. First, a particle can observe itself as an internal observer. Second, an external observer that is close to this particle can observe this particle in motion, simultaneously.

Most importantly, when a particle collides with another particle, the process of impact can be deconstructed into 3 steps:

1. First step: Convergence of Frames of Reference (see Figure 1.1)
   a. Deceleration of both particles to change velocities.
   b. Simultaneously, the process of merging both frames of reference.
2. Second step: Unification of Frames of Reference (see Figure 1.1 & 1.2)
   a. Some collisions, results in a reversal of velocities.
   b. At the moment of zero relative velocities, both particles have identical frames of reference, and the frames of reference have merged.
3. Third step: Divergence of Frames of Reference (see Figure 1.2)
   a. Acceleration of both particles to their new velocities, as dictated by Conservation of Momentum & Conservation of Energy.
   b. Simultaneously, the process of separation of their frames of reference.

1.3 Some Frame of Reference Basics

Therefore, one can infer that there exists a continuity of frames of reference, as both deceleration and acceleration are physical manifestations of the convergence and divergence of frames of reference, such that,

For constant relative velocity between the frames,

$$ds_{m,n}/dt_{m,n} = f_v(F_m, F_n) \quad (1.3.1)$$

where $ds_{m,n}/dt_{m,n}$ = velocity of this travel.
$s_{m,n}$ = distance traveled from point m to point n.
$t_{m,n}$ = time taken to travel from point m to point n.
F_m = frame of reference for conditions at point m.
F_n = frame of reference for conditions at point n.
f_v = a velocity function

For a constant velocity, we do know that the frame of reference is governed by Lorentz-Fitzgerald transformations. Thus, the difference between frame of reference n with respect to m, $\Delta F_{m,n}$, must be,

for $ds_{m,n}/dt_{m,n}$ = constant, k,

and, $d^2s_{m,n}/dt^2_{m,n} = 0$

$$\Delta F_{m,n} = f(\sqrt{[1-v^2/c^2]}) \quad (1.3.2)$$

That is, the difference is governed by the Lorentz-Fitzgerald transformation.

Or, the change in the frame of reference n with respect to m over time, t, or distance, s, is given by,

$dF_{m,n} / dt = 0$ (1.3.3)

$dF_{m,n} / ds = 0$ (1.3.4)

Note, that this is note a rigorous proof but formalization of a concept based on background knowledge of the field. It should be noted the change in the frame of reference, $dF_{m,n}$, is not dependent upon the mass of the observer.

For constant acceleration between the frames,

$d^2s_{p,q}/dt^2_{p,q} = f_a(F_p, F_q)$ (1.3.5)

where $d^2s_{p,q}/dt^2_{p,q}$ = acceleration from point p to point q.
$s_{p,q}$ = distance traveled from point p to point q.
$t_{p,q}$ = time taken to travel from point p to point q.
F_p = frame of reference for conditions at point p.
F_q = frame of reference for conditions at point q.
f_a = an acceleration function

There is a change in the frame of reference, q with respect to p, $\Delta F_{p,q}$, when constant acceleration is present is,

for $ds_{p,q}/dt_{p,q} = f(s_{p,q})$

and, $d^2s_{p,q}/dt^2_{p,q} \neq 0$

$\Delta F_{p,q} = f(\text{acceleration})$ (1.3.6)

That is, the difference is governed by the some non-inertial transformation.

Or rephrasing,

The convergence of frames of reference q, with p as q decelerates towards p, is given as follows.

The condition when $d^2s_{p,q}/dt^2_{p,q} < 0$

$F_q \rightarrow F_p$ (1.3.7)

$\Delta F_{p,q} \rightarrow 0$ (1.3.8)

and, the change in the frame of reference q with respect to p over time, t, or distance, s, is given by,

$dF_{p,q} / dt < 0$ (1.3.9)

$dF_{p,q} / ds \quad < \quad 0$ (1.3.10)

And the divergence of frames of reference q with respect to p as q accelerates away from p, is given as follows.

The condition when $d^2s_{p,q}/dt^2_{p,q} \quad > \quad 0$

$dF_{p,q} / dt \quad > \quad 0$ (1.3.11)

$dF_{p,q} / ds \quad > \quad 0$ (1.3.12)

It should be noted that again, the change in the frame of reference, $dF_{p,q}$, is not dependent upon the mass of the observer.

As an aside one can postulate that just maybe, before the Big Bang, everything had a single unified frame of reference, the Starting Frame.

2 Continuity of Frames of Reference

2.1 Basic Postulate

This paper postulates the Continuity of Frames of Reference, which states that an observer's frame of reference is continuous and consistent with the observations, events and processes of another observer. That there is a continuous and consistent transformation between any two frames of reference.

Note, this does not mean that frames of reference are not discrete. One cannot prove or disprove this at this point.

The direct consequence of this axiom is that, the external observer's observations about a particle's behavior must be consistent with the internal's observer's observation of the particle's behavior.

By using the term "consistent", one means that there is a mathematical relationship that determines the transformation of one frame of reference with respect to another; and possibly that this transformation is reversible.

2.3 Gravity Thought Experiment

The real world validation for Continuity of Frames of Reference lies in the gravitational red and blue shifts. To an external observer, when both a photon and the observer are at an infinite distance from a gravitational field, the photon has a frequency, f. Both photon and observer can observe this same value of the photon frequency, at collision.

When an external observer arrives on the surface of a planet (ahead the photon) and observes the incoming photon, both the photon and the external observer are able to observe the blue-shifted photon frequency, at collision. The photon, however, is able to observe its blue shift as it enters the gravitational field because it gains energy.

When an external observer having left the gravitational field is very far from a gravitational field, and the photon is leaving this gravitational field, then both the external observer and the photon are able to observe the red-shifted photon frequency, at collision. The photon is able to observe its red shift as it exits the gravitational field because it loses energy.

One can place the external observer anywhere in the gravitational field. The red/blue shift the external observer sees, at impact, will be consistent with the red/blue shift the photon has experienced, because both have lost or gained energy.

One can restate this as follows. The gravitation field applies a consistent transformation to any and all observers, through their frames of reference.

3 Mathematical Structure

3.1 Basic Structure

The basic mathematical representation of the Continuity of Frames of Reference, can be stated as follows,

$$F_1 = T_{0,1}(F_0) \tag{3.1.1}$$

Where F_0 = frame of reference 0, at initial state, 0
F_1 = frame of reference 1, at ending state, 1
$T_{0,1}$ = transformation for frame of reference from F_0 to F_1.

An initial starting frame of reference, F_0, is transformed by a physical process that can be represented by a transformation operator, $T_{0,1}$, into the ending frame of reference, F_1. It should be noted that, given that frames of reference relate to coordinate positions, velocities and accelerations, the transformation operator is a representation of the difference and change in the unit energy of the observed. Further work is required to show that this relationship is dependent on the energy per unit mass.

One can further propose that the transformation operators are consistent when, transformations are net cumulative (3.2.1), path independent (3.3.1), reversible (3.4.1) and preserved (3.5.1) or,

3.2 Net Cumulative Property

This property requires that the total net effect of all the transformations along the path 0, 1, 2, …, n-2, n-1 & n, must be the same as the single direct path, 0 to n.

Or the **Net Cumulative Property** can be represented as,

$$\begin{aligned} F_n &= T_{n-1,n}(F_{n-1}) \\ &= T_{n-1,n}(T_{n-2,n-1}(F_{n-2})) \end{aligned}$$

$$= T_{n-1,n}(T_{n-2,n-1}(T_{n-3,n-2}(F_{n-3}))$$
$$= T_{n-1,n}(T_{n-2,n-1}(T_{n-3,n-2}(\ldots T_{0,1}(F_0) \ldots)))$$
$$= T_{0,n}(F_0)$$

$$T_{0,n}(F_0) = T_{n-1,n}(T_{n-2,n-1}(T_{n-3,n-2}(\ldots T_{0,1}(F_0) \ldots))) \quad (3.2.1)$$

3.3 Path Independence Property

The net transformation along the path m-x-n must be the same as the net transformation along an alternative path m-y-n, as the Net Cumulative Property requires net transformations equal that of the single most direct path, m-n.

$$F_n = T_{x,n}(T_{m,x}(F_m)), \quad \text{and by (3.2)}$$

$$= T_{m,n}(F_m)$$

But,

$$F_n = T_{y,n}(T_{m,y}(F_m)) , \quad \text{and by (3.2)}$$

$$= T_{m,n}(F_m)$$

Therefore, **Path Independence Property**, can be represented as,

$$T_{x,n}(T_{m,x}(F_m)) = T_{y,n}(T_{m,y}(F_m)) \quad (3.3.1)$$

for any $x \neq y$

This is the primary representation of the Principle of Relativity that the laws of physics must be the same for any inertia frame of reference. Or more clearly, there are two elements to this Path Independence.

1. Any two observers with different frames of reference will observe the laws of physics, by the appropriate frame of reference transformation. This is because it is possible to transform the first observer's frame of reference to the second observer's, by the appropriate transformation. For the inertia frames of reference Lorentz-Fitzgerald transformations apply.
2. Any observer, moving from a starting frame to another different ending frame will observe the laws of physics by the appropriate transformation of the frames of reference. A good example of a frame of reference being transformed by the non-linear distortions is that in a gravitational field.

Path Independence Property shows that any two dissimilar frames of reference will observe the laws of physics by the appropriate transformation. When the dissimilarity is due to non-accelerating or inertia, frames of references, the transformations are governed by Lorentz-Fitzgerald transformations. When the dissimilarities are due to acceleration, the transformations are governed by non-inertia frame of reference transformations.

3.4 Reversible Property

Transformations are reversible if retracing our steps will return us to our original set of conditions. This is a necessary consequence of the Path Independence Property. The Reversible Property is critical to any space exploration endeavor, as one expects to return home, at some reasonable time in the future.

Reversible Property, can be succinctly represented as,

$$F_n = T_{m,n}(T_{n,m}(F_n)) \qquad (3.4.1)$$

This can be more clearly rewritten as,

$$F_{n(s1,t1)} = T_{m(s0,t0),n(s1,t1)}\,(T_{n(s1,t1),m(s0,t0)}\,(F_{n(s1,t1)})) \qquad (3.4.2)$$

Where $F_{n(s1,t1)}$ = frame n, whose final state, exists at some point in space s1, and time, t1.
$m(s_0,t_0)$ = initial state, m, which exists at some initial location s0, and time t0.
$T_{m(s0,t0),n(s1,t1)}$ = transformation for frame of reference from state m to n.
$T_{n(s1,t1),m(s0,t0)}$ = reverse transformation for frame of reference from state n to m.

If one assumes that, t_0, is earlier than t_1,

$$t_0 < t_1 \qquad (3.4.3)$$

and do not make any assumptions about location, then, the reverse transformation $T_{n(s1,t1),m(s0,t0)}$, is the reversing of the frame of reference back in time. One can take this thought a step further and define,

Spatial Reversibility as,

$$F_{n(s1)} = T_{m(s0),n(s1)}\,(T_{n(s1),m(s0)}\,(F_{n(s1)})) \qquad (3.4.4)$$

and Temporal Reversibility as,

$$F_{n(t1)} = T_{m(t0),n(t1)}\,(T_{n(t1),m(t0)}\,(F_{n(t1)})) \qquad (3.4.5)$$

If frame of reference transformations are truly reversible with respect to time and space, then one would expect thermodynamic and therefore, physiological processes to be exactly reversed. However, that would imply a reversal of memories, and with temporal reversible frames of reference one could not determine whether one was traveling back in time or not.

This raises a question about temporal reversibility. Is reversibility collective or individual? If temporal reversibility is collective, it means that the entire universe travel backwards and forwards in time together. With individual temporal reversibility a single entity can reverse temporal frame of reference transformations independently of the surrounding universe.

Therefore, one cannot detect Collective Temporal Reversibility, but on can detect Individual Temporal Reversibility.

One now recognizes a subtle distinction between time travel and temporal reversibility. With temporal reversibility, an entity or particle is returned precisely to its previous state, at its previous location and its previous time. With time travel, the entity or particle is in its future state in a historical context, as follows,

$$F_{n(sy,t+j)} = T_{m(sx,t),n(sy,t+j)} (F_{m(sx,t)}) \mid W_{(sx,t-i)} \quad (3.4.6)$$

Time travel is the transformation of an entity from state, m(sx,t), at some location sx, at some time t in entity's present, to some state, n(sy,t+j), at some location sy, at some relative time, t+j, in the entity's future, given that, the world, W, is in some historical state, $W_{(sz,t-i)}$; and with no specific relationship between i and j.

Given that the world state is some transformation of a prior state, one can state,

$$W_{(sx,t-i)} = U_{(sq,t),(sx,t-i)}W_{(sp,t)} \quad (3.4.7)$$

Where $W_{(sp,t)}$ = world state, at location sp, and at time, t.
$W_{(sx,t-i)}$ = subsequent world state, at location sx, and at time, t-i.
$U_{(sq,t),(sx,t-i)}$ = transformation of the universe from world state, $W_{(sp,t)}$, to $W_{(sx,t-i)}$.

Therefore, the time travel transformations (see Figure 3.1) can be rewritten as follows,

Traveling backwards in time,

$$F_{n(sy,t+j)} = T_{m(sx,t),n(sy,t+j)} (F_{m(sx,t)}) \mid U_{(sq,t),(sp,t-i)}W_{(sq,t)} \quad (3.4.8)$$

Traveling forwards in time,

$$F_{n(sy,t+j)} = T_{m(sx,t),n(sy,t+j)} (F_{m(sx,t)}) \mid U_{(sq,t),(sp,t+k)}W_{(sq,t)} \quad (3.4.9)$$

Similarly, equation (3.4.5) can be rewritten (see Figure 3.2), taking world state into account as, Temporal Reversibility given that the Universe keeps moving forward in time,

$$F_{n(t1)} = T_{m(t0),n(t1)} (T_{n(t1),m(t0)} (F_{n(t1)})) \mid U_{(sq,t),(sp,t+i)} W_{(sq,t)} \quad (3.4.10)$$

Note, that equations (3.4.8), (3.4.9) and (3.4.10) remind us of Mach's Principle. Mach suggested (Schultz 2003) that "the Universe itself establishes what is meant by uniform velocity, that a velocity can be maintained without an external force if it is uniform with respect the Universe. He speculated that this condition had a real cause, that bodies exerted an influence on one another that resisted their relative acceleration".

However, with these equations, one sees that the temporal behavior is established with respect to the background Universe; and at this stage no attempt is made to either derive or extrapolate a cause-effect with the Universe.

Or more clearly, Time Travel is the forward temporal movement of the observer given that the world state can move in both temporal directions, forward and backward; while Temporal Reversibility if the forward and backward temporal movement of the observer, with the world state moving forward in time.

Two inferences come to mind. First, equations (3.4.8), (3.4.9) and (3.4.10) clearly illustrate that Temporal Reversibility is not Time Travel. Second, unless Collective Temporal Reversibility is in effect, the energy required to transform the world states is next to infinite, thus Time Travel is impossible. However, if Collective Temporal Reversibility did exist, the question arises, can it co-exists with Individual Temporal Reversibility.

As things stand, it is safe to state that in the macro world, either time travel is not possible or collective temporal reversibility holds. At the quantum level, observations suggest that individual temporal reversibility exists (Rosner, 2001), but not time travel.

A third inference is that given that the Universe is on the surface of an expanding sphere, (see Figure 3.2) a possible logical construct is that the magnitude of the Individual Temporal Reversibility is governed by the thickness of the Universe Expanding Sphere.

$$| F_{n(t1)} - F_{n(t1)} | = f(\text{Thick of the Universe}) \quad (3.4.11)$$

Therefore, one just maybe able to determine the thick of the Universe, as follows,

$$\text{Thick of the Universe} = f(| F_{n(t1)} - F_{n(t1)} |) \quad (3.4.12)$$

3.5 Preservation Property

If an event occurred, it occurred. No two observers may contradict each other about what did or did not happen, with regard to an event, but, within limits, may state different location and time of occurrence. For example, if two particles collided, they did.

The Preservation Property requires that if an event occurred at some location and time, governed by some transformation, then, that event is preserved and real, such that

1. It may or may not be observed by different observes, and
2. If observed, in general relative simultaneity is in effect.

Preservation Property, can be represented as,

$$F_i = T_{0,i} (F_0) \quad \text{for all } i \quad (3.5.1)$$

However, using Minkowski diagrams or light cones (Taylor, Wheeler, 1992d), one can show that some events cannot be observed if outside the light cone. Therefore, equation (3.5.1) can be rewritten as follows,

$$T_{0,i} (F_0) = F_i \quad \text{for all i within the light cone} \quad (3.5.2)$$

$$N_{0,i} (F_0) = 0 \quad \text{for all i outside the light cone} \quad (3.5.3)$$

Where F_0 = Frame 0, initial state, 0, frame of reference
F_i = Frame i, ending state, i, frame of reference
$N_{0,i}$ = the null transformation for frame of reference from F_0.

4 Inconsistent transformations

A frame of reference transformation is inconsistent when at least one of the three properties (Net Cumulative, Path Independence & Reversible) no longer holds. The Preservation Property must always hold, for both consistent and inconsistent transformations because an event either did or did not happen. One cannot have it both ways.

With our current knowledge, macro-level temporal reversibility is not possible. Therefore, know macro physical processes are inconsistent with respect to time, as,

$$F_n \neq T_{m,n}(T_{n,m}(F_n)) \qquad (4.1)$$

Where n > m
n = later time
m = earlier time

If we are to reach the stars in a reasonable amount of time, we require a technology that enables inconsistent transformations. In particular, Path Independence Property cannot hold, but the Reversible Property must hold, otherwise we might not be able to return.

An inconsistent Path Independence requires, that if,

$$F_{n(x)} = T_{x,n}(T_{m,x}(F_m))$$

$$F_{n(y)} = T_{y,n}(T_{m,y}(F_m))$$

Then,

$$F_{n(x)} \neq F_{n(y)} \qquad (4.2)$$

Such that, the journey duration, D,

$$D_{m,x,n} > D_{m,y,n} \qquad (4.3)$$

And journey distance, $S_{m,x,n}$, may or may not be the same as, $S_{m,y,n}$, or,

$$S_{m,x,n} \leq/\geq S_{m,y,n} \qquad (4.4)$$

Where x ≠ y
$D_{m,y,n}$ = travel duration between n and m via x
$D_{m,x,n}$ = travel duration between n and m via y

$S_{m,y,n}$ = travel distance between n and m via x
$S_{m,x,n}$ = travel distance between n and m via y
$\leq / \geq$ = any of, less than, equal to or greater than relationship

That is, there is a set of states or conditions, y, that enable us to travel from m to n, via path m-y-n that is quicker than via path m-x-n. Note, too, that an inconsistent Path Independence, requires that the laws of physics behave differently between, $F_{n(x)}$ and $F_{n(y)}$.

The Reversible Property holds within the context of inconsistent Path Independence as follows. The m-x-n path, the conventional path is reversible.

$$F_{n(x)} = T_{x,n}(T_{m,x}(T_{x,m}(T_{n,x}(F_n)))) \quad (4.5)$$

However, the m-y-n path, the path that is inconsistent with respect to m-x-n, the reversibility condition is,

$$F_{n(y)} = T_{y,n}(T_{m,y}(T_{y,m}(T_{n,y}(F_n)))) \quad (4.6)$$

Since Path Independence is no longer true, we can hypothesize that the Net Cumulative Property will not hold.

Continuity of Frames of Reference provides several inferences:

1. All transformations must obey the Preservation Property.
2. Consistent transformations have 3 additional properties, Net Cumulative, Path Independence & Reversible.
3. A transformation is inconsistent when any of these three properties do not hold.
4. The Path Independence Property states that the laws of physics must be the same for any frame of reference path.
5. The Reversible Property enables thermodynamic processes to be reversible, because they are consistent transformations.
6. Future space propulsion technologies will harness inconsistent transformations.

5 The 5-Particle Box Paradox

Let's examine a 5 particle thought experiment. See Fig 5.1. The four particles, A, B, C & D, form a box, under a specific set of conditions. A, B, C, and D are at rest relative to each other. They form a square, and no relativistic effects are present, along the sides of the square, with respect to observers on adjacent particles on the sides of the box. Particle E is moving at a velocity, v, along CD, on a collision course with D.

To eliminate any possibility of relative simultaneity we require particle E to collide with D. Just prior to the collision, the distance between D and E, S_{DE}, is just barely greater than zero, if not zero.

$$S_{DE} \approx 0 \quad (5.1)$$

At this moment, E is aligned with D such that it, too, forms a square with A, B and C. At this moment since, E is moving perpendicularly to B, the relative velocity between B and E, V_{AB}, is zero.

$$V_{AB} = 0 \tag{5.2}$$

Therefore, within the square ABCE, E has relativistic effect along the x-axis, AD, and along the diagonal, AE. Lorentz-Fitzgerald contraction dictates that particle E's, measurement of CE, S_{CE}, and AE, S_{AE}, are given by the respective equation,

$$S_{CE} = s.\sqrt{(1-v^2/c^2)} \tag{5.3}$$

and, by the hypotenuse of the right angled triangle, ACE,

$$S_{AE} = s.\ \sqrt{(2-v^2/c^2)} \tag{5.4}$$

However, from the perspective of particle D, which has no relativistic effects, the corresponding distances of CD, S_{CD}, and AD, S_{AD}, are given by the respective equation,

$$S_{CD} = s \tag{5.5}$$

and, by the hypotenuse of the right angled triangle, ACD,

$$S_{AD} = s.\ \sqrt{(2)} \tag{5.6}$$

We have shown, that as a result of transformation of frames of reference, two different overlapping distances are measured differently, such that,

$$S_{CD} > S_{CE} \tag{5.7}$$

$$S_{AD} > S_{AE} \tag{5.8}$$

In fact as v, approaches c,

$$v \rightarrow c$$

$$S_{CE} \rightarrow 0 \tag{5.9}$$

$$S_{AE} \rightarrow s \tag{5.10}$$

6 The Basis of a Translocation Technology

Equation (5.9) shows that under the right transformations it is possible to measure any distance equal to zero. That is, there exists a transformation, $T_{i,Z}$, (pronounced tizzy) such that any distance, s_i, is zero,

$T_{i,Z}(s_i) = \quad 0$ (6.1)

In Special Relativity, the Lorentz-Fitzgerald transformation, requires that velocity approach the speed of light,

as $v \rightarrow c$

$\sqrt{(1-v^2/c^2)} \rightarrow 0$

If one adds, another key property, that time dilation, is not altered, such that,

$T_{i,Z}(t_i) = \quad t_i$ (6.2)

or at least that the time dilation factors are similar,

$T_{i,Z}(t_i) \approx \quad t_i$ (6.3)

where t_i = is the time dilation property of frame of reference, i.

then, equations, (6.2) and (6.3) provide the basis for a translocation technology. The two tizzy transformations require a technology that is capable of providing asymmetrical transformations, with respect to space and time. The frame of reference transformations are such that it applies to space but not to time.

Then, the tizzy transformation provide a path, n-m, from m to n, as follows,

$F_n(t_i,x_n,y_n,z_n) = \quad T_{i,z} F_m(t_0,x_m,y_m,z_m)$ (6.4)

Such that,

$T_{i,z}(\sqrt{[(x_n-x_m)^2 + (y_n-y_m)^2 + (z_n-z_m)^2]}) \approx \quad 0$ (6.5)

This is the Box Paradox measurement dichotomy. The term "dichotomy" is used, because neither 'inconsistency' nor 'uncertainty' are suitable terms to describe two different but real measurements.

The fact that distances change by our relationship to the rest of the world, our type of frame of reference, enables the development new propulsion technologies. One day we will be able to ask the question, how far do you want Alpha Centauri to be?

7 What will this Technology Look Like?

The two tizzy transformations,

$T_{i,Z}(s_i) = \quad 0$ (7.1)

$$T_{i,Z}(t_i) = t_i \qquad (7.2)$$

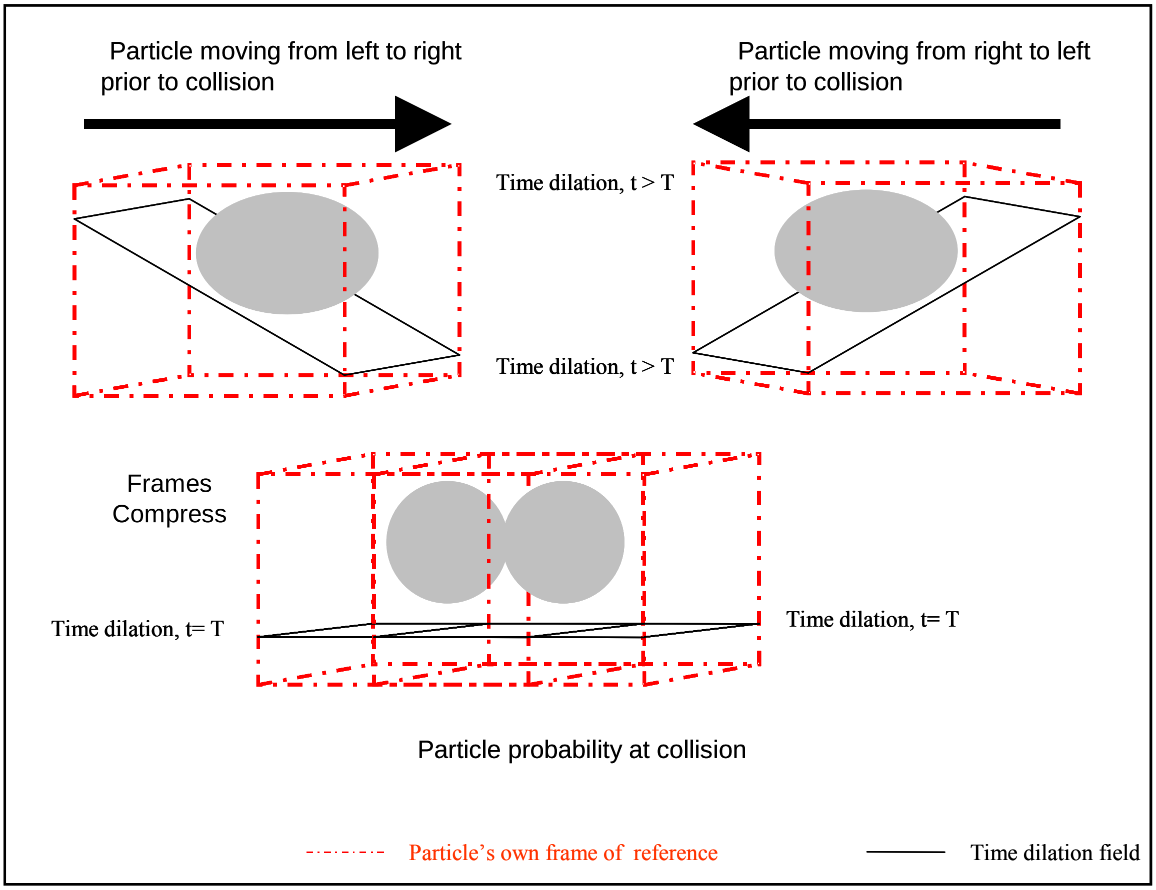
show that translocation technology should produce asymmetrical transformations, with respect to space (7.1) and time(7.2). Dr. Vadim Chernobrov (J Randles, 2005), has demonstrated the opposite asymmetrical transformations, time but not distance. Note, however, there is some debate about the validity of Dr. Chernobrov's results.

One can infer the following technology characteristics,

1. The key characteristic is the technology's ability to generate asymmetric transformations with respect to space and time.
2. The technology manipulates distance and not time. Time travel is incorrect.
3. The technology does not use velocity. Velocity causes both time dilation, and length contraction, simultaneously. We require only the second.
4. The technology does not use mass as a technology driver, as this induces relativistic effects with respect to time.
5. Therefore, one is left with fields. This technology will utilize field effects to achieve the translocation.

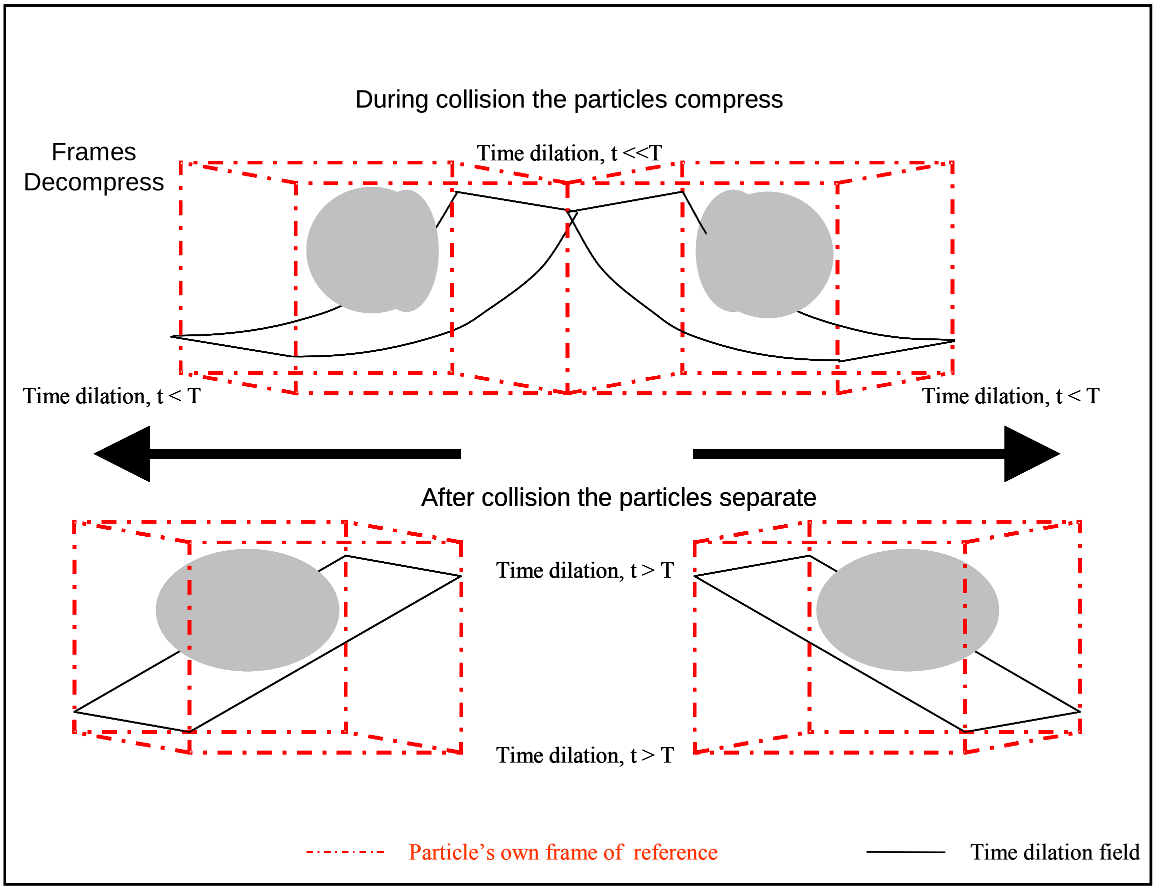
Conclusion

1. More research is required into behavior and manipulation of frames of references.
2. Future technologies will manipulate space and not time.
3. Research into Asymmetric Transformations is critical to future propulsion technologies.



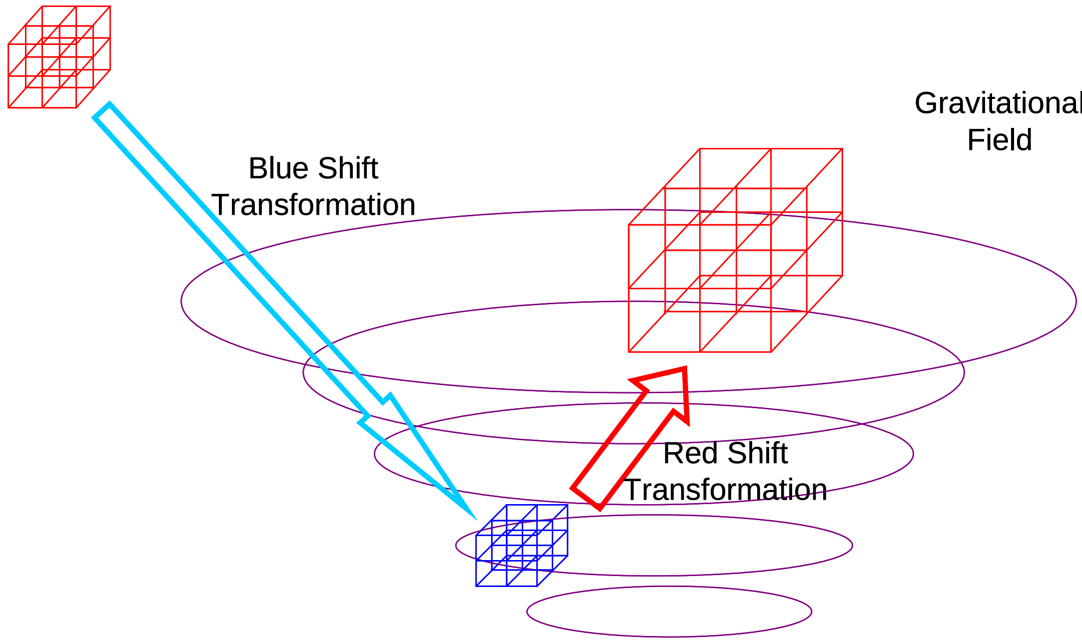
Source: BT Solomon, A New Approach to Gravity and Space Propulsion Systems, ISDC 2003

Fig. 1.1: Convergence of Frames of Reference



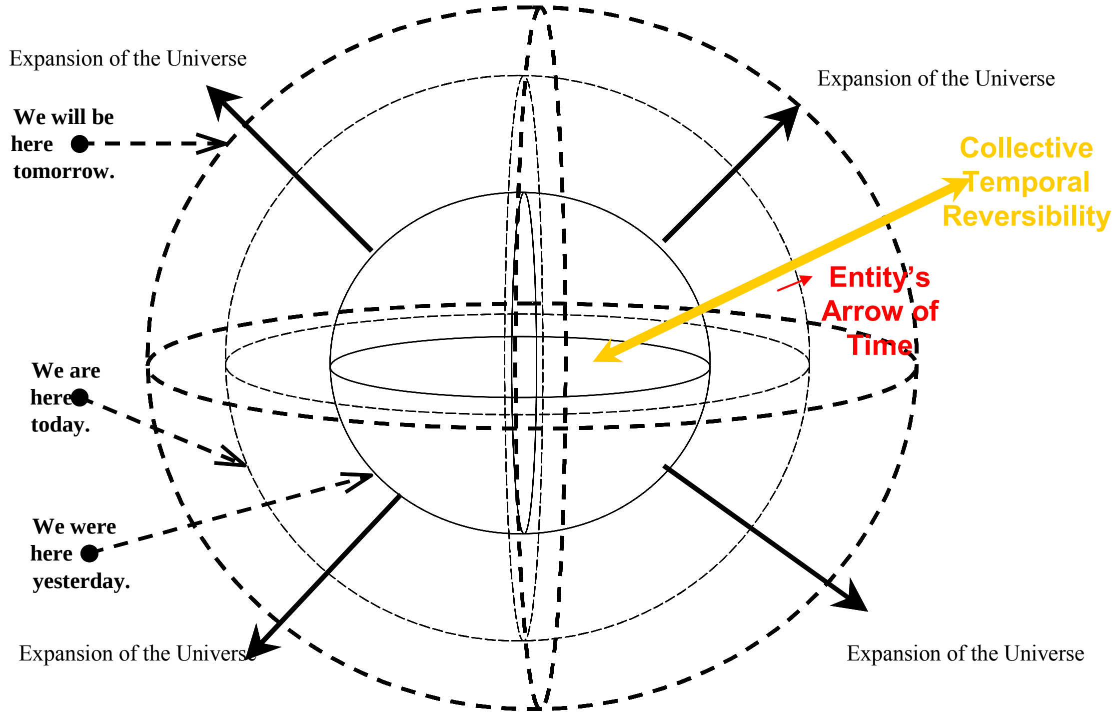
Source: BT Solomon, A New Approach to Gravity and Space Propulsion Systems, ISDC 2003

Fig. 1.2: Divergence of Frames of Reference



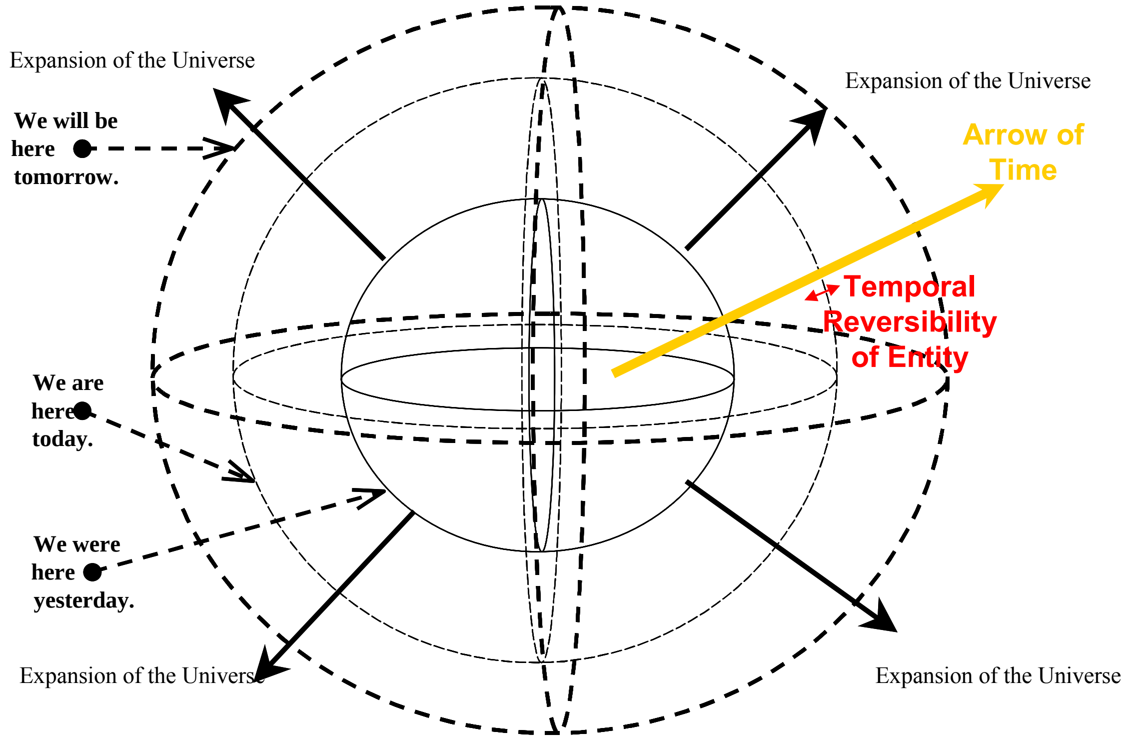
A gravitational field is an example of how a frame of reference is transformed in a consistent manner, independent of the observer.

Fig. 2.1: Independent Transformations



Adapted From: BT Solomon, Reaching The Stars: Interstellar Space Exploration Technology Initiative (iSETI) Report, 2003, ISBN 0-9720-116-3-3

Fig. 3.1: Time Travel with Collective Temporal Reversibility



Adapted From: BT Solomon, Reaching The Stars: Interstellar Space Exploration Technology Initiative (iSETI) Report, 2003, ISBN 0-9720-116-3-3

Fig. 3.2: Individual Temporal Reversibility

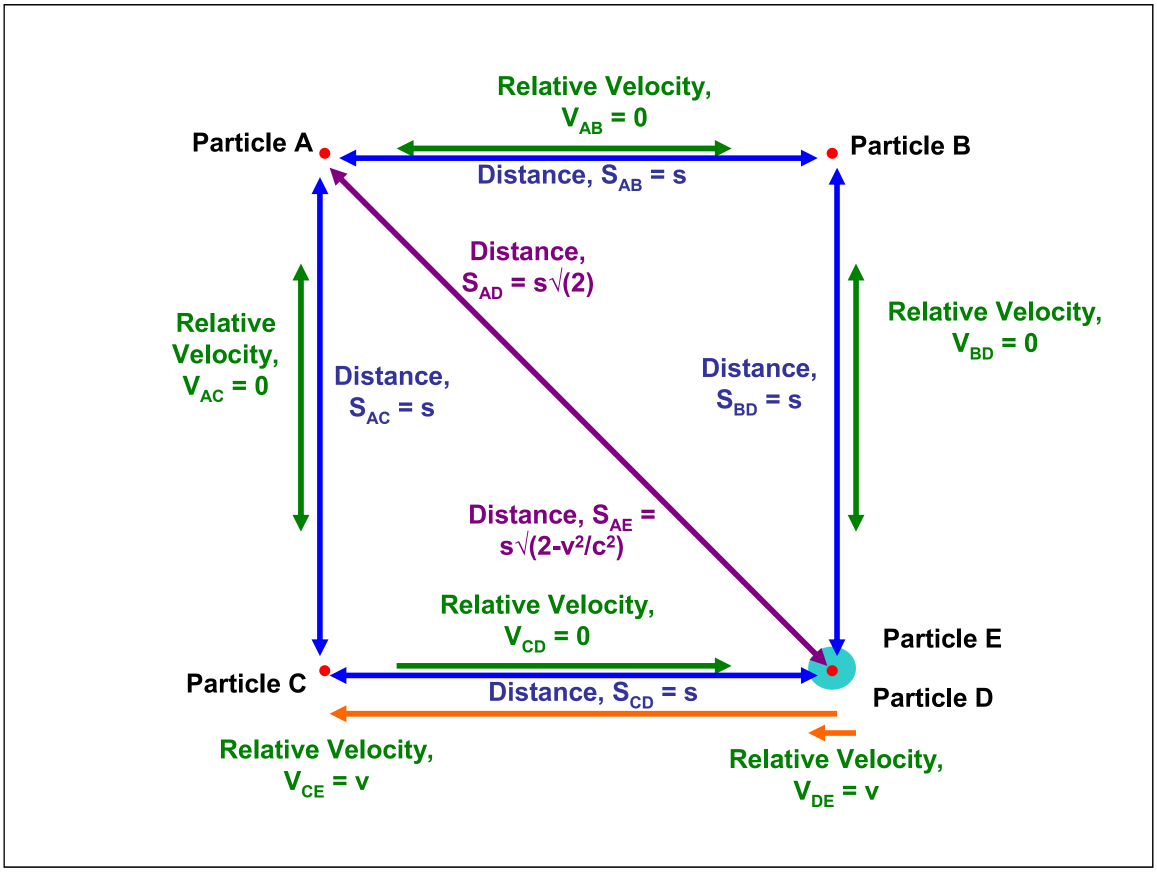


Fig. 5.1: 5-Particle Box Paradox

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