The Motion of Light

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Contents

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Introduction

Q[uestion]1.0.: What is the motion of light?
A[nswer]1.1.: 186,000 mps (miles per second), or $\boldsymbol{c}$, *in vacuo*, in a vacuum, a subvolume of space that is devoid of matter-energy (m/e), wherein a *light photon*, a *lightray* (LR), a *lightwave* (LW) or a *wavicle*, ($\boldsymbol{L}$), has an *absolute velocity* (AV_L) of 186,000 mps and travels past any entity (E) that has an $AV_E < \boldsymbol{c}$ at a *relative velocity* (RV) of $RV = AV_L \pm AV_E$ [but no more than $2\boldsymbol{c}$]!
... or ...
A1.2.: 186,000 mps, or $\boldsymbol{c}$, or $RV_L = \boldsymbol{c}$, for all observers in any and all reference frames or upon any and all reference bodies!

NOTE: For fun, because questions have question marks, answers ought to have exclamation marks.

A1.1. is the answer that is the result of observations of the distance/duration of the motions of light photons from observations of light emitted by/from orbiting stars and the intuitions inre (in regards, in regards to, about, concerning) the Einstein Railroad Diagrams and traditional concepts and principles of physics.

A1.2. is the answer that is one of the results of the Michelson-Morley Interferometer Experiment (and replications thereof) and one of Einstein's postulates (axioms, assumptions) for Special and General Relativity.

Either the motion of light is described by A1.1.: $AV_L = \boldsymbol{c}$ and $RV = AV_L \pm AV_E$ or by A1.2.: $RV_L = \boldsymbol{c}$.

But not *both* A1.1. and A1.2.

This result will be presented in this paper.

To facilitate the presentation of the concepts and principles that are relevant to the conclusions presented in this paper the relevant concepts and principles of philosophy and physics are presented by means of operational definitions to ensure that there are no misunderstandings of what is meant by the terms and phrases used herein.

Philosophy

The Operational Definition of Philosophy

Philosophy is the discipline whose practitioners – philosophers – search to find and thereby discover or otherwise create and then maintain, study, and revise, if necessary, the master set of concepts, principles and techniques that are the philosophers' tools that can be used to conceptualize reality and to solve problems.

[The short operational definition of *Philosophy*.]

Philosophy is the discipline whose practitioners – philosophers – search to find and thereby discover or otherwise create and then maintain, study, and revise, if necessary, the master set of concepts, principles and techniques that are the philosophers' tools that can be used to conceptualize reality and to solve problems and that practitioners in other disciplines can use for discovering, creating and maintaining, studying and revising the terms (single words) and phrases (sets of two or more words) they will use to conceptualize reality and to solve problems inre the concepts, principles and techniques that are relevant to their subject of study

[The long operational definition of *Philosophy*.]

The Philosophers' Tools

The philosophers' tools are the master concepts, principles and techniques philosophers have discovered or created and maintained, studied, and revised, if necessary that praactitioners in other disciplines can use for discovering, creating and maintaining, studying and revising the terms and phrases they will use to describe the concepts, principles and techniques that are relevant to their subject of study.

The philosophers' tools include but are not limited to ...

1. The Operational Definition;
2. The Laws of Logic (not presented herein);
3. The Concepts, Principles and Techniques inre Inductive Thinking (not presented herein);
4. The Concepts, Principles and Techniques inre Deductive Thinking (not presented herein);
5. The Concepts, Principles and Techniques inre Logical Arguments (not presented herein);
6. The Concept of Proof (not presented herein);
7. The Problem-Solving Process (not presented herein);
8. The Decision-Making Process (not presented herein).

The Operational Definition

An operational definition is a definition which defines a term (one word) or a phrase (two or more words) by a description of the observation or/and measurement of the people, the objects or/and the events who/which are relevant to the term or phrase being defined.

Ex(ample): *Love* [term being defined operationally] is when *someone says they like you and they do nice things with you and for you* [description of the observation/measurement of the people, objects or/and events who/which are relevant to the term being defined, *love*]. [A child's operational definition of *love* from a radio program whose host, call letters and date were not recorded.]

Ex: *Love* [term being defined operationally] is when *you would rather be with someone than without them* [description of the observation/measurement of the people, objects or/and events who/which are relevant to the term being defined, *love*]. [An operational definition of *love* from Phyillis Goyette, a friend, circa the 1960s.]

Ex: *Love* [term being defined operationally] is when *Mom see Dad on the toilet and doesnt think it's gross* [description of the observation/measurement of the people, objects or/and events who/which are relevant to the term being defined, *love*]. [A teendage girl's operational definition of *love* from an **Headlines** segment of **The Tinight Show with Jay Leno** on NBC-TV whose date was not recorded.]

While none of these operationa definitions of *love* precisely describe all possibilities inre *love* they nevertheless present *some* of the possibilities inre *love* that are relecant to *love* and possibly can be included in in a final precise operational definition of *love*.

The Concept of the Concept

A concept is a mental representation (idea, intuition) of a person, an object or an event.

Ex: Concepts: A woman named Jane, a man named Dick, a ball, and a dog named Spot (who is Jane's dog).

The Concept of the True Concept

A true concept is an accurate concept – a mental representation (idea, intuition) that accurately represents a person, an object or an event.

The Concept of the False Concept

A false concept is an inaccurate concept – a mental representation (idea, intuition) that does not accurately represent a person, an object or an event.

The Concept of a Person

A person is an entity comprised of the biological or organic form of matter-energy (m/e) who retains his/her identity for a longer period of time than a relevant event.

Ex: Concepts of Persons: Jane, Dick.

NOTE: Although Spot, Jane's dog, is comprised of an organic form of m/e, he is not considered to be an entity who/which is a person.

The Concept of an Object

An object is an entity comprised of the non-biological or inorganic form of m/e which retains its identity for a longer period of time than a relevant event.

NOTE: The distinction between people and objects is the distinction between people being comprised of organic m/e and objects being comprised of inorganic m/e.

Ex: Concept of an Object: The ball.

The Concept of an Event

An event is a causal or coincidental relationship between or among people, objects or/and events.

Ex: Concept of an Event: Jane throws the ball to Dick – Jane is the cause of the effect/event wherein the ball traveled through space over time to Dick. Spot is proximal to but does not interfere with the ball traveling through space over time, therefore Spot is coincidental to the event wherein Jane caused the ball to travel through space over time to Dick.

The Concept of the Principle

A principle is a mental representation idea, intuition) of a causal or proximal (coincidental) relationship between or among people, objects or/and events.

The Concept of the True Principle

A true principle is an accurate principle – a principle which accurately describes or accurately refers to an actual causal or coincidental relationship between or among people, objects or/and events.

The Concept of the False Principle

A false principle is an inaccurate principle – a principle which does not accurately describe or accurately refer to an actual causal or coincidental relationship between or among people, objects or/and events.

The Concept of Causality

Causality is the event that occurs when people, objects or/and events who/which are comprised of m/e and who/which as causes cause as effects (A) changes in the physical states of pre-existing people, objects or/and events or (B) new people, objects or/and events from pre-existing m/e.

Causality = Causes Causing Effects

The Sequence of Causality/The Causality Sequence

Causality occurs in a sequence over time.

The Sequence of Causality/The Causality Sequence:

1. P/Conditions/Causes → 2. Q/Consequence(s)/Effect(s)

Whereas the causality sequence occurs over time and thereby has an endurance or duration, the sequence can

be determined by, and measured by the use of clocks.

At T1 the P/Conditions/Causes are present; at T2, the Q/Consequence(s)/Effect(s) is/are present.

T1. P/Conditions/Causes → T2. Q/Consequence(s)/Effect(s)

If the time of a causality sequence is measured by observers in different reference frames who use distortable clocks, clocks whose tickrates (rates of ticking) are distorted by changes of the clocks' kinetic mass-energies (KMEs) caused by accelerations or decelerations, then the causality time sequence may appear to some observers to be reversed. This causality sequence reversal is an illusion created by the use of distortable clocks.

If non-distortable clocks, clocks whose tickrates are adjusted and thereby synchronized to compensate for changes of the clocks' KMEs caused by accelerations/decelerations are used for the measurement of a causality sequence, then, because the non-distortable (adjustable, synchronized) clocks' timepoints, timelines, and timecounts are identical, and are so regardless of the motions including accelerations/decelerations of reference frames, the causality time sequence will always be as described thus:

T1. P/Conditions/Causes → T2. Q/Consequence(s)/Effect(s)

The Causality Link Between Causes and Effects

For causality to occur, there must be and therefore is a physical link, or connection, or contiguity, between the P/Conditions/Causes and the Q/Consequence(s)/Effect(s).

Regardless of what is that physical link/connection/contiguity, and regardless of whether/not that physical link/connection/contiguity is directly or indirectly observable/measurable, the physical link/connection/contiguity is a physical reality.

This physical causality link is implied/inferred by the Corollaries of the Law of Causality.

The Law of Causality

The Law of Causality: People, objects, and events will retain their physical states (including inertial states) until acted upon by forces which cause changes in those physical states.

The Corollaries of the Law of Causality

The Corollaries of the Law of Causality:

1. A force is a form of matter-energy (m/e).
2. A force is a push (push-force) or a pull (pull-force).
3. Only a force can cause a change of physical state (a change of physical state does NOT occur without a cause; a physical state is an effect caused by a cause which is a force of some kind).
4. The observation/measurement of a change of physical state implies that resulting state is an effect caused by a cause which is a force which is a form of m/e.

The observation/measurement of a change of a physical state implies that there is a causal link/connection between the cause and the effect which is the change of the physical state.

The causal link is the physical contact of a cause with an effect by means of a force.

The Concept of Coincidentiality (Proximality)

Coincidentiality or proximality is the non-causal nearness of people, objects or/and events to other people, objects or/and events. People, objects and events who/which are coincidential/proximal do not interact with and therefore and thereby are not causal inre other people, objects or/and events. Coincidental/proximal people, objects and events do not have physical contact with other people, objects and events.

The Concept of the Technique

A technique is an application of a principle for the purpose of solving a problem.

The Concept of a Problem

A problem is learning or discovering how to achieve a desire or avoid a fear.

All problems have the characteristic of learning or discovering how to achieve a desire or avoid a fear.

The Concept of a Desire

A desire is wanting a person, an object or/and an event.

The proof that an individual has a desire for a person, an object or an event is his/her approach behavior towards that desired/desirable person, that desired object or that desired event. When an individual approaches a person, an object or an event, he/she is demonstrating and thereby proving that he/she has a desire for that person, that object or that event.

The Concept of a Fear

A fear is not-wanting a person, an object or an event.

The proof that an individual has a fear of a person, an object or an event is his/her avoidance behavior away from that feared/fearsome person, that feared object or that feared event. When an individual avoids a person, an object or an event, he/she is demonstrating and thereby proving that he/she has a fear of that person, that object or that event.

The Concept of the Practical Technique

A practical technique is an application of a causal principle that achieves a desire or avoids a fear and thereby solves a problem.

The Concept of the Impractical Technique

The impractical technique is an application of a causal principle that does not achieve a desire or avoid a fear and thereby does not solve a problem.

The Concept of Knowledge

Knowledge is an individual's or organization's set of concepts and principles and techniques.

The Concept of True Knowledge

True knowledge is an individual's or organization's set of accurate and therefore true concepts and principles and practical techniques.

The Concept of False Knowledge

False knowledge is an individual's or organization's set of inaccurate and therefore false concepts and principles and impractical techniques.

The Concept of Conceptualization

Conceptualization is the observation and measurement of reality for the purpose of develop concepts, principles and techniques that can be used to solve problems.

The Two Sources of Concepts and Principles: Observation and Intuition

There are two sources of facts – information that can serve as proof of an hypothesis-to-be-proven: (1) observation and (2) intuition.

The Concept of Observation

Observation is the use of the perceptual organs inre sight,hearing, touch, smell, and taste to perceive space, time and matter-energy to learn if/not there exist in space, endure over time and comprised of matter-energy people, objects and events.

The observations perceived by the use of the percptual organs – analyzed for the possibility of illusions – become facts that are independent of opinions until discomfired by additional observations.

The Concept of Intuition

Intuition is the mental manipulation of concepts and principles for the purpose of imagining the existence and therefore the reality of other concepts and principles inre space, time and matter-energy and the people, objects and events who/which exist in space, endure over time and are comprised of matter-energy and who/which as causes cause as effects (A) changesof the physical states of pre-existing people, objects and/or events or (B) new people, objects and/or events from pre-existing matter-energy.

The Scientific Method requires observation (and measurement) inre physical phenomena for factual information that can serve as proof of an hypothesis-to-be-proven (verified/falsified) but intuition can provide insights and information where observation cannot be done.

The Scientific Method

1. Observe examples of a phenomenon.
2. Develop a causal or coincidental (proximal) hypothesis-to-be-proven.
3. Observe additional examples for data that can confirm or disconfirm the hypothesis.
4. Determine if/not the hypothesis has been proven/confirmed.
5. If the data confirm the hypothesis, then release (publish) info inre the hypothesis and the data confirming the hypothesis so other researchers can replicate the observations and confirm the hypothesis – which, if continuously confirmed, becomes a scientific principle or natural causal relationship (NCR) or a natural proximal relationship (NPR); if the data disconfirm the hypothesis, then either adjust the hypothesis to fit the data (if possible) or discard the hypothesis and create a new hypothesis and conduct Steps 2-5.

Observation occurs when people use the perceptual senses of sight, hearing, touch, smell, and taste and machines (devices) which augment the perceptual senses including telescopes and microscopes for augmenting sight and hearing aids and audio amplifiers for augmenting hearing to discover the people, objects and/or events who/which are comprised of m/e and who/which are physical evidence who/which confirm or disconfirm hypotheses inre natural causal relationships (NCRs) and natural proximal relationships (NPRs).

The inductive method of thinking occurs when people observe a number of cases wherein causal or proximal similarities occur which prompt the observers to create a causal or proximal hypothesis to be tested and confirmed or disconfirmed by the use of the scientific method requiring additional observations.

The deductive method of thinking occurs when people used confirmed concepts and principles to create new concepts and principles as hypotheses to be verified/falsified by the scientific method.

Intuition occurs when people link together concepts and principles to form new concepts and principles as hypotheses to be researched (verified or falsified) by the scientific method and as confirmed hypotheses, new facts or new NCRs and NPRs if/when the hypotheses are confirmed.

Physics

Physics is the discipline whose practitioners – physicists – study the causes of the changes of the positions, motions and/or physical states within space over time of people, objects, and events who/which are comprised of matter-energy (m/e).

The Concept of the Universe

The universe is the combination of space, time and matter-energy (m/e).

Universe = Space + Time + M/E.

The Concept of Space

Space, along with time and m/e, is one of the components of the universe, ...

Universe = Space + Time + M/E.

Space, the spatial component of the universe, is the one-and-only volume of infinite size (the infinite volume, or i-volume, the volume of infinite radius or diagonal) that has no surface and therefore no shape, that surrounds all volumes of finite size (finite-volumes, or f-volumes, or subvolumes) and which is a pure vacuum inre subvolumes that are devoid of m/e, and within which distances are measured by chosen distances called space-intervals (SIs).

NOTE: The i-volume which is space eliminates any possibility of the existences and realities of any other i-volumes that could be spaces. Therefore, there is one space, one-and-only-one space, one-and-only-one spatial component of the universe, and therefore there is one-and-only-one universe.

The essence of space is *distance*. People, objects and events have positions (locations), separations, sizes, and volumes. The positions of people, objects and events are located at distances from chosen origins and separated by distances from each other. At any chosen timepoint, between the Sun and the Earth is a specific distance. Between the event wherein a photon is emitted from the Sun and the event wherein the photon is detected on the Earth there is a distance – the distance separating the Sun from the Earth. The sizes and volumes of people, objects and events are measured by chosen distances – each person, each object and each event has a size and a

volume measurable by a length, a width and a height or depth that can be measured by a chosen distance.

The chosen distance for the unit of spatial measurement is a space-interval (SI). The SI is used to measure the distances between people, objects, and events, the lengths, heights, widths, and depths of people, objects and events, and is used to determine the changerates inre the distances between and the lengths, heights, widths, and depths of people, objects and events.

The sizes (lengths, heights, widths, and depths) of people and objects change when people and objects are accelerated or decelerated. When accelerated, people and objects decrease in size; when decelerated, people and objects increase in size. Similarly, rulers decrease in length when accelerated and increase in length when decelerated.

The characteristic common to rulers which increase in length when accelerated and decrease in length when decelerated is their distortability – these rulers are distortable rulers.

Thus, when accelerated, distortable rulers decrease in length but when decelerated distortable rulers increase in length.

The space-interval (SI) of a distortable ruler varies inversely with accelerations and decelerations.

Thus the space-interval of a distortable ruler is a variable space-interval (VSI), and the ruler is therefore a variable space-interval ruler (VSIR).

The distance defined by a variable space-interval ruler (VSIR) is a variable space-interval ruler distance (VSIRD) and its length can be used to measure local space (LS), the distances relative to a single reference frame or reference body.

If the space-interval of a distortable ruler were adjusted to compensate for the distortions caused by accelerations and decelerations, then that space-interval would become an invariable space-interval (ISI) and its ruler would then become an invariable space-interval ruler (ISIR).

If the ruler had a piston or ram that could be extended or closed that would vary the length of the ruler, either by radio signals from a master ruler, or by an inertial system of accelerometers that would detect accelerations and decelerations and computers that would adjust the ruler's length so its space-interval is maintained at a desirable preset length, then that ruler would become an invariable space-interval ruler (ISIR) and its length would become an invariable space-interval ruler distance (ISIRD) for the measurement of absolute space (AS), the identical distances relative to multiple reference frames and reference bodies.

The Concept of Time

Time, along with space and matter-energy (m/e), is one of the components of the universe, ...

Universe = Space + Time + M/E.

Time, the temporal component of the universe, is the measurement of durations by the use of chosen durations.

Durations

A *duration* is the existence of a phenomenon over a period of time. A duration is an endurance.

The durations to be measured by temporal measurement are the durations between the occurrences of multiple events, the durations of single events, and the durations (ages) of people, objects and events.

Chosen Durations

The *chosen durations* used for temporal measurement are typically cycles, or consistent repetitions of motions. They can be based upon known physical phenomena or they can be abstractions of physical durations.

The *standard second* is defined to be 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom. [1]

The Time-Interval (TI)

The chosen duration for temporal measurement is a *time-interval* (TI).

A TI determines a clock's timerate, timepoints, timeline, and timecount.

The Timerate

A clock's *timerate* is its tickrate, or rate of ticking. A timerate is measured in ticks-per-minute, or ticks-per-hour.

The Timepoints

A clock's *timepoints* are its marks, its timemarks, along a timeline or continuum.

A clock's timepoints are the marks that are the moments or instants that enable observers to determine the sequences of events (events occurring at different timepoints), the simultaneity of events (events occurring at the same timepoints), the causalities and coincidentialities of events, and the changerates of events (timerates of events), and to coordinate (synchronize) events inre single and multiple reference frames and bodies.

The Sequences of Events

A *sequence of events* is a series of events occurring at consecutive timepoints on a timeline.

Simultaneity

Simultaneity is as two or more events occurring at the same timepoint on a timeline.

The Simultaneities of Events

The *simultaneities of events* are the occurrences of events at the same timepoints on a timeline. When events occur at identical timepoints on indentical timelines, then the events are simultaneous.

The Causalities and Coincidentialities of People, Objects and Events

The *causalities and coincidentialities* of people, objects and events are determined by their occurrences at timepoints on timelines and whether/not they are physically contacted by each other, by whether/not they are causally contiguous or coincidentially proximal.

The Changerates of Events

A *changerate* is the rate at which an event changes or occurs. When events change, they undergo a changerate that can be measured by timepoints on timelines inre timepieces.

The Timeline

A clock's *timeline* is its continuum, history, or linear record of the passages of timepoints from the past through the present into the future.

The past is what was – the previous timeline, the previous record, the present is what is – the current timepoint on the current timeline, and the future is what will be – the forthcoming timeline, the forthcoming record.

The Timecount

A clock's *timecount* is its readout, or accumulation, or summation, of timepoints along its timeline.

A clock's timecount accumulates always from the past through the present into the future, generating a direction for the passage of time, the direction of time, the arrow of time.

By the use of a clock, the sequence of events, the simultaneity of events, the causality and coincidentiality of events, and the changerates of events can be determined and events can be coordinated (synchronized) inre single or multiple reference frames or reference bodies.

The Timepiece

A *timepiece* is a device used for the measurement of time (for the measurement of durations); a timepiece could be a clock, a watch, an hour-glass, or an atomic clock.

The Effects Caused by Accelerations and Decelerations of Clocks

When a clock is accelerated or decelerated, it undergoes effects that are changes inre its time-interval, timerate, and timecounts.

When accelerated a clock's time-interval increases and as a result its timerate and its timecount decrease; when decelerated a clock's time-interval decreases and as a result its timerate and its timecount increase.

The Cause of the Effects of Clocks' Timerate and Timecount Changes: KME

The cause of the increases or decreases of a clock's time-interval and the consequent decrease or increase in the clock's timerate and timecount is the change of the clock's kinetic mass-energy (KME) caused by accelerations or decelerations.

With an acceleration, clocks' KMEs increase and clocks' timerates and timecounts slow down; with a deceleration, clocks' KMEs decrease and clocks' timerates and timecounts increase.

The effects of KME changes on clocks' timerates and timecounts are similar to the effects of increases and decreases of weights upon the walkrate and walkcount of a walking man. With no weight other than his own, a normal man will have a walkrate or rate of walking which could be figured in miles per hour. A normal man's walkrate is typically four miles per hour and therefore his walkcount or the miles he will walk in one hour will be four miles in one hour. With an increase of weight upon him, a normal man's walkrate will decrease and he will walk slower and his walkcount will decrease; with a decrease of weight from him, a normal man's walkrate will increase and he will walk faster and his walkcount will increase.

The Essence of Time: The Time-Interval (TI)

The *essence of time* is the time-interval (TI, pronounced *Tee-Eye*), the chosen duration used as the unit of temporal measurement, the duration used for the measurement of other durations.

The duration of the TI sets the timerate, timepoints, timeline, and timecounts of timepieces (clocks, watches – timekeeping devices, time-measuring devices).

The Two Types of TIs: (1) The VTI; (2) The ITI

There are two types or kinds of TIs: (1) The Variable Time-Interval (VTI, *VEE-Tee-Eye*) and (2) The Invariable Time-Interval (ITI, *EYE-Tee-Eye*).

The Variable Time-Interval: The VTI

The *variable time-interval* (VTI) varies directly with changes of a kinetic matter-energy (KME) and inversely with accelerations and decelerations.

Accelerations cause increases in a timepiece's KME that cause increases in the duration of a timepiece's VTI; decelerations cause decreases in a timepiece's KME that cause decreases in the duration of a timepiece's VTI. Thus, a timepiece's VTI varies inversely with accelerations and decelerations.

A VTI is a *distortable* TI.

The Invariable Time-Interval: The ITI

The *invariable time-interval* (ITI) does not vary regardless of accelerations and decelerations and changes of its timepiece's KME.

The reason an ITI does not vary regardless of accelerations or decelerations or KME changes is the fact that it is adjusted to compensate for the effects of accelerations, decelerations and KME changes inre its TI.

An ITI is a *non-distortable* TI; an ITI is an *adjustable* TI.

The Two Types of Timepieces: (1) The VTIC; (2) The ITIC

Because there are two types of TIs, the VTI and the ITI, there are two types of timepieces or clocks: (1) The Variable Time-Interval Clock (VTIC, *VEE-Tick*) and (2) The Invariable Time-Interval Clock (ITIC, *EYE-Tick*).

The Variable Time-Interval Clock: The VTIC

The *variable time-interval clock* (VTIC) varies because it is not adjusted to compensate for the effects of accelerations, decelerations and KME changes.

The VTIC is a distortable timepiece.

The VTIC is a non-adjustable timepiece.

The Invariable Time-Interval Clock: The ITIC

The *invariable time-interval clock* (ITIC) does not vary because it is adjusted to compensate for the effects of accelerations, decelerations and KME changes.

The ITIC is a non-distortable timepiece.

The ITIC is an adjustable timepiece.

Thus, ...

The VTIC is a distortable timepiece; the ITIC is a non-distortable timepiece.

The VTIC is a non-adjustable timepiece; the ITIC is an adjustable timepiece.

The Two Types of ITICs: (1) The RITIC or RC; (2) The IITC or IC

There are two types of ITICS: (1) The Radio Invariable Time-Interval Clock (RITIC, *RYE-Tick*) or Radio Clock (RC) and (2) The Inertial Invariable Time-Interval Clock (IITIC, *EYE-EYE-Tick*) or Inertial Clock (IC).

The Radio Invariable Time-Interval Clock: The RITIC or RC

The *radio invariable time-interval clock* (RITIC or RC) consists of a *master clock* (MC) that sends timing signals that control the timerates and timecounts of *slave clocks* (SCs).

The RC type of timepiece is found in the standard clocks of the USNO (United States Naval Observatory), the NIST (National Institute of Standards and Technology, United States), and the BIPM (Bureau Internationale des Poids et Measures, France).

The RCs of the USNO are the standard clocks that are used for controlling the master clock of the US GPS (United States Global Positioning System) that controls the timerates and timecounts of slave clocks in the GPS satellites so all GPS satellite slave clocks have the identical timerates and timecounts that are necessary for the GPS nav system to operate as designed and as needed.

SCs of RCs are dependent on the stability of their MCs; so long as their MCs are stable, are neither accelerated nor decelerated, then the RC's will function as designed and as needed.

Thus, RCs are dependent on the stability of their reference frames/bodies.

The Inertial Invariable Time-Interval Clock: The IITIC or IC

The *inertial invariable time-interval clock* (IITIC or IC) consists of a set of accelerometers that detect changes of the IC's inertial state (accelerations and decelerations) and a computer that adjusts the IC's timerate and timecount to maintain a pre-set or initial timerate and timecount.

ICs are 100% independent of any and all reference frames/bodies.

ICs are found in the INS (Inertial Navigation System) in military aircraft, ships, submarines, tanks, etc., and in civilian aircraft and ships.

The Two Types of Time: (1) VTICT; (2) ITICT

Because there are two types of TIs, VTI v ITI, and two types of timepieces or clocks, VTIC v ITIC, there are two types of time: (1) Variable Time-Interval Clock Time (VTICT, *VEE-Tick-Tee*) or Local Time (LT) and (2) Invariable Time-Interval Clock Time (ITICT, *EYE-Tick-Tee*) or Absolute Time (AT) or Adjustable Time (AT).

The Variable Time-Interval Clock Time: The VTICT or LT

The *variable time-interval clock time* (VTICT) is distortable time, local time, the type of time that is distorted by accelerations and decelerations and KME changes.

The VTICT is Einstein's time, the type of time measured by VTICs, the time that is sometimes called *local time* (LT), or *proper time*, the time that is unique to a reference frame or reference body, the time that must be specified for a time-value to be meaningful, to have *time-value*.

The Invariable Time-Interval Clock Time: The ITICT or AT

The *invariable time-interval clock time* (ITICT) is non-distortable time, the time that is called *adjustable time*, (AT) or *absolute time* (AT), the type of time that is NOT distorted by accelerations and decelerations and KME changes, the time that is common to all reference frames and reference bodies, the time that defines for the entire universe the past - present - future continuum, the time that defines for the entire universe the absolute sequence of events, simultaneities of events, the causalities and coincidentialities of events, and the changerates of events, and the time that can be used for coordinating (synchronizing) events in single and multiple reference frames and upon single and multiple reference bodies.

The ITICT is Newton's time, the time that is the same for all reference frames and bodies, the time that was denied reality but now cannot be denied because it exists and therefore is real inre the RCs and ICs that are operational and that serve as examples of ITICs and therefore ITICT.

The ITICT is the time that is broadcast by the GPS nav system, which is used for time standards by real-world scientists for real-world scientific research.

Time: The Temporal Principle and the Temporal Process

The essence of time is duration. People, objects and events endure – each person, object and event has a duration, an age. Between the occurrences of events are durations. Between the event wherein a photon is emitted from the Sun and the arrival of the photon at the Earth's surface is a duration – the time of the photon's transit from the Sun to the Earth.

Durations are observed inre the repetitions of natural cycles including the rotations about their axes of planets, moons and suns, the orbits of moons about planets, the orbits of planets about suns, and the frequencies associated with atoms.

The durations of natural and man-made cycles, repeated actions, and recurring motions, can be used to create/define time-intervals which can be used to measure durations.

The fact that cycles can be used to create/define time-intervals which can be used to measure durations is a principle of time, a temporal principle, a description of what is time and how time can be used.

Time-intervals can be used in the designs of timepieces (clocks, watches, etc.). Time-intervals can generate in timepieces their timerates (rates of ticking, tickrates), their timepoints (timemarks on a timeline), their timelines (records of timepoints, histories of the occurrences of timepoints), and their timecounts (counts of timepoints, the accumulation of timepoints, always by addition from a chosen origin, a chosen timepoint, thus creating a direction of time, an arrow-of-time, from the past through the present into the future).

With timepieces providing time-intervals, timerates, timepoints, timelines, and timecounts, the durations between the occurrences of multiple events, the durations of single events, and the durations (ages) of people and objects can be measured.

Thus, durations can be measured by durations. [Similarly, distances can be measured by distances, e.g. intervals in space, distances, can be measured by space-intervals, chosen distances.]

In addition to the measurement of the occurrences of multiple events, the durations of single events, and the durations of people and objects, the time-intervals, timerates, timepoints, timelines, and timecounts generated by timepieces can be used to determine the sequences of events, the simultaneities of events, the causalities and coincidentialities of events, and the changerates (rates of changes, rates of changes of physical states) of events and for the coordination/synchronization of events.

Moreover, the time-intervals, timerates, timepoints, timelines, and timecounts generated by timepieces can be

used to measure the durations between the occurrences of multiple events, the durations of single events, and the durations of people and objects and for the determination of the sequences of events, the simultaneities of events, the causalities and coincidentialities of events, and the changerates of events and for the coordination/synchronization of events inre single and multiple reference bodies/frames.

The incorporation of a time-interval into the design, fabrication and deployment of a timepiece for generating the timepiece's timerate, timepoints, timeline, and timecount which can be used to measure the durations between the occurrences of multiple events, the durations of single events, the durations of people and objects, and for the determination of the sequences of events, the simultaneities of events, the causalities and coincidentialities of events, and the changerates of events and for the coordination/synchronization of events inre single and multiple reference bodies/frames is a process of time, a temporal process.

Thus, time is both a temporal principle and a temporal process.

Here is a comprehensive operational definition of time ...

Time = **(I) The Temporal Principle** by which a duration can be chosen to be a time-interval which can be used in timepieces to generate their timerates, timepoints, timelines, and timecounts which can be used to measure the durations of the occurrences between multiple events, the durations of single events and the durations (ages) of people and objects and for the determination of the sequences of events, the simultaneities of events and the causalities and coincidentialities of events, and the changerates of events and for the coordination/synchronization of events inre single and multiple reference bodies/frames and **(II) The Temporal Process** by which chosen durations which are time-intervals are incorporated into the design, fabrication and deployment of timepieces to generate the timepieces' timerates, timepoints, timelines, and timecounts which are used to measure the durations between the occurrences of events, the durations of single events, and the durations (ages) of people and objects, and for the determination of the sequences of events, the simultaneities of events, the causalities and coincidentialities of events, and the changerates of events and for the coordination/synchronization of events inre single and multiple reference bodies/frames.

The Temporal Principle describes what is time and The Temporal Process describes the actual usage of The Temporal Principle.

If a watch is dropped and it breaks, the Temporal Process embodied in the production and use of the watch is destroyed but time itself is not destroyed because the Temporal Principle continues to describe what is time and how the Temporal Process can be re-engaged by either the repair and re-usage of the watch or the procurement and usage of another timepiece.

Thus, there is a difference between the Temporal Principle and the Temporal Process, and time is both.

Here are two shorter operational definitions of time ...

Time = The measurement of durations

... or ...

Time = The use of durations for the measurement of other durations

... that can be used effectively inre discussing time.

The essence of time is the time-interval (TI).

A TI is a chosen duration.

A TI is used to generate a timepiece's timerate, timepoints, timeline, and timecount.

Observations, measurements and experiments have proven that the timerates of timepieces decrease when the timepieces are accelerated and increase when the timepieces are decelerated.

When the durations of timepieces' timerates decrease with accelerations, the durations of the timepieces' TIs increase, and the timecounts of accelerated timepieces decrease; when the durations of timepieces' timerates increase with decelerations, the durations of the timepieces' TIs decrease, and the timecounts of decelerated timepieces increase.

Time Effects Inre Timepieces Caused by Accelerations and Decelerations					
Physical State	Velocity	KME	Time-Interval	Timerate	Timecount
Acceleration	Increase	Increase	Increase	Decrease	Decrease
Deceleration	Decreases	Decrease	Decrease	Increase	Increase

Timepieces whose TIs, timerates, timepoints, timelines, and timecounts change, distort, or vary with accelerations and decelerations can be called *distortable timepieces* or *variable timepieces*.

When a TI is distortable, or variable, it can be labeled a variable time-interval (VTI, pronounceable as *VEE-Tie*).

When a VTI is incorporated into the design of a timepiece, a clock, then the timepiece can be labeled a variable time-interval clock (VTIC, pronounceable as *VEE-Tick*).

A VTIC can measure variable time-interval clock time (VTICT, pronounceable as *VEE-Tick-Tee*).

A VTIC is a distortable timepiece. A VTIC distorts inre accelerations and decelerations.

It is possible to design, fabricate and deploy non-distortable timepieces.

Non-distortable timepieces are adjustable timepieces.

There are two types of non-distortable timepiece designs: (1) The Radio Clock Design in which a master clock is used to send timing signals to slave clocks; (2) The Inertial Clock Design in which accelerometers are used to detect changes of timepieces' inertial states caused by accelerations and decelerations and computers are used to adjust the timepieces' time-intervals, timerates, timepoints, timelines, and timecounts.

Radio slave clocks are dependent upon stable master clocks for stability and coordination/synchronization; inertial clocks are independent of other clocks.

Radio clocks are temporal and physical realities. They are deployed in the USNO (US Naval Observatory), and US NIST (US National Institute of Standards and Technology), and the BIPM (Bureau Internationale des Poids et Measures, located in France). Radio clocks used by the USNO, the US NIST, and the BIPM generate time standards including the standard second scientists use for scientific experiments and citizens use for civilian time standards.

The US GPS navigation system uses radio clocks. The GPS master clock is synchronized to the radio clocks of the USNO. The GPS master clock sends timing signals to GPS ground stations located along the Earth's Equator, and these ground stations relay (resend) the master clock's timing signals to the GPS slave clocks in the GPS satellites. The GPS satellite slave clocks are therefore synchronized with each other – they have the identical time-intervals, timerates, timepoints, timelines, and timcounts that are necessary for the effective functioning of the GPS nav system.

Inertial clocks are also temporal and physical realities. They are deployed in US Military ships, submarines, airplanes, and tanks and in commercial ships and aircraft worldwide. Military pilots refer to the inertial navigation systems in their aircraft as "The INS".

In theory, inertial clocks are the ultimate timepieces because they can generate identical time-intervals, timerates, timepoints, timelines, and timecounts in any and all reference frames and upon any and all reference bodies and thereby can be used for time standards by all humans and all space aliens.

The opposite of a variable time-interval (VTI) is an invariable time-interval (ITI, pronounceable as *EYE-Tie*).

When an ITI is incorporated into the design of a timepiece, a clock, then the timepiece can be labeled an invariable time-interval clock (ITIC, pronounceable as *EYE-Tick*).

An ITIC is an adjustable timepiece. Because it is adjusted to maintain an initial/original TI – ITI, timerate, timepoints, timeline, and timecount, for practical purposes an ITIC is a non-distortable timepiece.

An ITIC will maintain its initial/original TI, timerate, timepoints, timeline, and timecount despite being accelerated or decelerated, despite changes of its inertial state caused by accelerations and decelerations.

An ITIC can measure invariable time-interval clock time (ITICT, pronounceable as *EYE-Tick-Tee* or *EYE-Tick-Time*).

Absolute Space and Absolute Time

If throughout the universe ITICs which are set to Earth time-intervals (seconds, minutes, hours, etc.) are used for measuring time/duration, and considering the eliptical orbits of the Sun and the Earth, then everywhere in the universe the duration of the motion of a photon over the distance from the Sun to the Earth will always be measured to be approximately eight minutes.

Similarly, if ISIRs which are set to Earth space-intervals and distance measurements (inches, feet, yards, miles, etc.) are used throughout the universe to measure space/distance, and considering the eliptical orbits of the Sun and the Earth, then everywhere in the universe the distance from the Sun to the Earth will always be measured to be approximately 93,020,000 miles.

NOTE: The distance and the duration of the motion of a photon through space and over time from the Sun to the Earth are not changed by the measurements of that distance and that duration. Therefore the time required for a photon to travel the space between the Sun and the Earth is not changed by the measurement of that time nor the measurement of that space.

The Concept of Matter-Energy (M/E)

Matter-Energy (M/E) is the set of elementary particles, subatomic particles, atoms, and molecules that comprise people, objects or/and events. If an entity (something) is neither space nor time then it has to be comprised of m/e.

The *universal m/e system* (UMES, pronounced as "*YOU-Mez*") has the following characteristics:

1. The UMES is a closed/isolated m/e system. The concept of space as the i-volume, the one-and-only volume of infinite size, of unbounded radius or diameter, eliminates any possibility there could be another i-volume within which there could be another m/e system. Therefore the UMES is a one-of-a-kind m/e system which, being the one-and-only m/e system in the universe, cannot and therefore does not exchange m/e with another m/e system.

2. M/E cannot be removed from the UMES. There is no space in addition to, outside, or beyond the one-and-only i-volume which is the one-and-only space/spatial component of the universe, therefore there is no other space into which m/e removed from the UMES could be relocated.

3. M/E cannot be added to the UMES. There is no source of m/e other than the UMES, therefore m/e cannot be added to the UMES.

4. M/E is neither created nor destroyed. ($E = mc^2$)

5. The sum total of the m/e in the UMES is a constant. Because m/e cannot be removed from nor added to the UMES, the quantity of m/e in the UMES never changes, neither increasing nor decreasing.

6. The UMES is the source of all causality.

7. The UMES is infinite in duration.

8. No one has ever observed the creation of m/e being caused by or resulting from the physical condition of no m/e. No one has ever observed something from nothing.

The Law of Inertia

The Law of Inertia: A body having the inertial state of being at-rest or in-motion will continue to be at-rest or in-motion until acted upon by a force.

The Corollaries of the Law of Inertia

1. A force is a form of m/e.

2. A force is either a push-force or a pull-force.

3. Only a force can cause a change of an inertial state.

4. The observation of a change of an inertial state implies the change is an effect caused by a cause that is a force of some kind.

Inertial States and Physical States

An inertial state is a physical state inre motions inre people, objects and events.

A physical state is a set of conditions inre space (distance), time (duration) and physics (m/e).

An inertial state is one form of a physical state that includes the concept of motion. In addition to inertial states, physical states include size (distance), age (duration), color, shape, surface, etc.

Thus, the concept of the physical state is more inclusive than the concept of the inertial state.

The Law of Inertia and the The Corollaries of the Law of Inertia can be converted into The Law of Physical States and the Corollaries of the Law of Physical states.

The Law of Physical States

The Law of Physical States: A physical state will continue unchanged until acted upon by a force.

The Corollaries of the Law of Physical States

1. A force is a form of m/e.

2. A force is either a push-force or a pull-force.

3. Only a force can cause a change of a physical state.

4. The observation of a change of a physical state implies the change is is an effect caused by a cause that is a force of some kind.

NOTE: The Law of Physical States and the Corollaries of the Law of Physical States are based upon the Law of Inertia and the Corollaries of the Law of Inertia.

The Continuums of Time

Time can be represented as a continuum – The Continuum of Time (CoT).

A continuum is a continuous whole wherein parts are adjacent to each other and are therefore contiguous with each other so that there are no divisions within the whole.

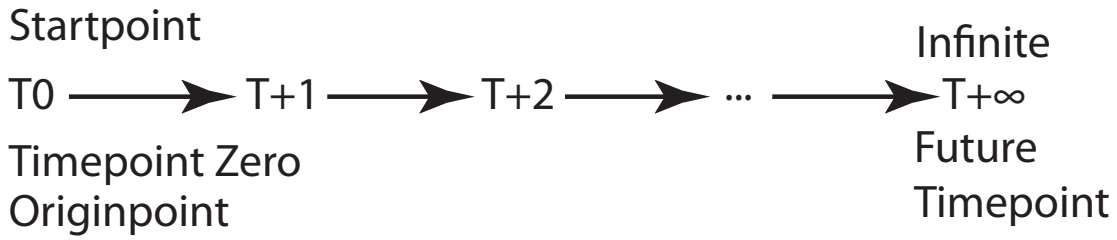
Because there are two types of time, VTICT/LT and ITICT/AT, there are two categories of continuums of time: (1) The Continuum of Local Time (CoLT) and (2) The Continuum of Absolute Time (CoAT).

The Continuums of Local Time (CoLTs)

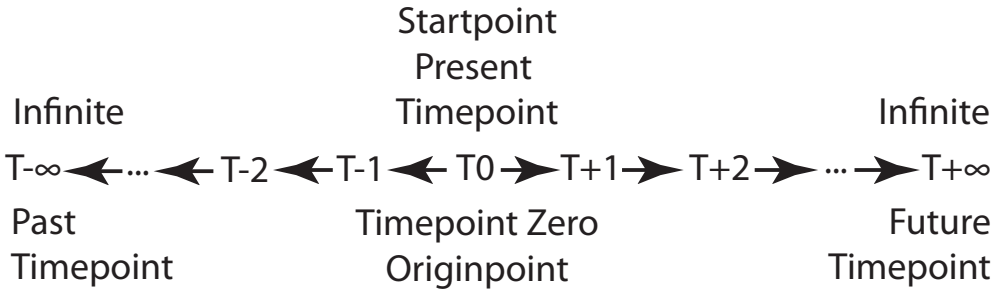
The continuums of local time are generated by the use of local time clocks (LTCs) which are VTICs – distorable non-adjustable clocks.

There are two possibilities for continuums of local time: (1) The UniPolar Continuum of Local Time (one direction: T0 → T +∞) and (2) The BiPolar Continuum of Local Time (two poles/directions T-∞ ← T0 → T+∞).

The UniPolar Continuum of Local Time (UCoLT)



The BiPolar Continuum of Local Time (BCoLT)

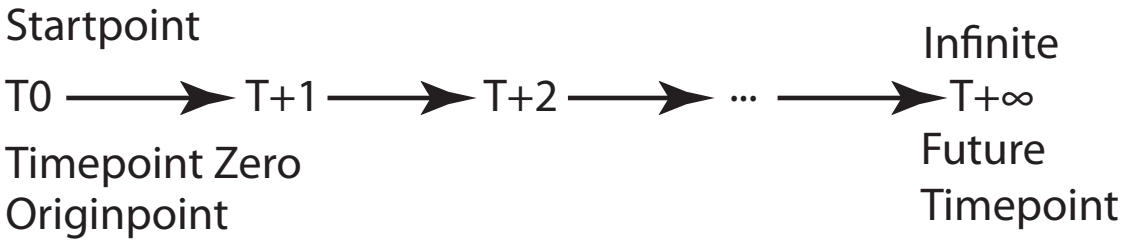


The Continuums of Absolute Time (CoATs)

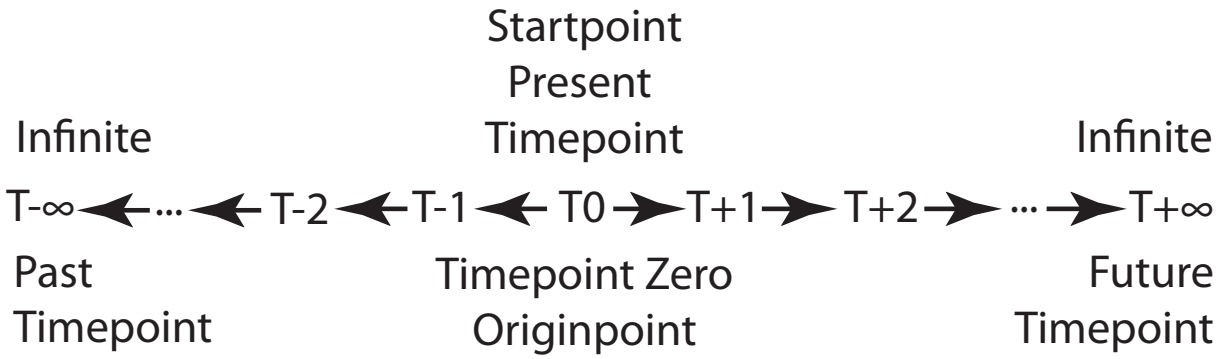
The continuums of absolute time are generated by the use of absolute time clocks (ATCs) which are ITICs – adjustable non-distortable clocks.

There are two possibilities for continuums of absolute time (CoAT): (1) The UniPolar Continuum of Absolute time (one direction: T0 → T +∞) and (2) the BiPolar Continuum of Absolute Time (two directions T-∞ ← T0 → T+∞) .

The UniPolar Continuum of Absolute Time (UCoAT)



The BiPolar Continuum of Absolute time (BCoAT)



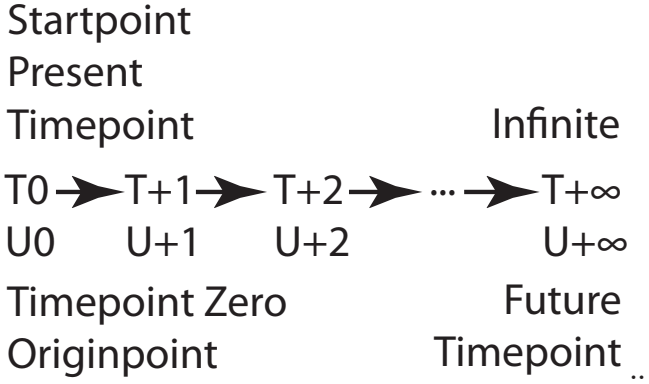
The Continuums of Time and The Universal M/E Configuration

For each timepoint on each continuum of time, there exists a corresponding configuration (Config) of the universal m/e system (UMES).

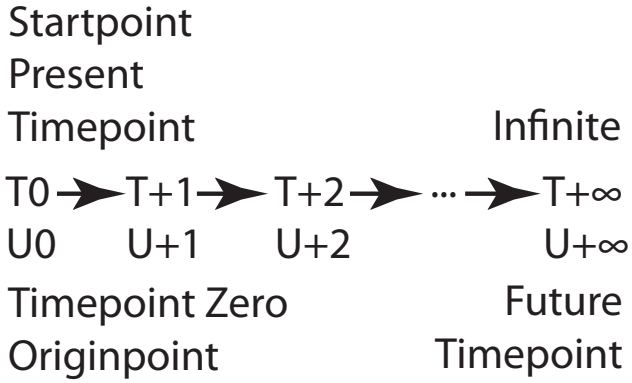
Within each UMES Config the sum total of m/e remains a constant because m/e is not being added or removed or created or destroyed.

The following CoLTs and CoATs illustrate the corresponding links between timepoints and the universal m/e configuration.

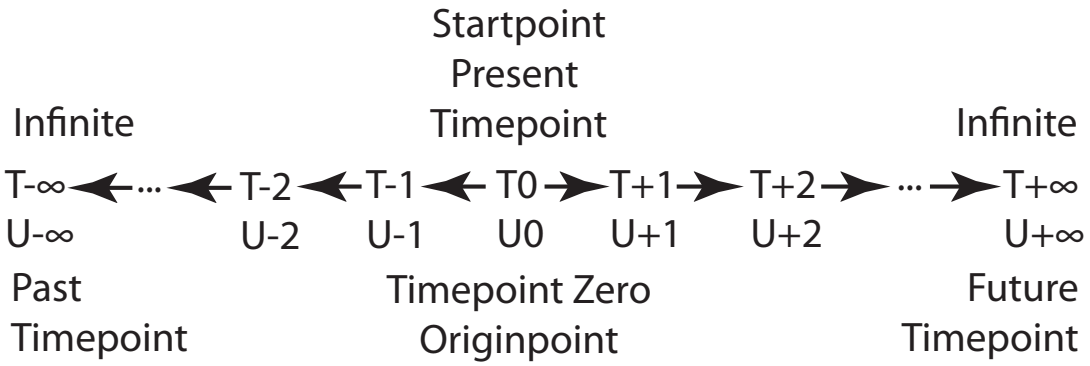
The UniPolar Continuum of Local Time with Universal M/E Configurations



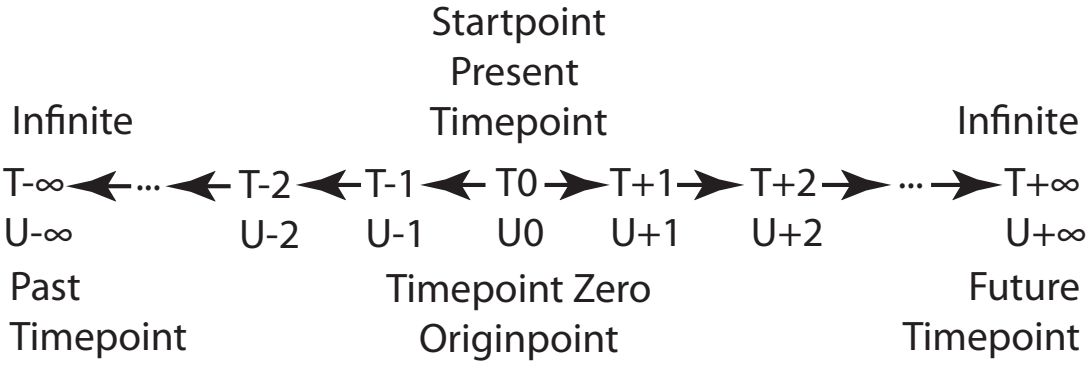
The UniPolar Continuum of Absolute Time with Universal M/E Configurations



The BiPolar Continuum of Local Time with Universal M/E Configurations



The BiPolar Continuum of Absolute Time with Universal M/E Configurations



For each timepoint there is the UMES ConFig which is relevant to that timepoint. It is critical to remember that the UMES ConFig at each timepoint is not a new UMES but is instead a new ConFig of the UMES. Thus, the T/Timepoint is new and the ConFig is new but the UMES is not new (it is 'old' because its sum total is a constant and changes only inre transformations of m/e wherein matter (m) transforms into energy (e) and e/energy transforms into m/matter inre $E = mc^2$ and $m = E/c^2$).

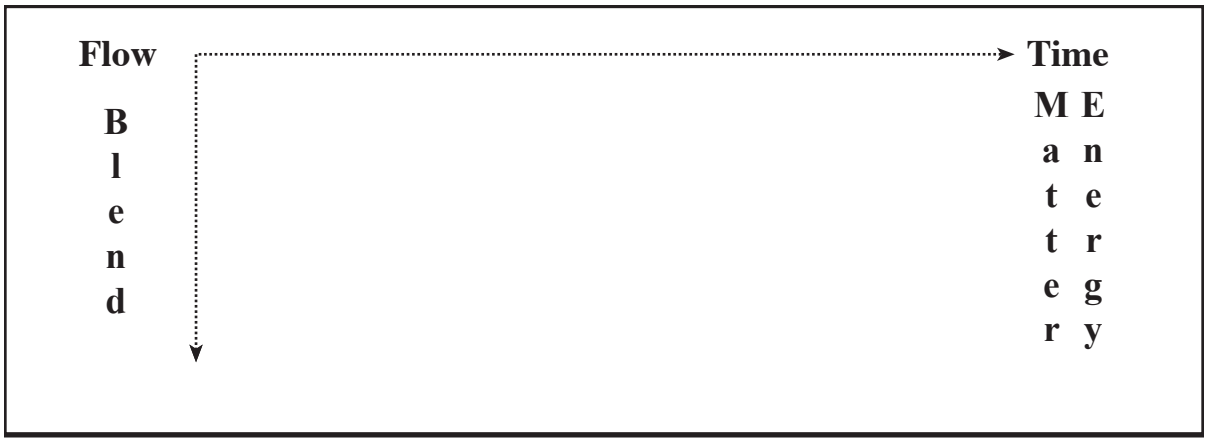
The Flow and Blend of the Universe

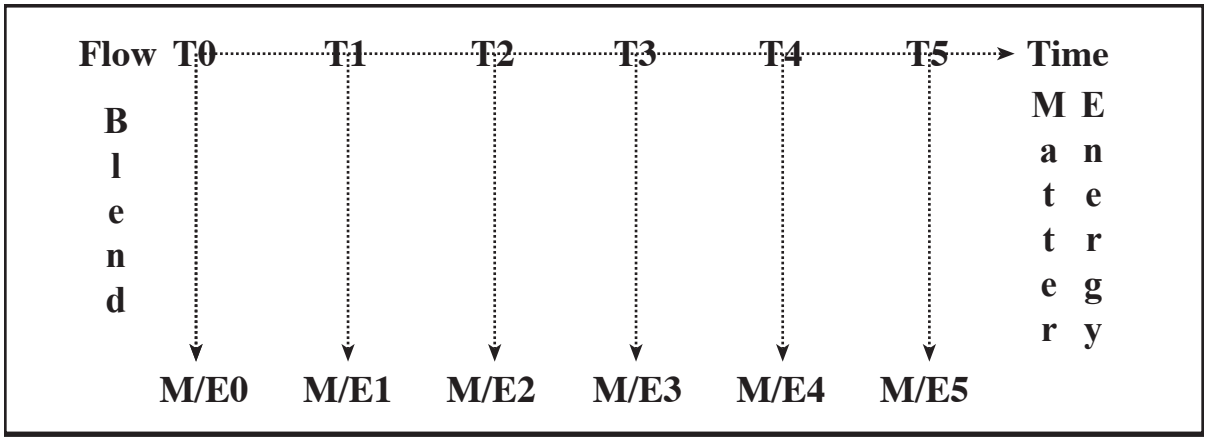
The universe has a flow and blend of the space, time and m/e which are the components of the universe that is similar to the flow and blend of the melody, harmony and rhythm which are the components of music.

The flow of the universe is the timeline from the past through the present into the future; the blend of the universe is the configuration of the universal matter-energy system (UMES or M/E) which is relevant to each timepoint on the universal timeline.

Flow

Blend

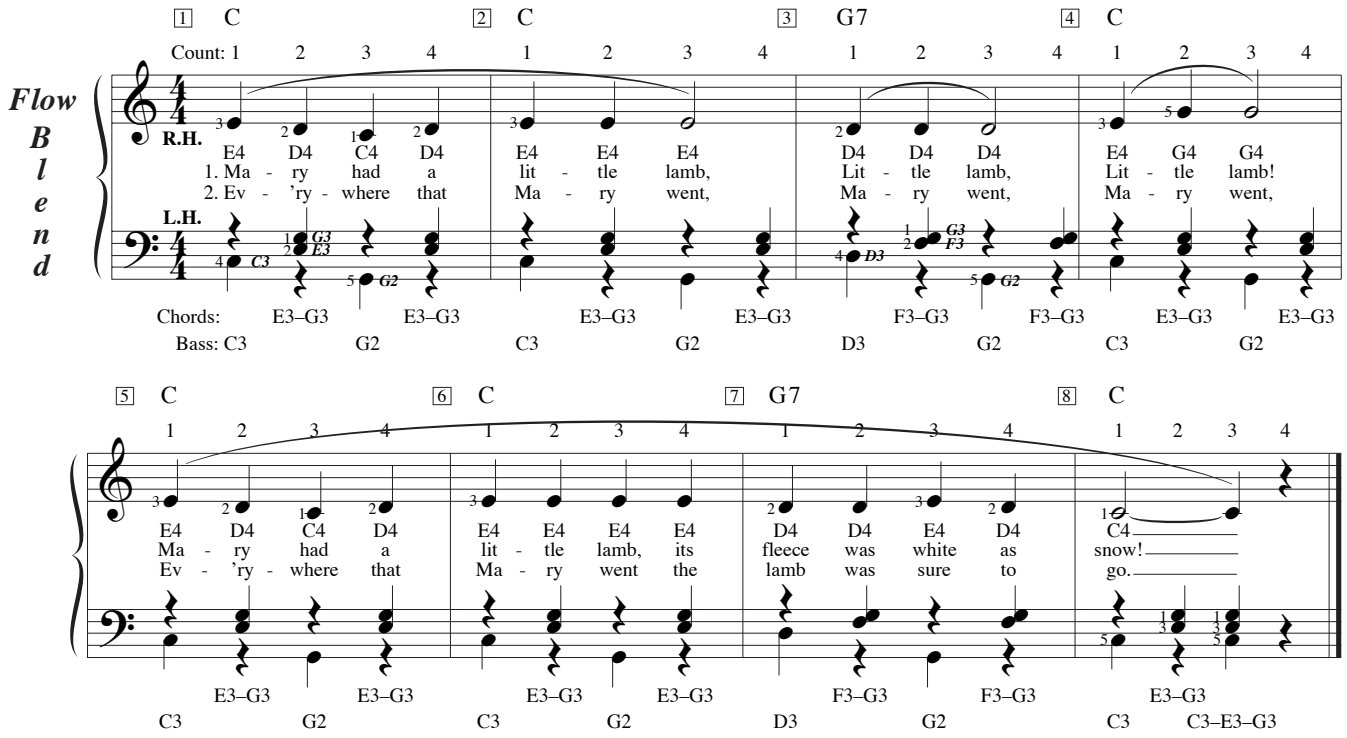




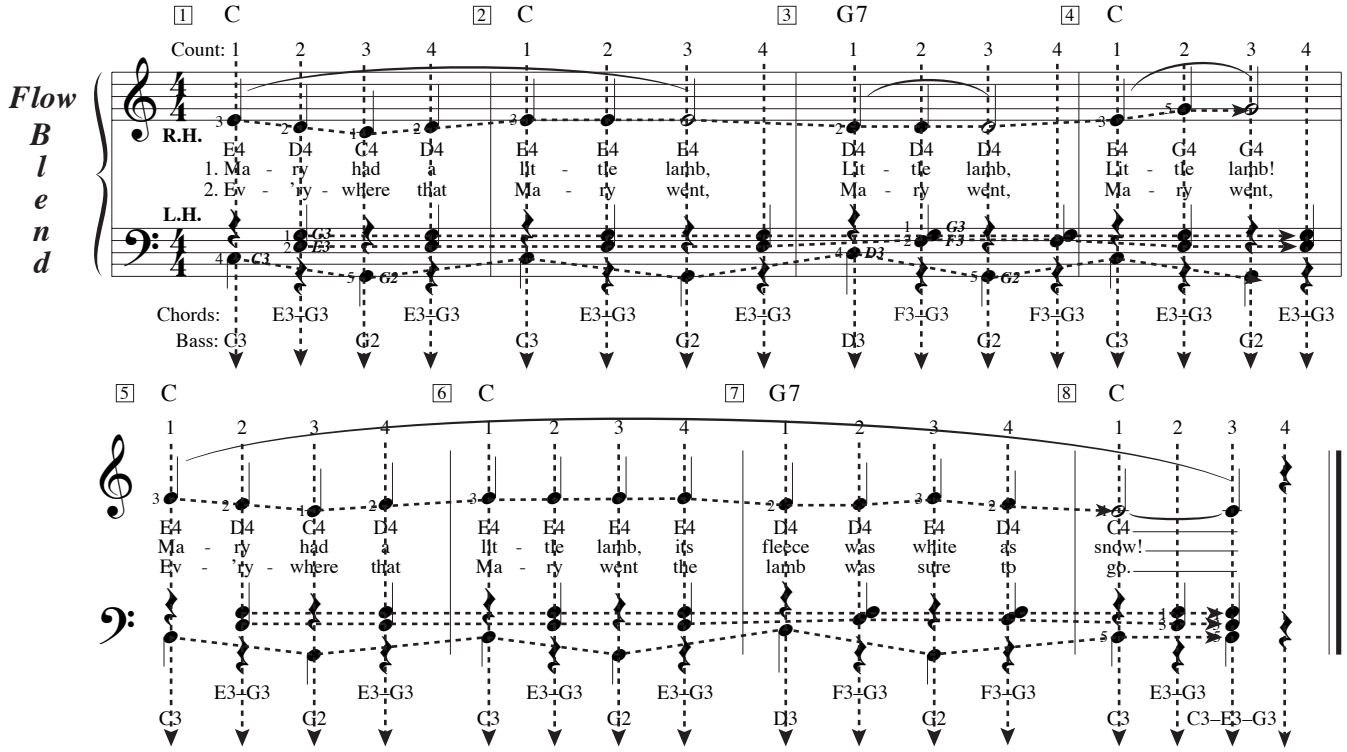
In music, there is a flow of blend of melody notes, harmony notes and rhythms.

The flow of music is the progression of the melody, harmony and rhythm from the first beat of the Count through the last beat of the Count; the blend of music is the set of melody notes and harmony notes (chord-tones and bass notes) beneath each beat of the Count.

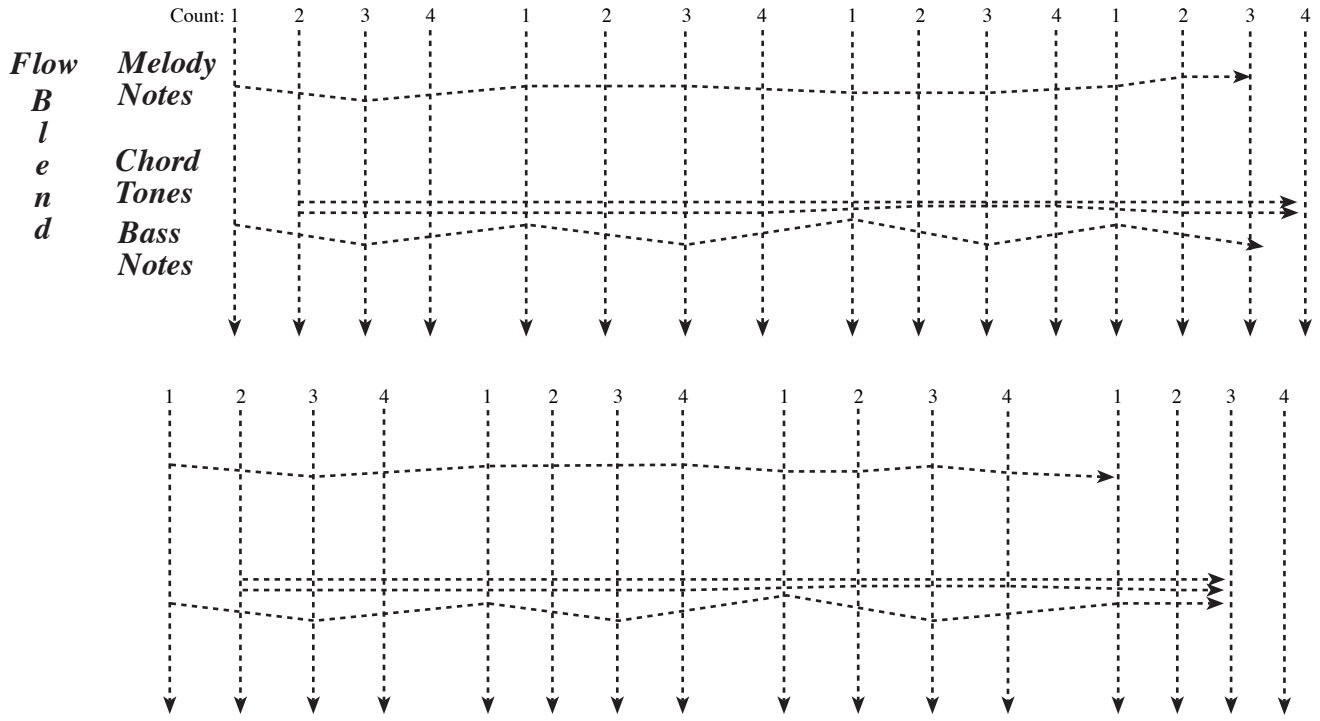
Here is “May Had a Little Lamb” written in Piano Grand Staff format.



Here is Mary Had A Little Lamb showing the flow and blend of the melody, harmony and rhythm.



Here is "Mary" with the music removed to show the flow and blend of the melody, harmony and rhythm.



Thus and therefore, the flow and blend of matter-energy through space over time is similar to the flow and blend of music over time.

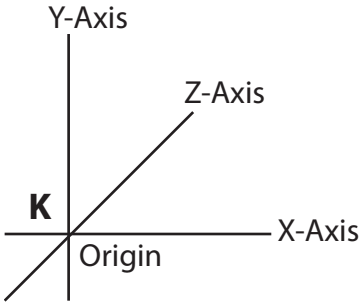
The Concept of the Reference Frame

In physics, a *reference frame* is a coordinate system within which and from which observations and measurements of physical phenomena can be made, within which the laws of physics (the natural causal relationships among the objects and events which are comprised of matter and energy – m/e) are the same, and within which all objects which have identical velocities (speeds and directions) are at-rest relative to each other, e.g. the objects within a reference frame have the same relative velocity (RV) and the RV = 0 mps.

If the spacepoints at which lightrays were emitted were not on the same gridline, but, nevertheless, all lightrays were moving at AV = RV = MV = 186,000 mps relative to their emission spacepoints and all were in-motion moving in the same direction of motion, then the Lightrays would have RVs = 0 mps relative to each other and their emission spacepoints would have RVs = 0 mps relative to each other.

In the Orbiting Stars Diagram 0g on page 40, the Orbiting Star System has disappeared, Lightrays A, B, C, and D were emitted from their lightsources on their respective gridlines at AV = RV = MV = 186,000 mps relative to their emission spacepoints, and because Lightrays A, B, C, and D have identical AVs = MVs = 186,000 mps and are moving in the same direction of motion relative to each other, then they have the same RV which is RV = 0 mps, and therefore they are in the same reference frame, the light reference frame (LRF), and because the emission spacepoints have identical AVs = RVs = 0 mps relative to each other, then they are at absolute rest (AR) in the absolute rest reference frame (ARRF).

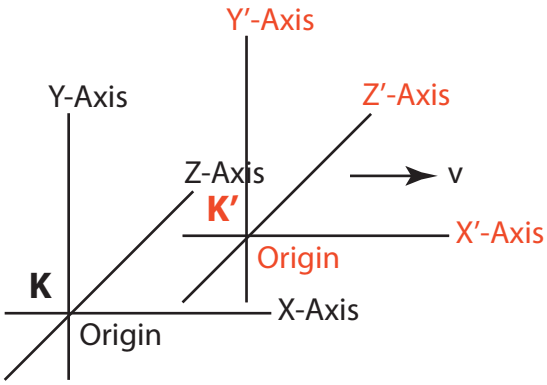
Ex: The reference frame **K** has an origin that is the intersection of three axes: x-axis (left-to-right/horizontal), y-axis (up-down/vertical), and z-axis (towards-away).



Reference Frame K

NOTE: When multiple reference frames are referenced using **K** letters, primes (‘) typically are added to the **K** letters (**K’**, **K”**, etc.) to designate and distinguish the reference frames.

Ex: Reference frame **K’** is shown in-motion parallel to reference frame **K** with a velocity v (designated by the arrow) relative to reference frame **K** when **K** may or may not be at-rest with a $v = 0.00$ mph (or mps).



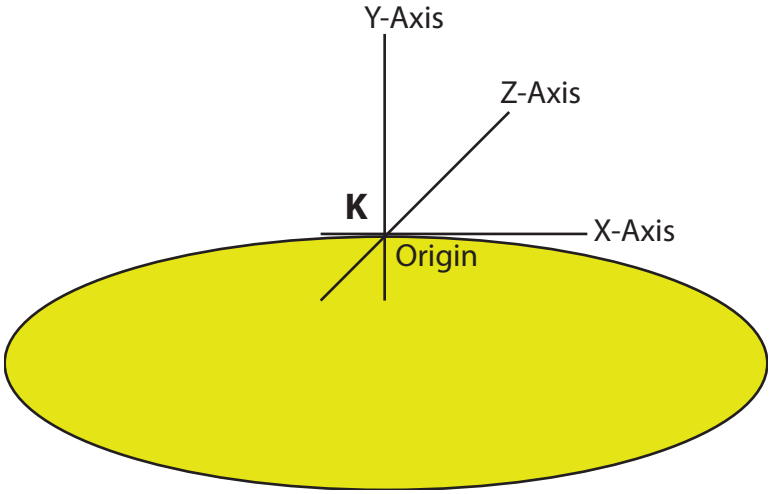
NOTE: The ***v*** for **K’** is a relative velocity (***rv***) because **K’** is moving relative to **K** regardless of whether/not **K** is at-rest and only **K’** is in-motion.

NOTE: To be at-rest an object would have to have an absolute velocity (***av***) of av = 0.00 mps (***av*** equal to zero miles per second); to be in-motion an object would have to have an ***av*** > 0.00 mps (***av*** greater than zero miles per second).

The Concept of the Reference Body

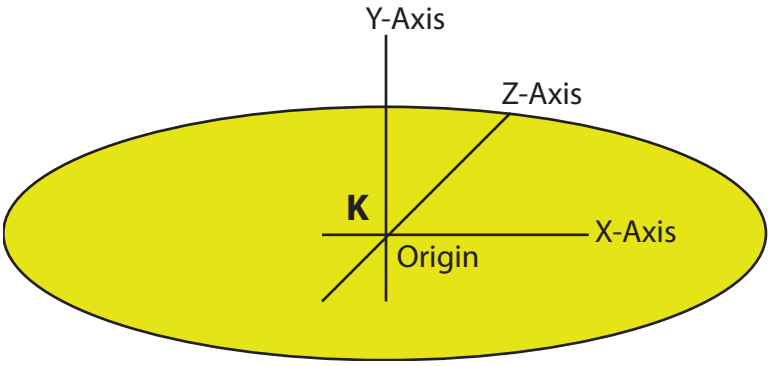
A *reference body* is physical entity (thing, object) existing in space, enduring over time and comprised of m-e such as the Earth, a laboratory apparatus (test equipment), an automobile, a spacecraft, etc., upon which or from which distances and durations between or among people, objects and/or events can be measured.

Ex: Eliptical reference body (yellow) with reference frame coordinates with an origin on the body’s surface or shape that is the body’s boundary.



Reference Body with Coordinates Originating on a Surfacepoint or a Shapepoint

Ex: Eliptical reference body (yellow) with reference frame coordinates within the body.



Reference Body with Coordinates Originating within the Reference Body

The unobservable and unmeasurable infinite volume of space is extrapolated from observations and measurements of finite radii within finite volumes to infinite radii within the single infinite volume which is space.

Finite radii within finite volumes have finite lengths, limited lengths, bounded lengths, lengths which have both a startpoint – an originpoint – and an endpoint.

Startpoints And Endpoints

What Are Startpoints and Endpoints?

Startpoint = A point within space, within a reference frame, or upon a reference body (such as the Earth) at which a length – a distance – begins; a startpoint is the opposite of an endpoint.

Just as the longest journey upon the reference body which is the Earth begins with the first step, that first step is the startpoint of the distance of that journey upon the Earth. If a journey begins within the finite volume of a finite building upon the reference body of the Earth, then that journey – that finite distance traveled within the building's finite volume – begins at the startpoint of the first step. The observation or measurement of a finite distance upon a finite body begins with the startpoint and extends to an endpoint.

Endpoint = The point on a length or a distance opposite the startpoint.

Just as the longest journey begins at the startpoint of the first step, the end of that longest journey is the endpoint which is the last step taken on that journey. A journey within a finite volume of a finite building begins at a startpoint and ends at an endpoint. The observation or measurement of a finite distance upon a finite body begins at a startpoint and ends at an endpoint.

Thus, a finite distance has both a startpoint and an endpoint.

Finite Distance: Startpoint – Endpoint

Finite Radii Startpoints and Endpoints

What Are Finite Radii Startpoints and Endpoints?

Within a finite volume, finite radii have both startpoints and endpoints.

Finite Radius Startpoint = The origin of a finite radius; the beginning of a radius; a radius' *originpoint*.

Finite Radius Endpoint = The end of a finite radius; a finite radius' *surfacepoint* or *shapepoint*.

Finite Radii: Startpoint – Endpoint

Finite Radii Surfacepoints and Shapepoints

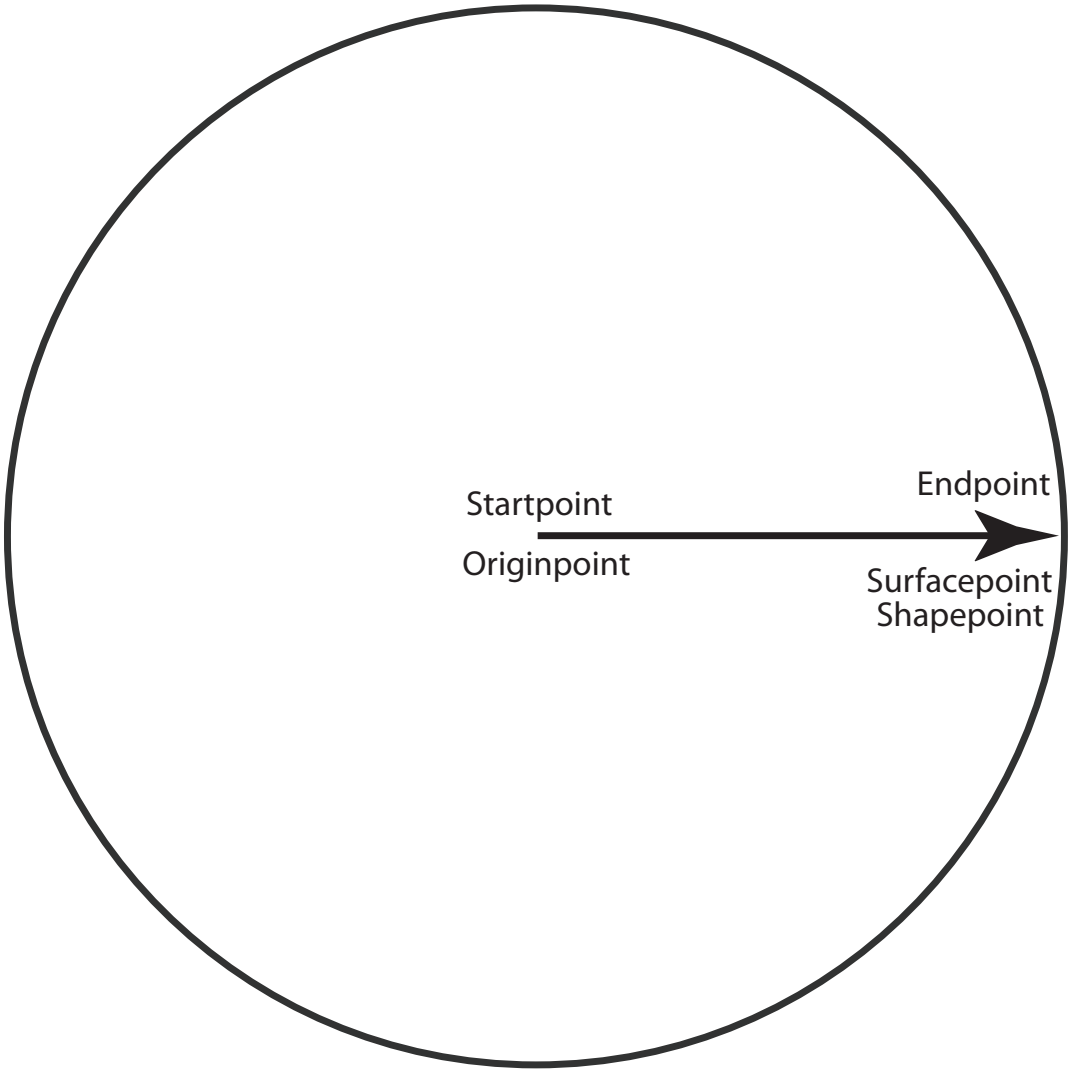
What Are Finite Radii Surfacepoints and Shapepoints?

Surfacepoint = A radius endpoint on a body's or finite volume's surface or boundary.

A finite radius' endpoint ends at a point on a finite body's or a finite volume's surface; thus, a finite radius' endpoint is also a *surfacepoint*.

Shapepoint = A radius endpoint on a body's or finite volume's surface or boundary that is a surfacepoint.

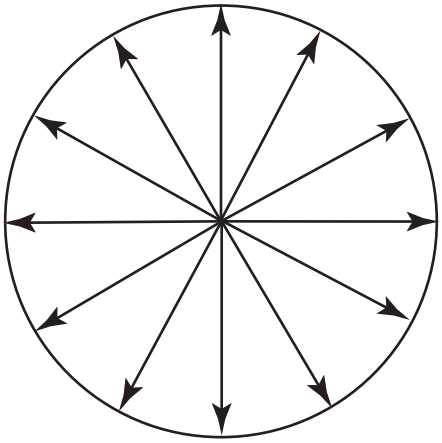
Finite radii that have both a startpoint and an endpoint that is a surfacepoint define an object's shape; thus an endpoint on a finite radius is both a surfacepoint and a shapepoint.



Finite Radius: Startpoint/Originpoint – Endpoint: Surfacepoint/Shapepoint

Within a finite volume, finite radii have startpoints within the volume and endpoints at the volume's surface. The endpoints of a finite volume's finite radii define both the finite volume's surface and its shape.

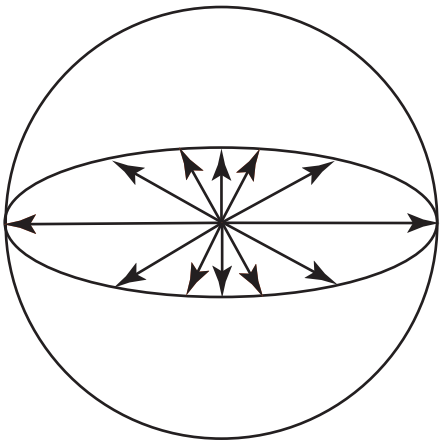
Ex: Within a circle, the finite radii have equal lengths; the distances from their startpoint (the center of the circle) to the endpoints are equal - identical - and the resulting shape of the circle is perfectly round - having the same curvature everywhere upon its circumference.



Finite Radii of a Circle: Startpoint (Center) – Endpoint (Circumference)

NOTE: The circumference of a circle is the circle's boundary – the circle's physical limitation. Things (people, objects or events) that exist (are located) within a circle exist within its circumference; things that do not exist within a circle exist (are located) beyond or outside or in addition to the circle's circumference.

Ex: Within a finite sphere, the finite radii have equal lengths; the distances from their startpoint (the center of the sphere) to the endpoints are equal – identical – and the resulting shape of the sphere is perfectly round, having the same curvature everywhere upon its surface.



Finite Radii of a Sphere: Startpoint (Center) – Endpoint (Surface/Shape)

NOTE: The surface of a sphere is the sphere's boundary – the sphere's physical limitation. Things (people, objects and events) that exist (are located) within a sphere exist within its surface (within the sphere's interior, within the sphere's volume); things that do not exist within a sphere exist (are located) beyond or outside or in addition to the sphere's surface.

NOTE: If a finite volume has finite radii of different lengths, then the volume's surface becomes less and less round and more and more irregular unless some of the radii are equal and define a more regular surface and shape, such as the surface and shape of a finite cube that would require some of the finite radii distances to be equal.

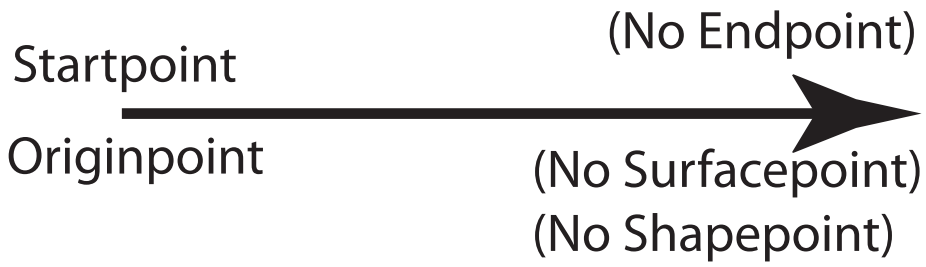
The Principle That Infinite Radii Define The Single Infinite Volume: Space

The observable and measurable startpoints and endpoints of finite radii of finite volumes can extrapolated to unobservable and unmeasurable infinite radii whose startpoints can be observed and measured but whose endpoints do not exist and therefore cannot be observed or measured and therefore cannot and do not define a surface or a shape to what has to be and therefore is the single infinite volume – the single, one-and-only, volume of infinite radii.

Thus, an infinite radius has only a startpoint.

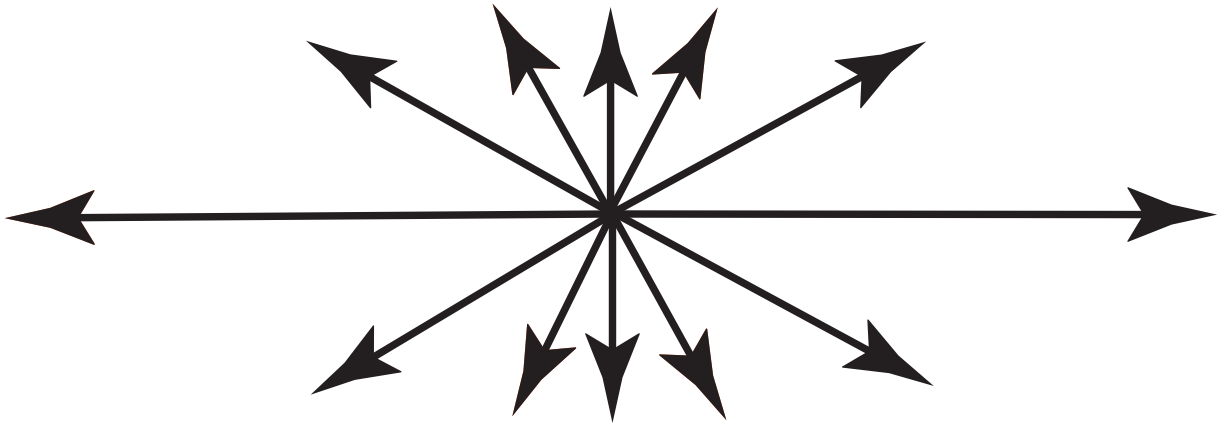
Infinite Radius: Startpoint - … (?)

Ex: Infinite radius with a Startpoint (Originpoint) but no Endpoint or Surfacepoint or Shapepoint.



Infinite Radius: Startpoint – … (?)

Ex: Infinite radii have startpoints but no endpoints and therefore they have neither surfacepoints nor shapepoints (as illustrated by the group of radii which have a common startpoint but no endpoints and therefore no surfacepoints nor shapepoints).



Infinite Radii of the Infinite Volume of Space: Startpoint – … (?)

Because the infinite radii of the single infinite volume have no endpoints, the infinite volume has no surface and therefore no shape and therefore no curvature and therefore no limitation or boundary.

The Concept of The Infinite Volume That Is Space

The infinite volume of space eliminates any possibility of the existence of any space, time, m-e, or people, objects or/and events who/which are comprised of m-e beyond or outside or in addition to the infinite volume.

Moreover, because no one has ever observed something causing or creating itself, the infinite volume which is space, the spatial component of the universe, was never caused nor created.

Moreover, whatever causalities and coincidentialities are realities are realities only within space – within the single infinite volume which is space, the spatial component of the universe.

Thus, there are no realities beyond or outside or in addition to space – the single infinite volume.

If the m-e which is the physical component of the universe does not completely fill the infinite volume which is space, the spatial component of the universe, then there will be subvolumes of space that are devoid of m-e that are perfect vacuums – f-volume vacuums.

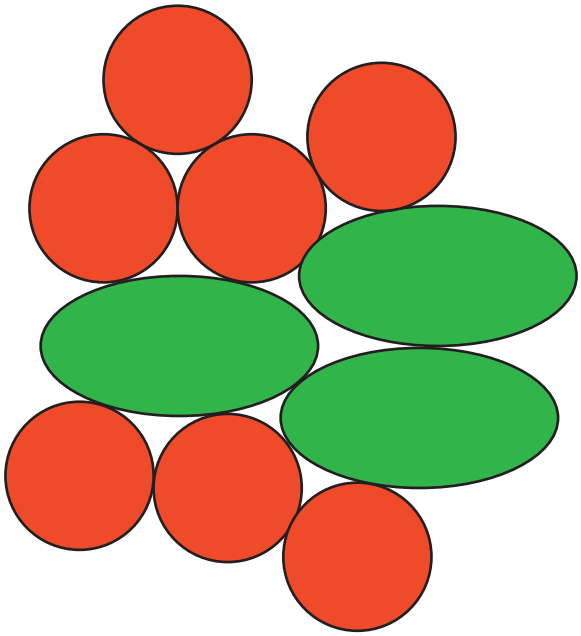
The Concepts of The Infinite Volume and Finite Subvolumes

Within the infinite volume which is space are finite volumes that are subvolumes of space.

The subvolumes of space are either filled with m-e or are devoid of m-e.

If (P) each elementary or subatomic particle is conceptualized to be a quantum – a packet of m-e, if each quantum has a finite volume and therefore a surface and a shape and therefore a physical boundary – a physical size limitation, and if quanta (plural of quantum) are not 100% contiguous – touching each other at all possible contact points, then (Q) between the finite volumes of non-contiguous quanta that are subvolumes of infinite volume of space must be and therefore are finite volumes that are spatial subvolumes that are devoid of m-e that are pure vacuums.

Ex: A 2-D representation of a group of finite 3-D volumes – f-volumes, seven red spheres and three green elipticals – that are subvolumes of space that are filled with m-e and that are contiguous – contacting each other – at limited contact points; the areas of space between and among the f-volumes are subvolumes of space that pure vacuums.



2D Representation of 3D F-Volumes

The Principle That Space Is a Pure Vacuum

If some subvolumes of space are pure vacuums because they are devoid of m-e, then space, itself, the single infinite volume which is not comprised of m-e, and which surrounds all finite-volumes, must be a pure vacuum.

The Concept of Velocity (V)

In physics, *velocity*, designated by the symbol, *v*, is the combination of speed and direction, the speed of motion and the direction of motion, the speed and direction of motion of an entity including light (a light photon).

The Concept of Relative Velocity (RV)

In physics, a *relative velocity* (*RV* or *rv*) is the velocity of one object, reference body or reference frame inre another object, reference body or reference frame. Thus, an RV is a velocity difference inre the velocities of two or more objects, reference bodies or reference frames.

The relative velocity (RV) inre an entity (*E*) at-rest or in-motion is computed thus: $RV_E = AV_1 \pm AV_2$

The Concept of Simultaneity

Simultaneity in physics is defined as two or more events observed to have occurred, to be occurring, or will be occurring at the same instant, moment, time, clock reading, timecount, or timepoint (a point or mark on a continuum of time – a history, or record, of time).

The simultaneity of two or more events occurring in a single reference frame or on a single reference body can be determined by the use of identical radio clocks (A) which are synchronized by radio timing signals from a master clock, (B) which are located close to the events and (C) which are linked to cameras which can take photographs of the events which can be time-stamped. The time-stamped photographs can serve as proof of the timepoints at which the events occurred. If events occur at the same time-stamp (timepoint on a photograph), then the events are simultaneous.

The simultaneity of two or more events occurring in two or more reference frames or on two or more reference bodies can be determined by identical inertial clocks whose timerates (rates of ticking, tickrates) can be adjusted to compensate for changes of the clocks' kinetic mass-energies (KMEs) caused by accelerations and decelerations of the clocks. These identical adjustable clocks maintain the timerates of identical clocks which have not been accelerated or decelerated. When identical adjustable clocks are used for the measurement of time and for the time-stamps of photographs of events, any identically time-stamped photographs of events are proof that the events occurred at the same timepoint (time-stamp) and therefore occurred simultaneously.

When the time-stamped photographs are used for the determination of the simultaneity of events, the photographs are independent of the motions of observers and thereby are independent of the reference frames in which observers are located.

The Concepts of Light Sources and Lightrays

Whereas light emitted from a Light Source (LS) such as a Lightning Strike (also LS) can be considered to be, and thereby designated, a Lightray, Lightwave, or Photon, the term Lightray (LR) is chosen herein because the motion of an LR from an LS can be considered to extend the distance from the spacepoint or position-in-space at which the LR was emitted from its LS (designated by an arrowfeather/arrowtail) to the LR's forward edge (designated by an arrowhead). An LR travels at *c* away from the spacepoint or light emission spacepoint (LES) at which the LR was emitted.

Straight Lines

What is a straight line?

In Euclidean geometry, a straight line is the shortest distance between two points.

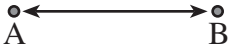


Fig. 1A

Fig. 1B

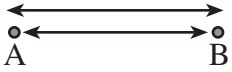


Fig. 1C

Between Points A and B in Fig. 1A, there is a line, and the line is the shortest possible length/distance between A and B, and that line is a straight line – a perfectly straight line.

One way to intuit a perfectly straight line between two Points, A and B, is to imagine the line being a taut rope, or wire, stretched between A and B. With this intuition the perfectly straight line would be the shortest possible string that could be stretched between Points A and B. Any other line would have a longer string. In Fig 1B the curved top line is observed to be longer than the straight bottom line. In Fig. 1C the top line has been straightened to reveal its actual length and is observed to be longer than straight bottom line.

If six Points, A, B, C, D, E, and F, are located on the orbital path of an astronomical object orbiting a massive body, then the shortest distances between Points A and B, C and D, and E and F would be straight lines – perfectly straight lines, and those perfectly straight lines would pass through the inside or interior of the orbit.

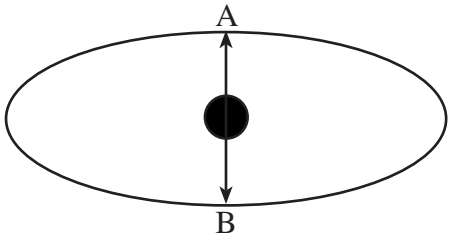


Fig. 2

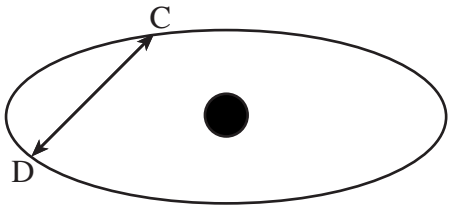


Fig. 3

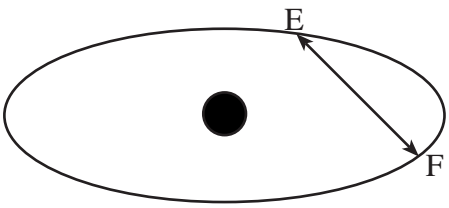


Fig. 4

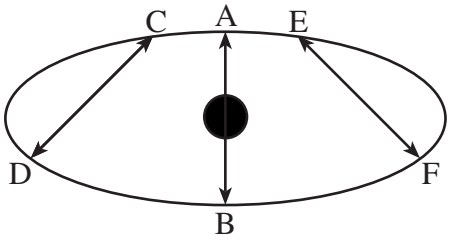


Fig. 5

There are two types of lines that can be drawn between two points on a sphere: (1) *surface lines* that are drawn over and therefore on the sphere's surface and (2) *interior lines* that are drawn through the interior or inside of the sphere and therefore under the sphere's surface.

If six Points, A, B, C, D, E, and F, are located on the surface of a hollow sphere, then the shortest distances between Points A and B, C and D, and E and F would be straight lines through the interior of the sphere – perfectly straight interior lines.

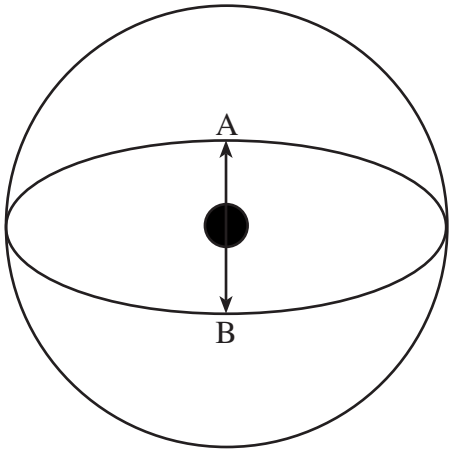


Fig. 6

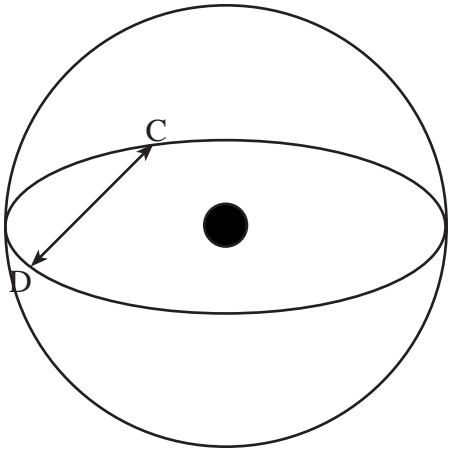


Fig. 7

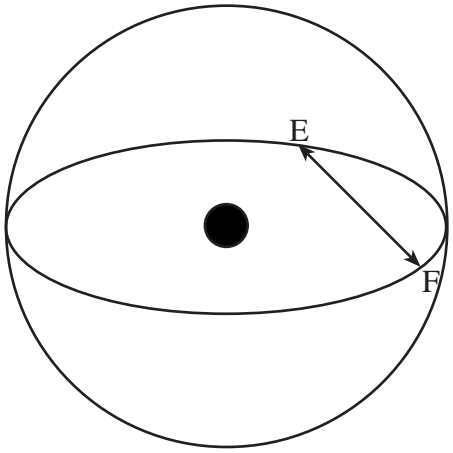


Fig. 8

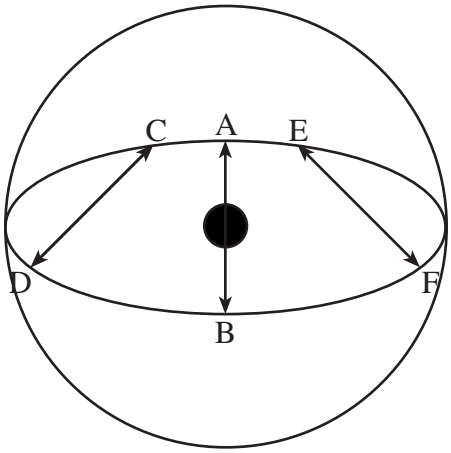


Fig. 9

If Points are located on the surface of a spherical solid, then the shortest distances between those Points would be straight lines through the interior of the spherical solid; these would be straight interior lines – perfectly straight interior lines.

If six Points, A, B, C, D, E, and F, are located on the surface of a spherical solid, then the shortest distances between Points A and B, C and D, and E and F would be straight lines through the interior of the spherical solid – perfectly straight interior lines.

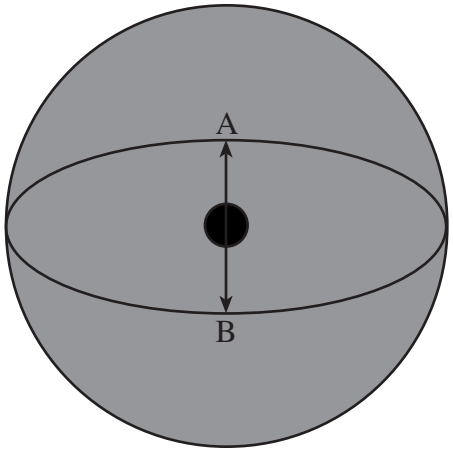


Fig. 10

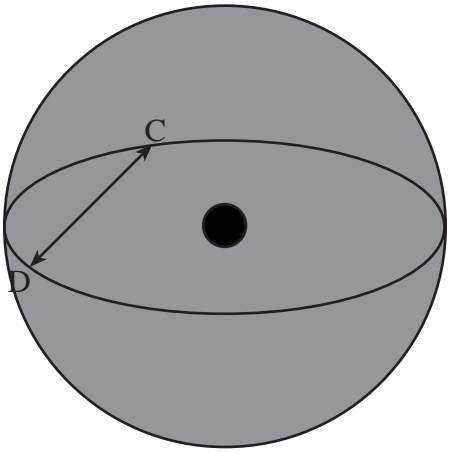


Fig. 11

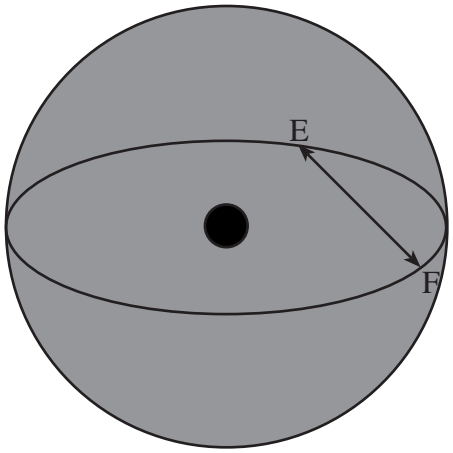


Fig. 12

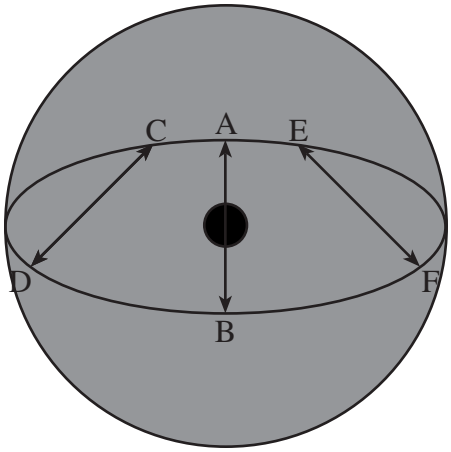


Fig. 13

If the distance between two Points, A and B, is to be a line drawn on the surface of a spherical solid, then the shortest distance between A and B would be a line which would drawn on a great circle – a line called a geodesic – which would NOT be a perfectly straight line because by being drawn on the surface of a spherical solid the line is automatically a surface line and is curved by the shape of the curvature of the spherical solid's surface.

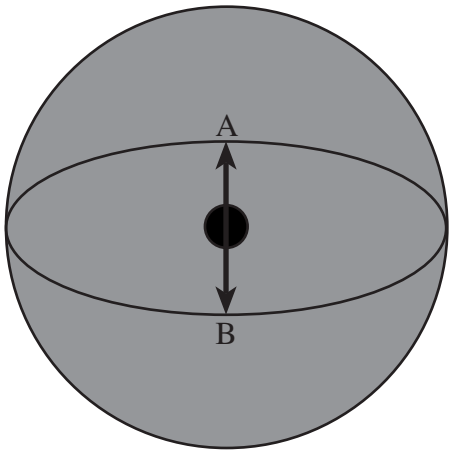


Fig. 13a

When the curved surface line between Points A and B is viewed from a point which is located directly above the spherical solid's surface and which is equidistant from A and B, then that curved surface line appears to be a straight line, as shown in Fig. 13a; but, as shown in Fig. 13b, if the spherical solid is rotated, then the curvature of the curved surface line between A and B is revealed, especially when the perfectly straight interior line which is the shortest distance between A and B and which is drawn through the interior of the spherical solid is drawn as a dotted line to show clearly the difference in distance between the perfectly straight interior line between A and B and the obviously curved surface line between A and B.

Herein are shown surface lines and interior lines drawn between Points A and B, Points C and D, and Points E and F located on the surface of spherical solid.

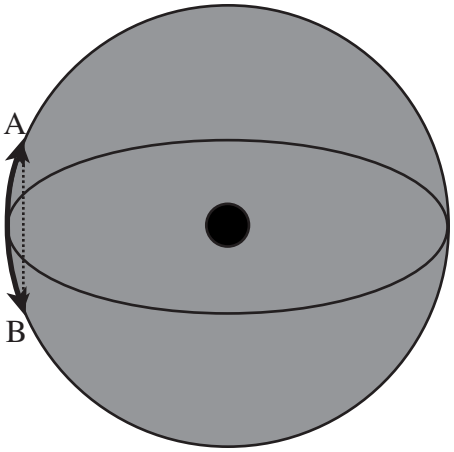


Fig. 13b

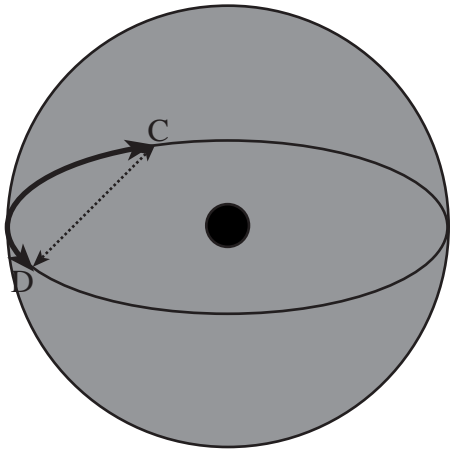


Fig. 14

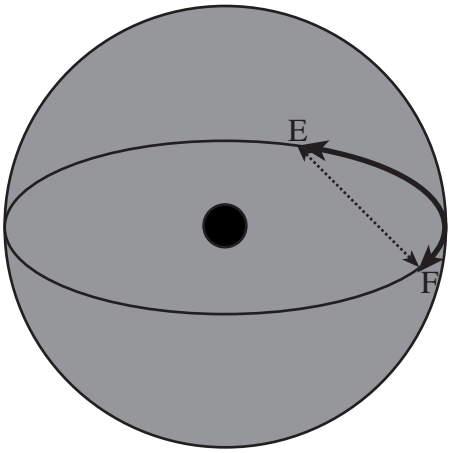


Fig. 15

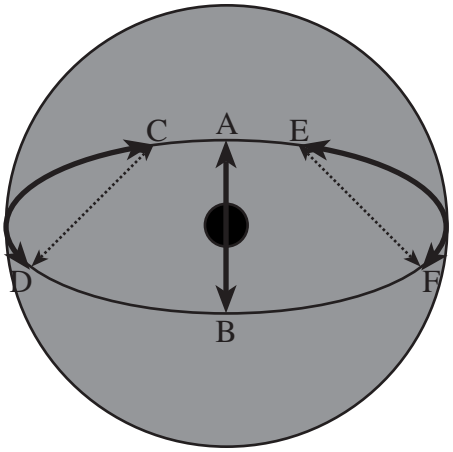


Fig. 16

With the establishment of straight lines – perfectly straight lines – as the shortest distance between two Points, even if drawn through the interior of a hollow or solid sphere, then a Euclidean Grid (Spacegrid) can be drawn to represent the interior of the space which is the volume of infinite size which is the infinite volume or i-volume which is the *space* of the *universe* when the *universe* is considered to be comprised of *space*, *time* and *m/e* (matter/energy), e.g. *universe = space + time + m/e*.

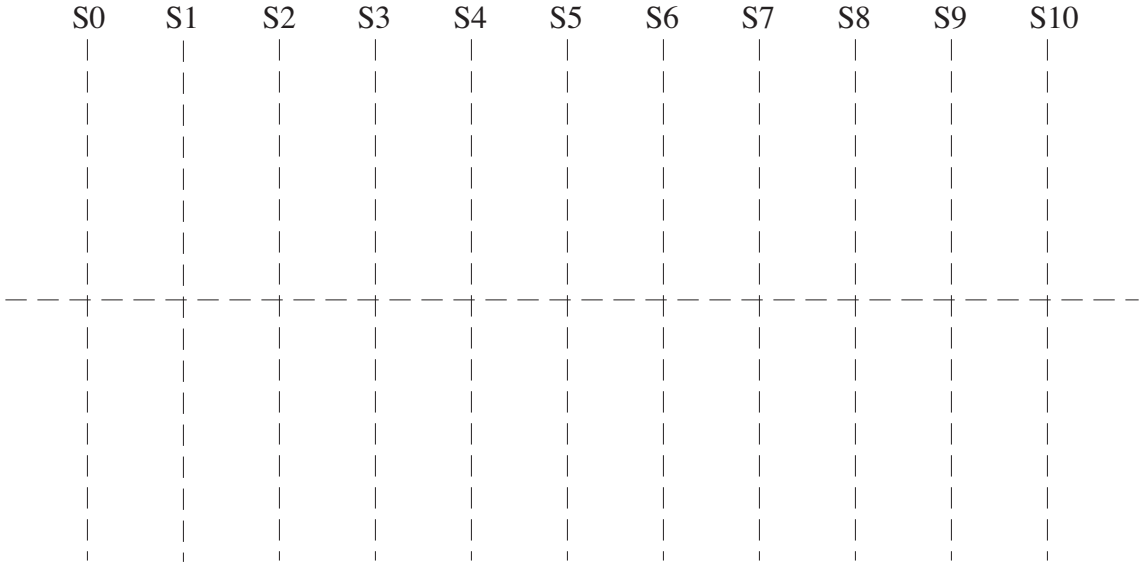


Fig. 17

The vertical lines, S0 (Spaceline 0), S1, S2, etc., on the Spacegrid are perfectly parallel to each other, they extend infinitely in length and they are perfectly perpendicular to the horizontal baseline.

The horizontal baseline is the x-axis and the vertical lines are the y-axes for the Fig. 17 Spacegrid.

Lines slanted at 45º can be drawn to represent the z-axes on the Spacegrid, as shown in Fig. 18.

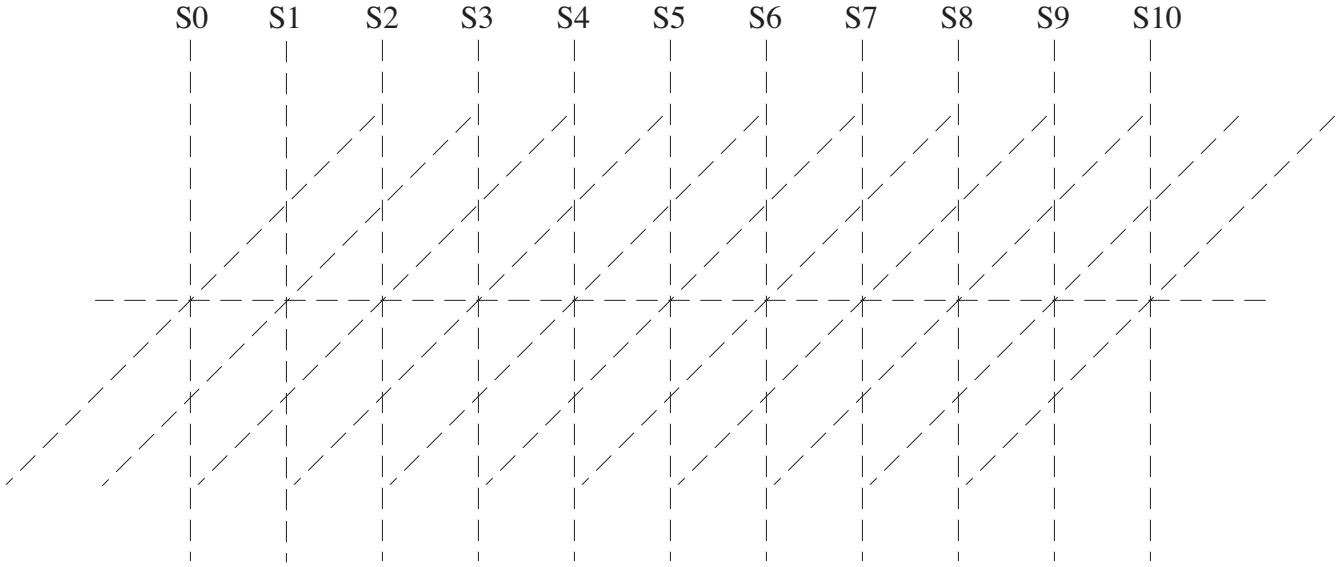


Fig. 18

At each intersection of an x-axis line, a y-axis line, and a z-axis line is an origin which can be used for observations and measurements of the positions and motions of objects within the Spacegrid.

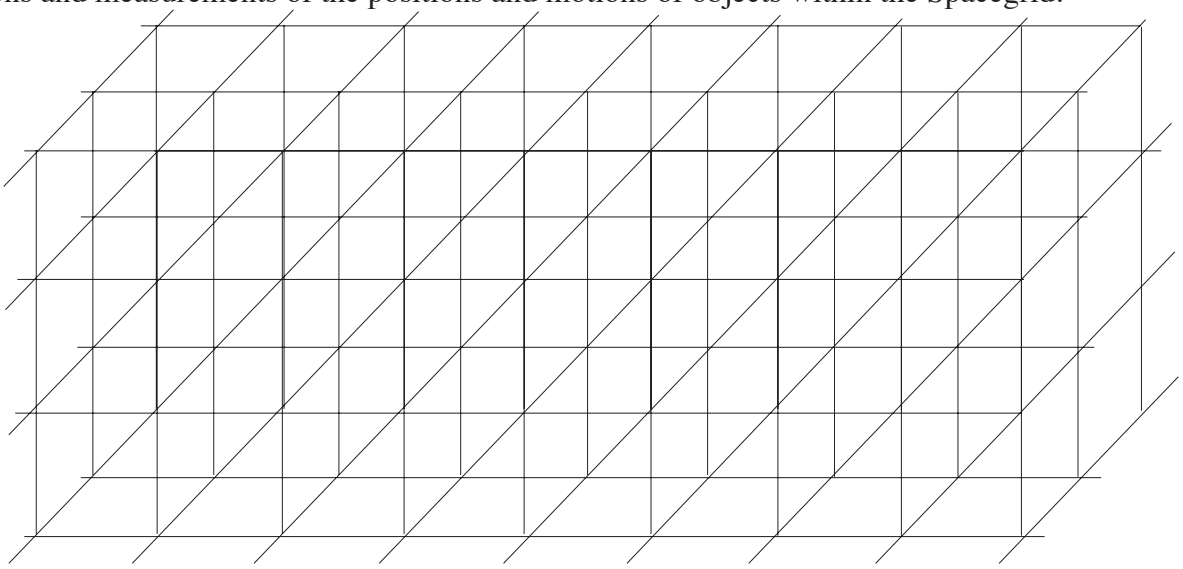


Fig. 19

In plane geometry, a 2D line has a length, it may have a width, but it has no depth. The dimension of depth would give a line three dimensions and cause it to become a 3D line.

A straight line can exist in three-dimensional space, 3D space, as the shortest distance between two spacepoints.

If a line exists in 3D space, then it can have dimensions of width and depth in addition to the dimension of length.

The concept of the 3D straight line that has length, width and height dimensions can be intuited from considering a proof of the reality of a 2D straight line.

The concept of the straight line in plane geometry is an axiom – an intuition accepted to be a reality.

In mathematics and in the sciences, an axiom is a premise, a starting point, a given, a law, etc., and an axiom is self-evident, i.e., a proposition no one can prove is a reality.

An axiom, however, is intuited, and, therefore, it is a proposition which has been derived by intuitive logic and whereas no disconfirming cases have ever been discovered or intuited, therefore, an axiom is considered to be a confirmed reality until it is disconfirmed. No one ever expects an axiom to be disconfirmed.

A line can be considered to be a geometrical shape which has length, width and height.

On a two-dimensional plane surface (a 2D surface, surface which is not curved), straight lines have been observed to exist as marking the shortest distances between two points. Any other lines between two points that do not coincide with the straight line between those two points are observed and measured to be longer than the straight line.

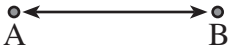


Fig. 1A

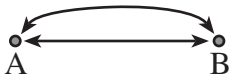


Fig. 1B

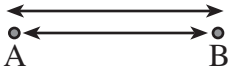
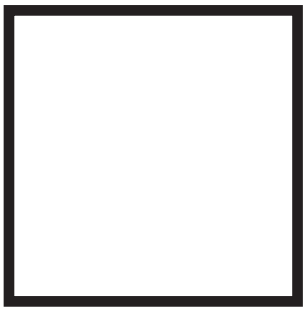


Fig. 1C

Figures 1A, 1B and 1C reveal howitiz that the the geometrical axiom that a straight line is the shortest distance between two points is no longer a geometrical axiom but is instead a physical reality.

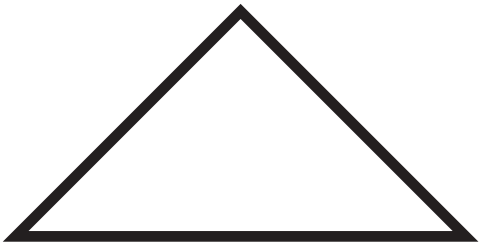
A square is a two-dimensional (2D) figure that has straight lines that are generally considered to have a length dimension and perhaps a width dimension but not an height dimension.

Square 1

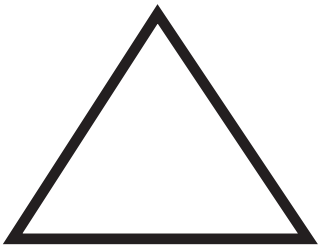


In engineering, a triangle is the most rigid shape because it cannot be deformed. Any force applied to one side would not change the length of that side without changing the lengths of all other sides or breaking the triangle.

Triangle 1: Isoceles

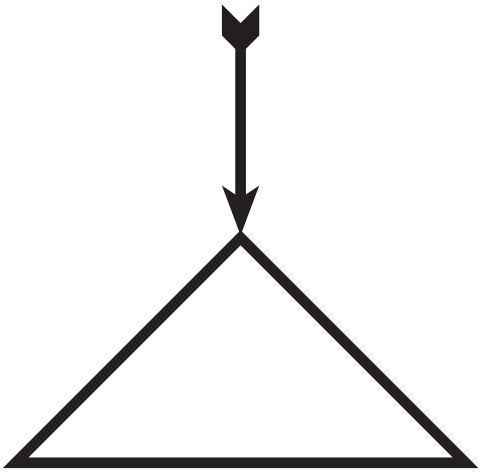


Triangle 2: Equilateral



If a force is applied to a point on an isosceles triangle ...

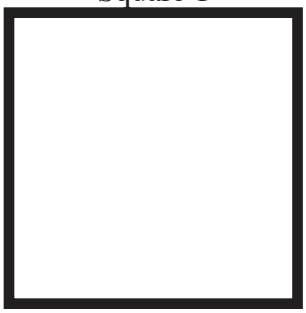
Triangle 1: Isosceles: A Force Is Applied to a Point



... and the force does not deform or shorten the sides, then the triangle will not deform.

A square has four equal sides.

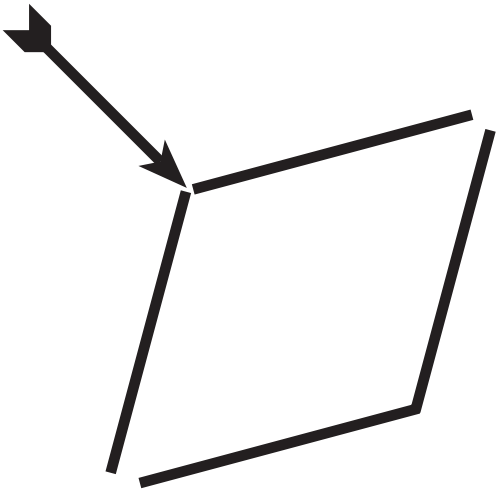
Square 1



If a force is applied to one corner point of a 2D square (or a rectangle), there is no diagonal to keep the corner points from breaking apart.

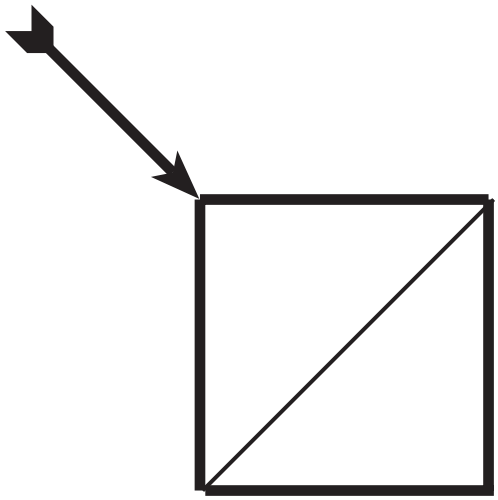
If a force is applied to one point, and if the sides did not deform, then that force could cause one or more of the square's corners to break apart and that in turn would cause the square to break apart.

Square 1: A Force Is Applied to One Corner



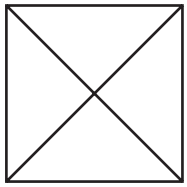
If a diagonal is added to the structure of a square, then the diagonal creates two triangles within the square, and if a force is applied to a corner point and the sides do not deform, then, because of the rigidity of the triangles formed by the diagonal, the square will not break apart.

Square 1 w. Diagonal: An Applied Force Does Not Break Apart The Square



A set of diagonals can be drawn from all corners of a square.

Square 2

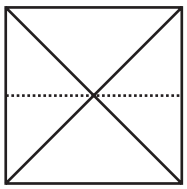


The diagonals form two isoceles triangles (triangles with two equal sides whose third side is longer than one of the other equal sides).

These isosceles triangles are rigid; they cannot be deformed. Thus, by adding diagonals, the square is strengthened and cannot be deformed without breaking.

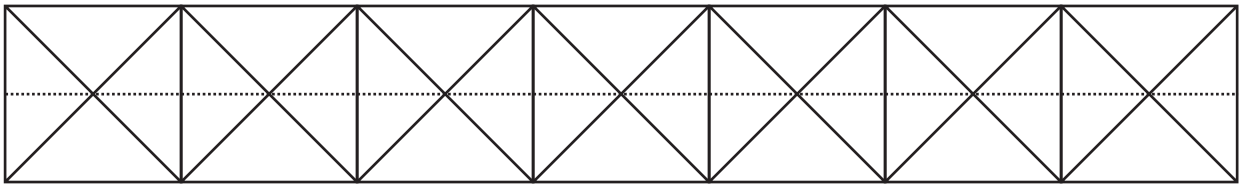
A centerline from one side of a square to the opposite side can be drawn for a reference line.

Square 3



A series of identical squares with diagonal supports can be joined together as a series of squares with their joint sides perfectly contiguous, e.g., the area of each side in a joint fits perfectly together with the area of its mate.

Square 4

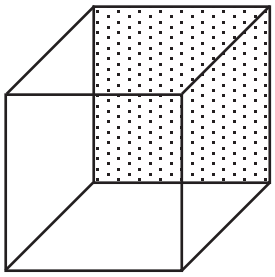


Since none of the rigid squares (actually, the rigid triangles that comprise the rigid squares) can be deformed (because they are comprised of rigid triangles), the set of squares forms a 2D straight line.

A cube is a three-dimensional figure comprised of six identical sides of equal sizes.

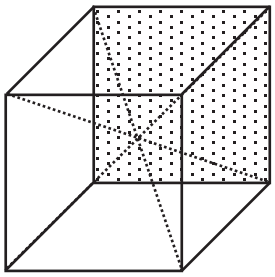
A cube can be intuited thus:

Cube: 5a



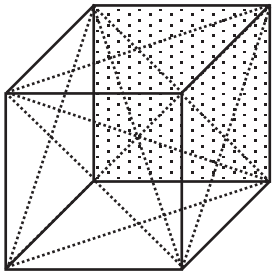
Diagonals can be drawn within the cube

Cube: 5b



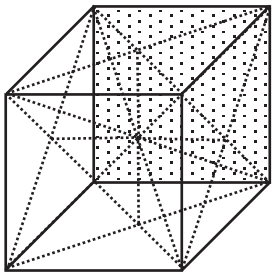
The diagonals create internal pyramids which add a measure of rigidity to the cube, but additional diagonals are needed to provide rigidity for the sides.

Cube: 5c



The new diagonals add more rigidity to the cube, but a set of diagonals from the center of the cube, the intersection of the diagonals from the corners of the cube, to the intersections of the diagonals for the sides will add more rigidity.

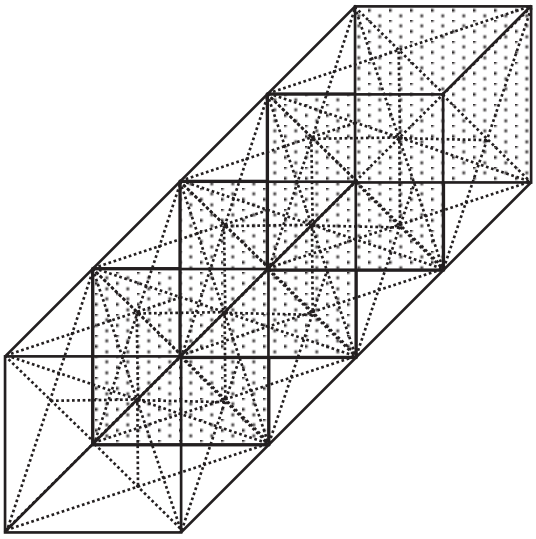
Cube: 5d



Now the interior of the cube is loaded with triangles and is as rigid as needed for the next step in operationally defining a straight line in 3D space.

A series of 3D cubes can be joined to form a 3D straight line.

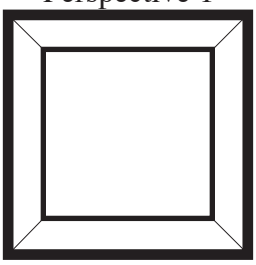
Cube: 5e



The cube structure thus becomes as rigid as needed for this intuition/thought experiment.

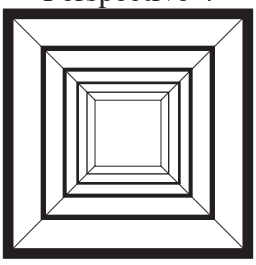
If an observer were to look through the center of a cube, then he would have this perspective:

Perspective 1



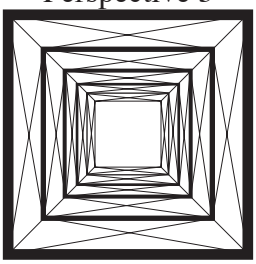
If an observer were to join five cubes together and were to peer through the center of the cubes, then he would have this perspective:

Perspective 4



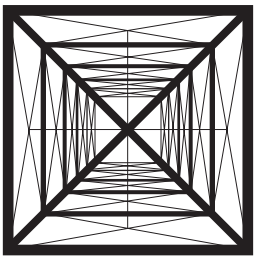
If an observer were to create diagonals for the sides of the cubes and t peer through the center of the cubes, then we would have this perspective:

Perspective 5



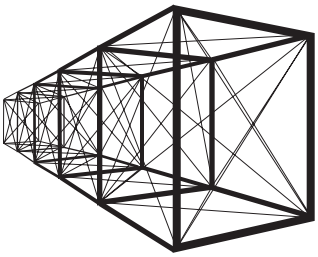
If an observer were to create diagonals from the intersections of the a cube's diagonals for the sides and were to peer through the cube's centers, then he would have this perspective:

Perspective 6



Because triangles are found everywhere within this structure, the structure cannot be deformed and is therefore a 3D version of a straight line.

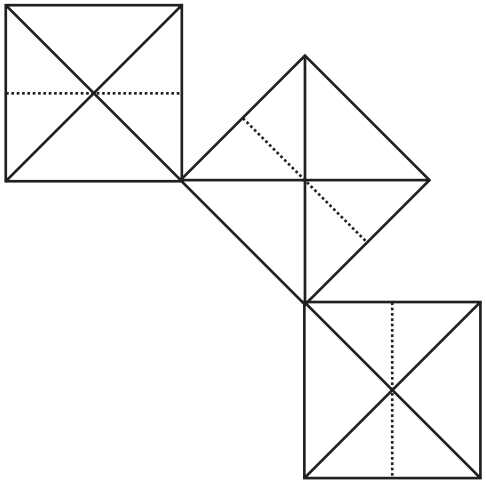
Perspective 3



Due to its rigidity, this cube structure cannot be twisted and will therefore retain its shape and will therefore be a perfectly straight 3D line regardless of forces which theoretically should cause distortions.

If a curved line was considered to be a set of short lines then an observer could thereby intuitively construct a curved line by joining the corners of a series of squares or the edges of a series of cubes, as shown by the following illustration:

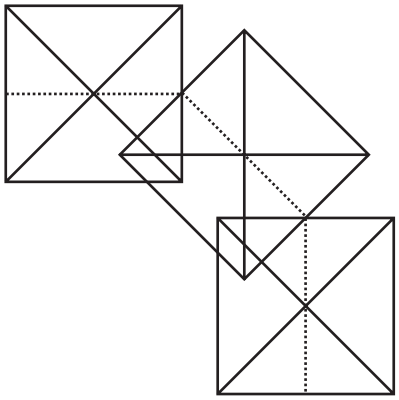
Curved Line: 7a



The joint sides of the squares or cubes would not be contiguous.

If a curved line were constructed by joining a series of squares or cubes at their centerlines, then that curved line would have the following configuration:

Curved Line: Line Square 7b

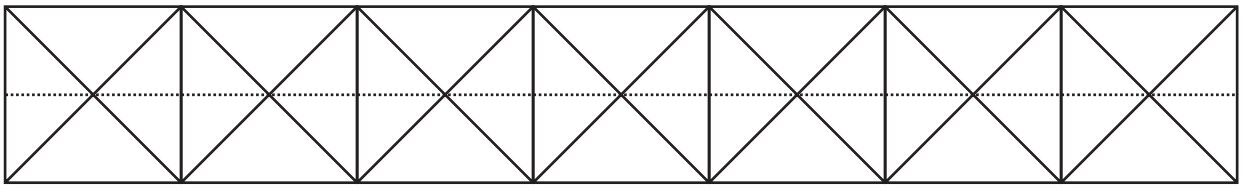


The joint sides would not be contiguous because there are intrusions of the sides of the squares or cubes upon each other.

This fact reinforces the conclusion that a series of rigid 2D squares or 3D cubes whose joint sides are contiguous will form a perfectly straight line, e.g., the 2D squares will form a perfectly straight 2D line and the 3D cubes will form a perfectly straight 3D line.

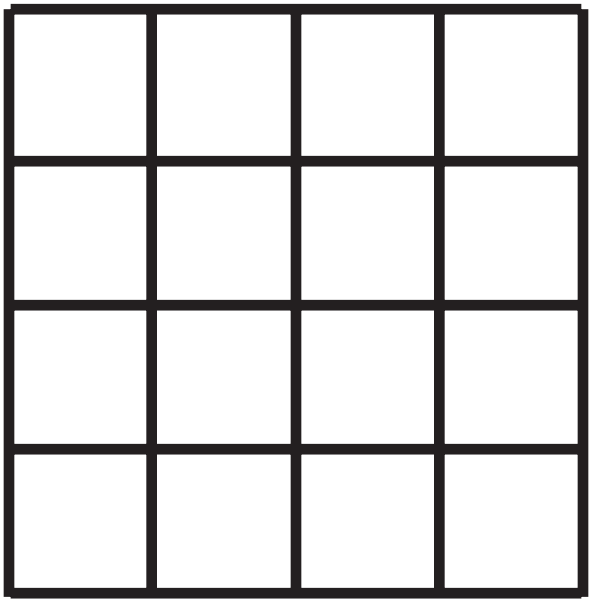
This fact reinforces the conclusion that a series of rigid 2D squares or 3D cubes whose joint sides are contiguous will form a perfectly straight line, e.g., the centerlines of contiguous equal-sized 2D squares will form a perfectly straight 2D line and the centerlines of contiguous equal-sized 3D cubes will form a perfectly straight 3D line.

Square 4

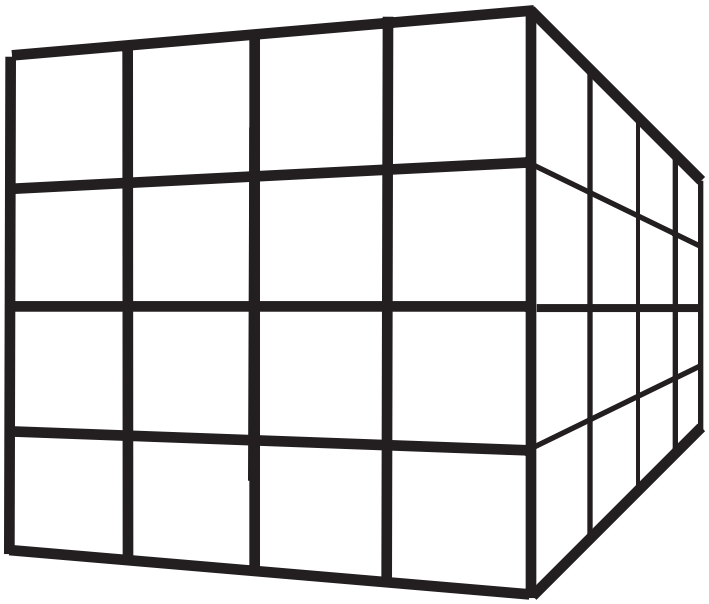


In theory, by intuition, a latticework of cubes can be joined with all sides being contiguous joint sides.

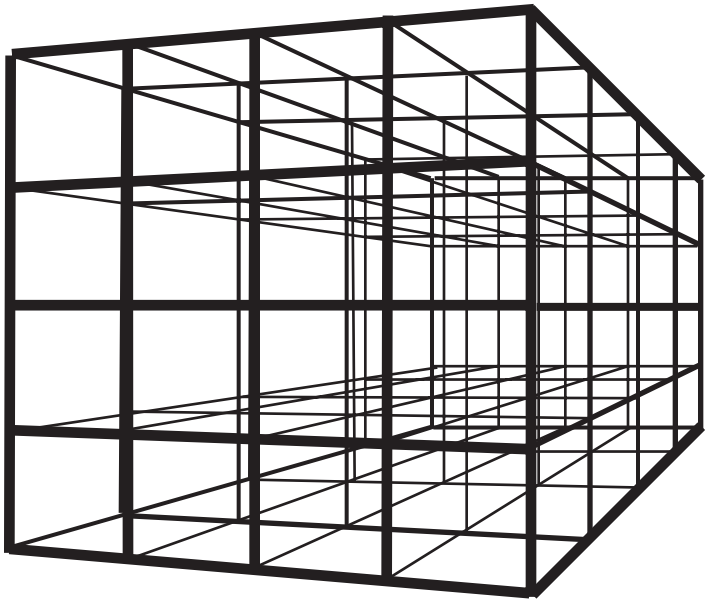
One 3D perspective of the top or bottom or one of the sides of the contiguous cube latticework is this view of a sixteen-cube per side latticework:



Another is this:



And another is this:



From all these intuitive perspectives the universe has indeed a 3D cube latticework – the universal 3D latticework – that is the Spacegrid that enables the conceptualization by intuition of the Absolute Rest Reference Frame – the ARRF.

All spatial measurements are conducted in reference to the Spacegrid/ARRF. All space-intervals/SIs are relevant to Spacepoint positions within the Spacegrid/ARRF. The locations of Xs comprised of m/e define and comprise the universal m/e configuration – the UMES – with the Spacegrid/ARRF. Curved surfaces can be plotted or analyzed as occupying positions within the Spacegrid/ARRF.

Thus, the universe is Euclidean after all. The ARRF says so.

There are no dimensions in addition to the three dimensions of space (length), the one dimension of time, and the single dimension of mass. Thus, there are no mysterious extra dimensions which lurk somehow beyond human imagination or comprehension regardless of mathematical convenience(s).

When space, the spatial reality of the universe, is considered to be the i-volume that has to be and therefore is the one-and-only volume of infinite radius within which all entities which are comprised of m/e must exist and endure over time, then there is no space 'beyond' or 'outside' or 'in addition to' the i-volume which is space and the concept and physical reality of space eliminates forever any possibility that there are extra dimensions beyond length, time and mass and there could be additional spaces or universes.

The Einstein Space Elevator

The Einstein Space Elevator (ESE) is a thought experiment (German: *gedankenexperiment*) wherein which Einstein intended to use intuition to explain and demonstrate a physical phenomenon inre light motion.

The physical phenomenon is the difference between the actual path of a lightray (or a photon, illustrated by a solid-line arrow) and the apparent pathway of the lightray (illustrated by a dashed-line arrow) as observed by an observer aboard an elevator which is being 'elevated' (set in-motion 'upwards') in gravity-free space.

The difference between the actual and the apparent photon pathways is relevant to whether or not there is a pathway track (trail) that would indicate no change of direction and therefore no change of velocity (velocity = speed + direction) or a pathway track (trail) that would indicate a change of direction and therefore a change of velocity regardless of whether/not there is an actual change of velocity (which would require an acceleration of the photon).

1. Actual Pathway: No change of velocity inre the photon.
2. Apparent Pathway: Change of velocity inre the photon.

In the Einstein Space Elevator diagrams, ...

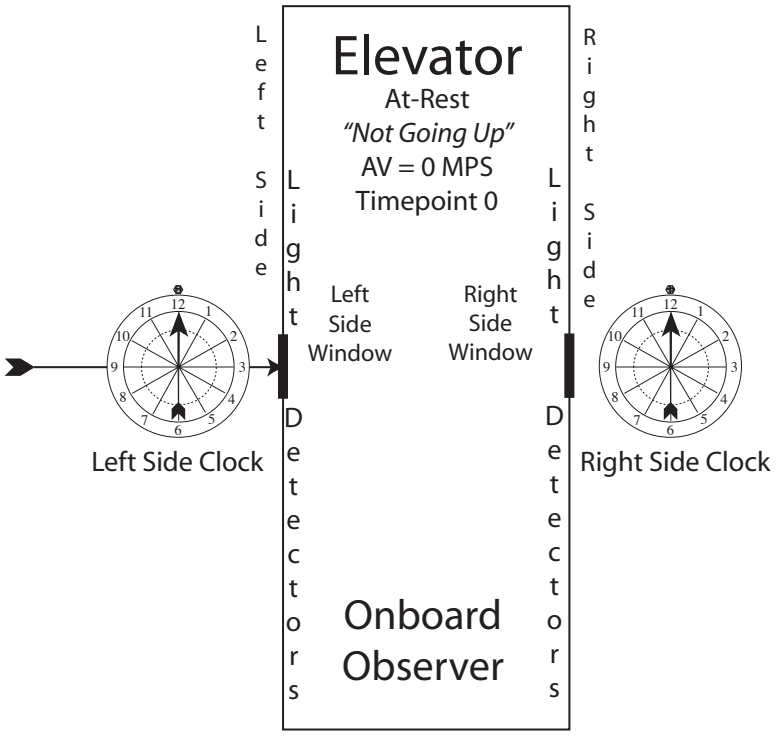


FIG. 1. The Einstein Space Elevator At-Rest at Timepoint 0 (T0)

1. The elevator is illustrated as a rectangle.
2. A lightray or photon is illustrated as an arrow – the photon arrow; The arrowhead illustrates the position of the photon and the arrowfeathers illustrate the position of the light source – the photon light source – from which the photon arrow was emitted; the photon light source is positioned outside and alongside the left side window of the elevator so that if the elevator has the physical/inertial state of being at-rest (not in-motion) the photon arrow would pass through both the left side and right side windows but if the elevator has the physical/inertial state of being in-motion 'upwards' towards the top of the page the photon arrow would pass through the left side window and strike the light detector positioned on the elevator's right side wall below the elevator's right side window.
2. A text block describes the elevator's physical/inertial state: (1) At-Rest "Not Going Up" at 0 mps; (2) In-Motion "Going Up" at a constant velocity; (3) In-Motion "Going Up" under acceleration. In the elevator's at-rest physical/inertial state, there is no arrow atop the elevator; in the elevator's in-motion physical/inertial state of either constant velocity or acceleration (changing velocity), an up-arrow is positioned atop the elevator to show the physical/inertial state of motion upwards (up the page).

2. Within the elevator are two windows: The Left Side Window and The Right Side Window.
3. Alongside the left side window is a Left Side Clock and alongside the right side window is a Right Side Clock. Both clocks are connected to light detectors located on the sidewalls of the elevator. The light detectors detect the presence of the arrowhead of the light arrow. The clocks then mark the timepoints at which the light detectors detect the photon arrow's arrowhead. Both clocks are set to 12:00 (AM or PM – either would be relevant). This 12:00 timepoint is designated to be Timepoint 0 or T0. The clocks would be positioned within the elevator inside and nearby to the windows but in the clock illustrations are positioned outside nearby to the windows for display purposes. The left side clock marks timepoint of the detection by the left side light detectors of the entry of the photon arrow's arrowhead into the left side window; The right side clock marks the timepoint of the detection of the photon arrow's arrowhead by the light detectors on the right side of the elevator. The clocks can be either radio clocks or inertial clocks. If they are to be radio clocks, then both clocks are slave clocks whose timerates (rates of ticking) and timecounts (hand positions for analog clocks, readouts for digital clocks, or distances traveled by an entity over a grid for linear clocks) are adjusted by being synchronized by a master clock. If they are to be inertial clocks, then they are self-adjusting to maintain an initial timerate and timecount. Regardless of the motion of the ESE, the onboard clocks display identical timecounts. The Offboard Observer (*see* #5. below) will read their actual timecounts while the Onboard Observer will read their apparent timecounts.
4. A text block within the ESE describes an Onboard Observer who is positioned within the elevator and is described as standing as if observing the interior of the elevator from the viewpoint of a reader of this page, i.e. with his back turned towards the reader.
5. An Offboard Observer (Outside Observer) is not illustrated but is described (in this paragraph) as positioned outside the elevator as if he has his back to the reader and as if he is looking at the elevator and the Onboard Observer through an open door (or another window) and as if he is moving parallel to the direction of motion of the elevator (up the page) alongside the elevator.
6. The elevator is illustrated as either at-rest (with no motion) or in-motion moving from the bottom of the page towards the top of the page at either a constant velocity or accelerated (under acceleration/being accelerated) by an arrow atop the ESE. The arrow at the top of the elevator shows the elevator's direction of motion from the bottom of the page towards the top of the page.
7. The pathway of the lightray is shown as an arrow – a photon arrow – with the arrowhead being the photon and the arrowfeathers being positioned at the location in space wherein the photon was emitted from a light source positioned at 90º to the elevator and the pathway of the elevator. The actual photon arrow will be shown as continuous by a solid line (no dashed line); it will expand in distance from the arrowfeathers/light source outside the elevator to the arrowhead/photon position inre the light detectors on the right side of the elevator. The actual photon arrow is observed by the Offboard Observer. An apparent photon arrow with the arrowfeathers in the left side window and the arrowhead at the position wherein the photon was detected by the light detectors on the right side of the elevator below the right side window will be shown as continuous by a dashed line that is straight for the case wherein the elevator is in-motion at a constant velocity and curved for the case wherein the elevator is in-motion and accelerated and illustrate the apparent pathways of the photon as observed by the Onboard Observer.

In FIG. 2., the actual photon arrow's arrowhead/photon has moved from its origin (represented by the arrowfeathers outside the ESE) to the left side window of the ESE.

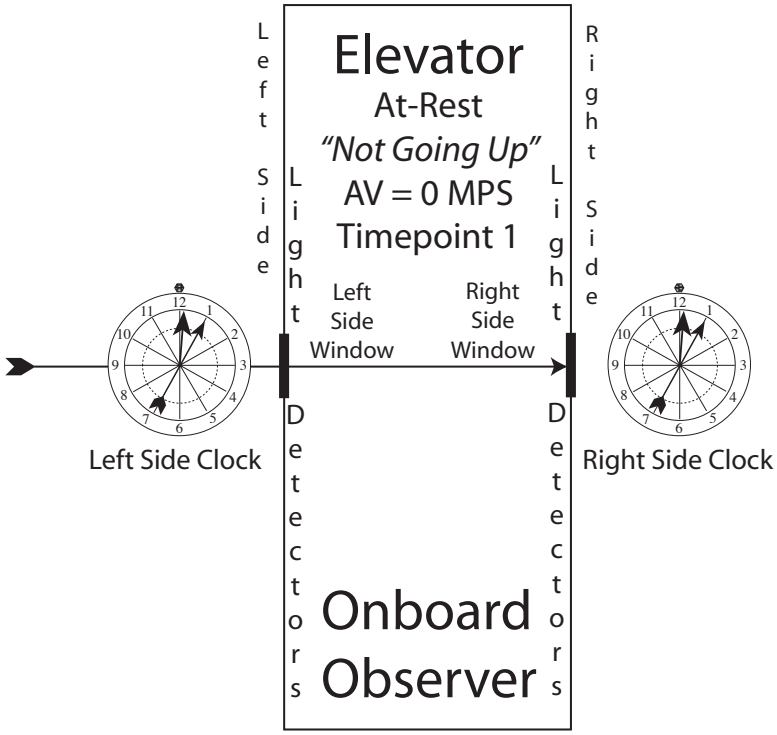


FIG. 2. The Einstein Space Elevator At-Rest (AV = 0 MPS) at Timepoint 1 (T1)

FIG. 3 and FIG. 4 illustrate how when the ESE moves 'upwards' at a constant velocity then the actual photon arrow's arrowhead continues to move in the same direction of motion with the same velocity (speed and direction) and will strike the right side of the elevator and be detected by the light detectors on the elevator's right side at a point below the right side window. This would be the perception/observation of the Offboard Observer who is observing the ESE from the same viewpoint as anyone reading this page.

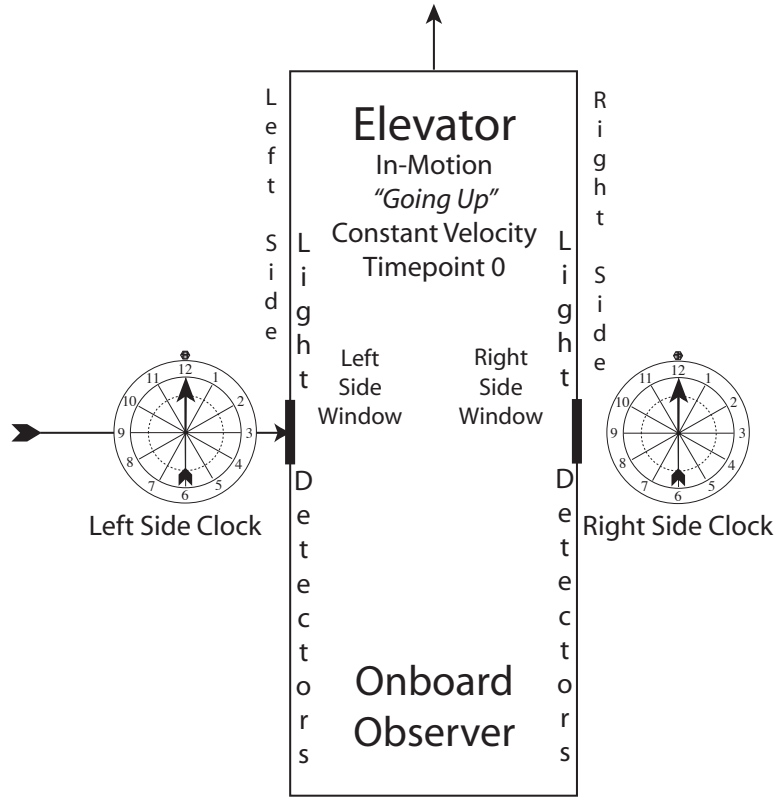


FIG. 3. The Einstein Space Elevator at Constant Velocity at Timepoint 0 (T0)

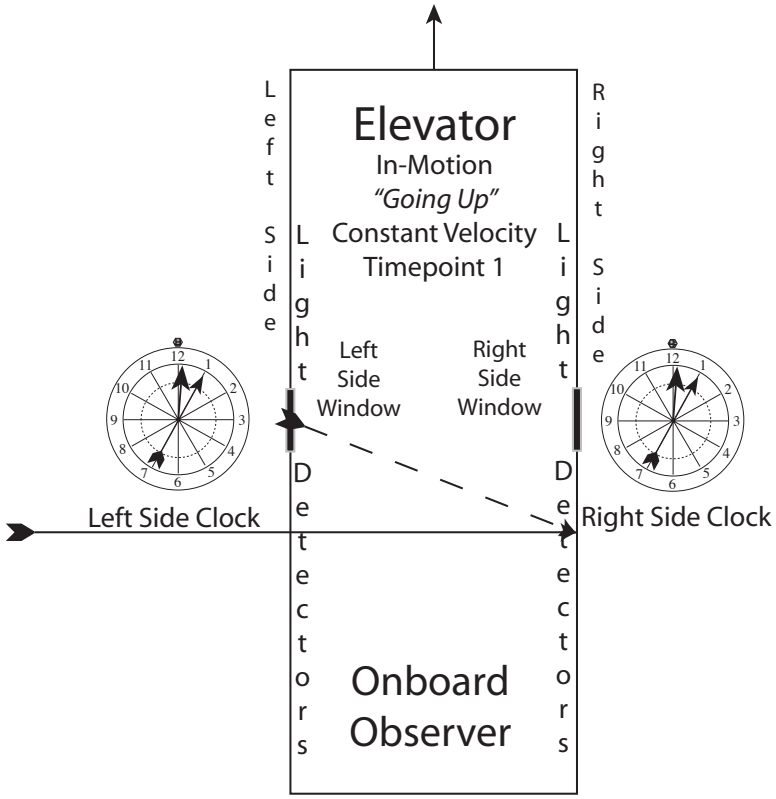


FIG. 4. The Einstein Space Elevator at Constant Velocity at Timepoint 1 (T1).

The Onboard Observer aboard the elevator perceives/observes the pathway of the photon arrow's arrowhead to be a straight but angled line extended from the left side window to a point below the right side window.

Inre FIGs 3 and 4, there is a difference between the actual pathway of the photon arrow's arrowhead observed by the Offboard Observer and the apparent pathway of that arrowhead observed by the Onboard Observer.

Inre FIGs 3 and 4, the apparent curved pathway is longer than the actual straight pathway because of the fact that because the clocks are synchronized and thereby have identical timerates and timecounts the apparent curved pathway takes the same amount of time (the same duration) as the actual straight pathway: T0 - T1.

If synchronized timepieces (clocks) were installed in/on the elevator, then at timepoint T0 in FIG. 5 the timepiece by the left side window of the elevator – the left side clock – would mark the detection by the left side light detectors of the presence of the photon arrow's arrowhead in the left side window and at timepoint T1 in FIG. 6. a timepiece by the right side of the elevator – the right side clock – would mark the detection by the right side light detectors of the presence of the arrowhead on the elevator's right side wall.

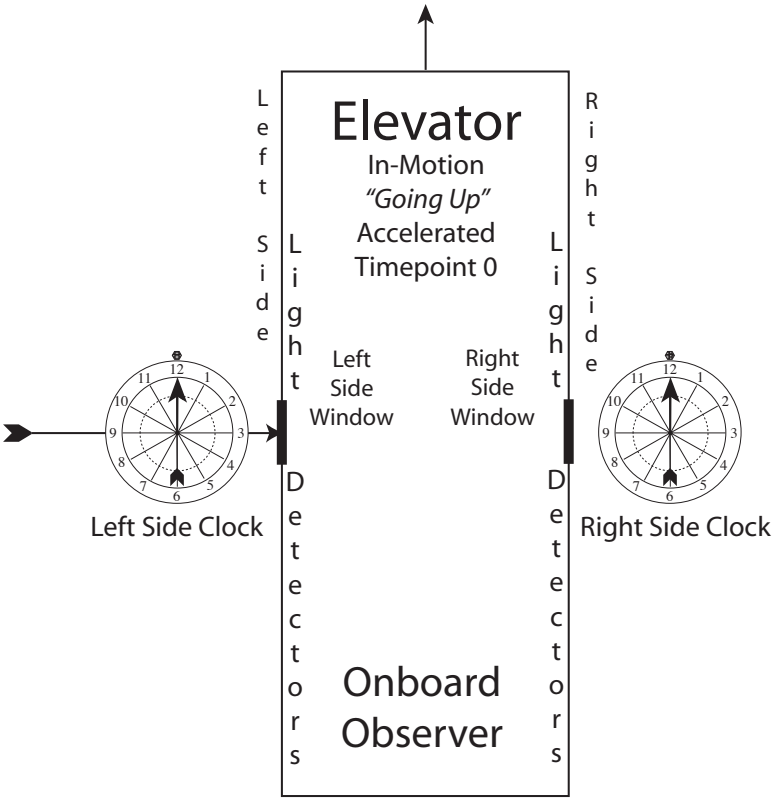


FIG. 5. The Einstein Space Elevator accelerated timepoint 0 (T0)

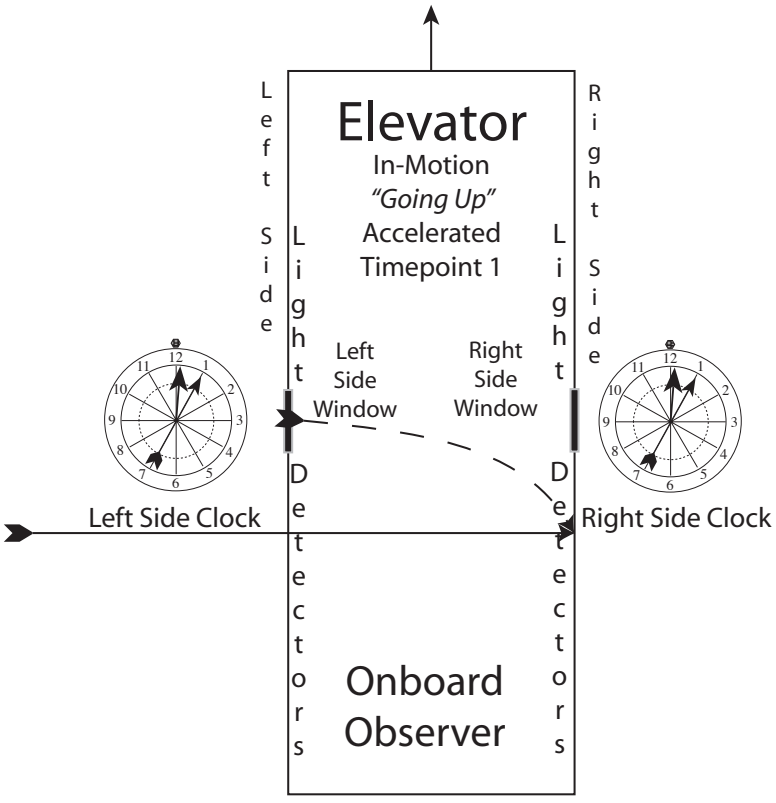


FIG 6. The Einstein Space Elevator Accelerated at Timepoint 1 (T1)

Inre FIGS 5 and 6, there is a difference between the actual straight pathway of the photon arrow's arrowhead observed by the Offboard Observer and the apparent curved pathway of that arrowhead observed by the Onboard Observer.

Inre FIGS 5 and 6, the apparent curved pathway is longer than the actual straight pathway despite the fact that because the clocks are synchronized and thereby have identical timerates and timecounts the apparent pathway

takes the same amount of time (the same duration) as the actual pathway: T0 - T1.

The duration from timepoint T0 to timepoint T1 (T0-T1) is identical for all pathways of the lightray (arrowhead) – the actual straight pathway, the apparent straight but angled pathway and the apparent curved pathway, but the distances inre the actual pathway and the apparent pathways are different.

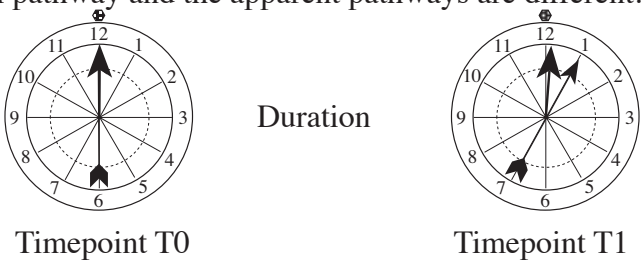


FIG. 7

At least in theory, any straight but angled line or any curved line can be placed parallel to another straight line so length/distance comparisons can be made.

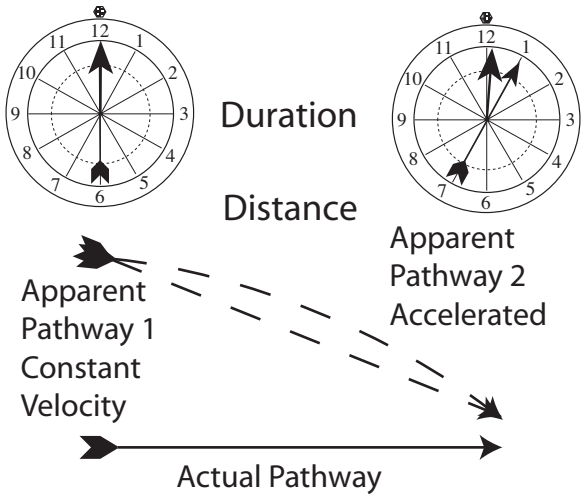


FIG. 8

At least in theory, any curved line can be straightened and placed parallel to another straight line so length/distance comparisons with other straight lines can be made.

If the straight but angled or the curved apparent pathway of the photon arrow's arrowhead is straightened and placed parallel to the straight line of the photon arrow's arrowhead's actual pathway, then the following illustrations describe the resulting physical states.

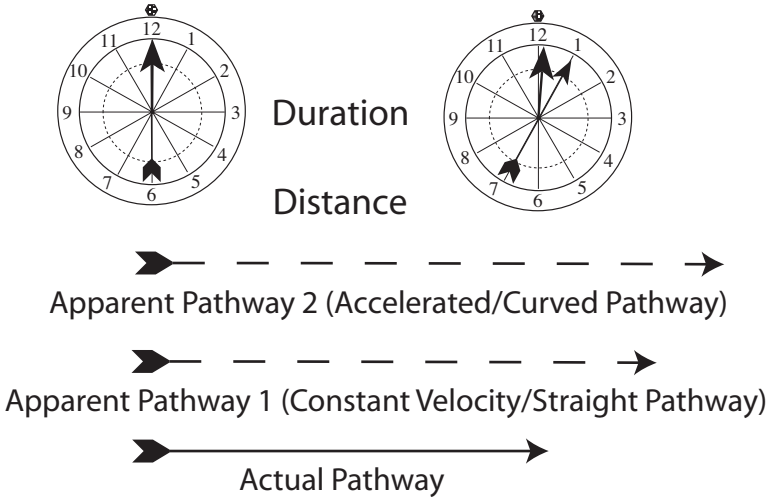


FIG. 9. Actual & Straightened Apparent Lightray Pathways

In Fig. 9, the constant velocity angled pathway and the accelerated curved pathways have been straightened. The Apparent Pathway 1 (the angled pathway of the case wherein the elevator is moving 'upwards' at a constant velocity) is longer than the Actual Pathway and the Apparent Pathway 2 (the curved pathway of the case

wherein the elevator is accelerated ‘upwards’) is longer than the Apparent Pathway 1 and the Actual Pathway.

For the apparent angled pathway and the apparent curved pathway the lightray would have to travel at super-luminal velocities to cover the additional distance in the same time duration T0-T1 as the lightray travels inre the distance inre the actual straight pathway.

The only case in which the lightray would pass straight through the elevator from the left side window to the right side window is the case wherein the elevator has no motion and therefore is at-rest and therefore has no velocity (or a velocity of 0 mph or 0 mps) and is therefore in the condition of Absolute Rest (AR) wherein AR = 0 mps wherein the velocity of 0 mps is an Absolute Velocity (AV) and that AV = 0 mps (the elevator’s AV is 0 mps, but any entity’s AV = 0 mps when the entity is at AR).

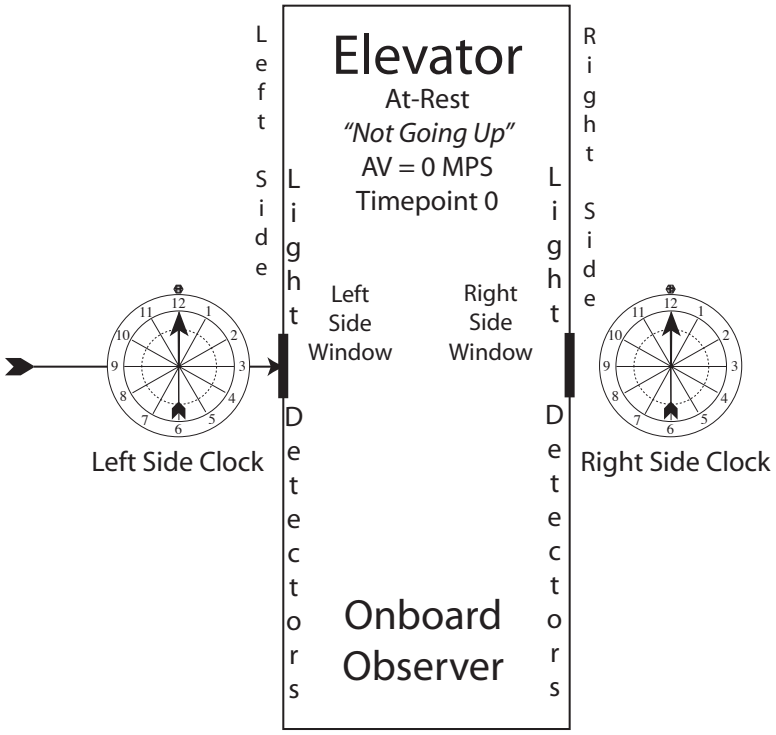


FIG. 7. The Einstein Space Elevator At-Rest at AV = 0 MPS at Timepoint 0 (T0)

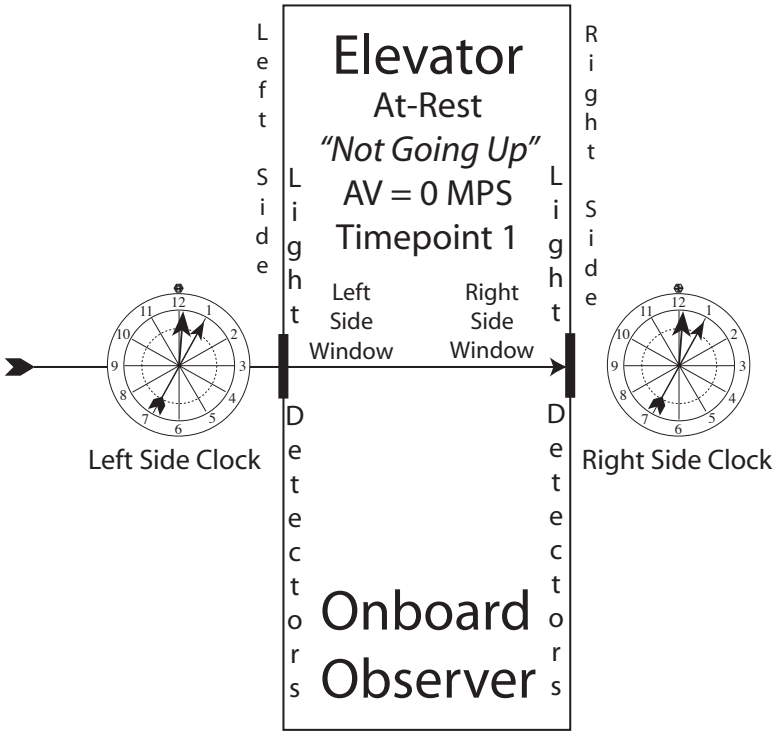


FIG. 8. The Einstein Space Elevator At-Rest at AV = 0 MPS at Timepoint 1 (T1)

If there is any movement (change of motion) of the elevator in any direction, there is an increase in the elevator's velocity and that increase is an increase of the elevator's AV and that AV is AV > 0 mps (the AV is greater than 0 mps).

If there is any movement of the elevator in the upwards direction of motion then, at least in theory, there will be a deflection of the photon arrow's arrowhead to a position and detection by a light detector below the right side window (as shown in FIGS 4. and 6.).

There is an assumption herein that the the motion of a light source has no causal effect inre the motion of a lightray or photon emitted from the light source. The motion of a light source neither increases nor decreases the velocity (speed + direction) of a lightray or photon emitted from that light source.

When a lightray or photon is emitted from a light source, then that lightray/photon has a velocity that includes the speed of 186,000 mps which is the speed of light *in vacuo* (in subvolumes of space that are devoid of gravity) and which traditionally has been designed by $\boldsymbol{c}$.

The Einstein Space Elevator was specified/stipulated by Einstein to be in a gravity-free subvolume of space. Therefore in the Einstein Space Elevator Diagrams there are to be no accelerations or decelerations of the elevator or the photon arrow caused by gravitational forces (forms of matter-energy, m/e) that cause accelerations or decelerations of entities which are comprised of m/e including lightrays/photons.

Because the motion of a light source does not affect the motion of a photon, when a photon is emitted from the light source positioned at the elevator's left side and in-motion perpendicular to the direction of motion of the elevator then the photon is assumed to be not accelerated forwards-backwards or side-to-side or upwards-downwards inre the page and is therefore assumed to be traveling at AV = $\boldsymbol{c}$ inre the elevator.

When researchers want to know the actual value of an observation then they are forced to focus on the actual and not the apparent physical phenomenon.

The focus can be framed in a question: What is the actual value of _____ ? [Physical Phenomenon]

The difference between an actual pathway and an apparent pathway is the difference of velocities wherein a change of velocity is required for apparent pathways and if observers could be positioned aboard the entities which are traversing a pathway then those observers would detect a change of velocity as an acceleration or a deceleration.

In the case wherein an observer observes an entity's angled or curved pathway then he is compelled to consider that if there is no actual acceleration or deceleration of the entity then the pathway is an apparent pathway and not an actual pathway and only when there is an actual acceleration or deceleration of the entity will that pathway be an actual pathway.

The elevator in-motion at either a constant velocity or under acceleration is not in its original reference frame $\boldsymbol{K_0}$. After acceleration up to and under constant velocity the elevator is in a different reference frame $\boldsymbol{K_1}$. Under acceleration the elevator is passing through different reference frames K_0, K_1, K_2, ... etc., until the acceleration force is ended and the elevator enters a constant velocity reference frame $\boldsymbol{K_i}$.

If the elevator is accelerated out of its original reference frame into another reference frame when the acceleration force is ended and the elevator is in-motion at a constant velocity then, in theory, the elevator shrinks in length in the x-axis direction which in these examples is the 'upwards' direction but not in either the y-axis nor the z-axis.

The y-axis would include the width of the elevator. The distance between the left and right side windows is the width of the elevator and this distance would not change during or as a result of accelerations from the original reference frame into the resulting reference frame and the time duration for the photon to traverse the elevator's y-axis width in a straight line pathway would not change as observed by the Offboard Observer but because the rates of operation of his perceptual processes would decrease in response to accelerations the Onboard Observer would observe the photon's angled pathway to traverse the elevator's y-axis width in the same time duration but this would be an illusion because the actual time duration would be the same time duration as when the elevator was at-rest at AV = 0 mps. This illusion is called the moving observer illusion or MOI.

Moreover, if distortable clocks (VTICs) were used to measure time durations (timecounts) when the elevator

was in-motion at a constant velocity of AV > 0 mps, then the measurement by an Offboard Observer of the time duration during which a photon traversed the elevator's width from the left side window to a right side light detector below the right side window would theoretically be the same time duration (timecount) as the time duration observed when a photon traversed the width of the elevator from the left side window to the right side window when the elevator was at-rest at AV = 0 mps. This illusion is supposed to be proof of time dilation but in reality is proof of distortable clock distortion caused by accelerations and decelerations and nothing more because of the fact that adjustable clocks (distortable clocks adjusted to compensate for the effects of accelerations and decelerations on time-intervals, timerates, timelines, and timecounts) could be used instead of distortable clocks and the timecounts (readouts) of adjustable clocks at AV = 0 mps and AV > 0 mps would be identical and therefore would produce no time dilation. [The use of adjustable clocks would produce the result of equivalent time durations or time equivalence regardless of accelerations and decelerations and changes of reference frames.]

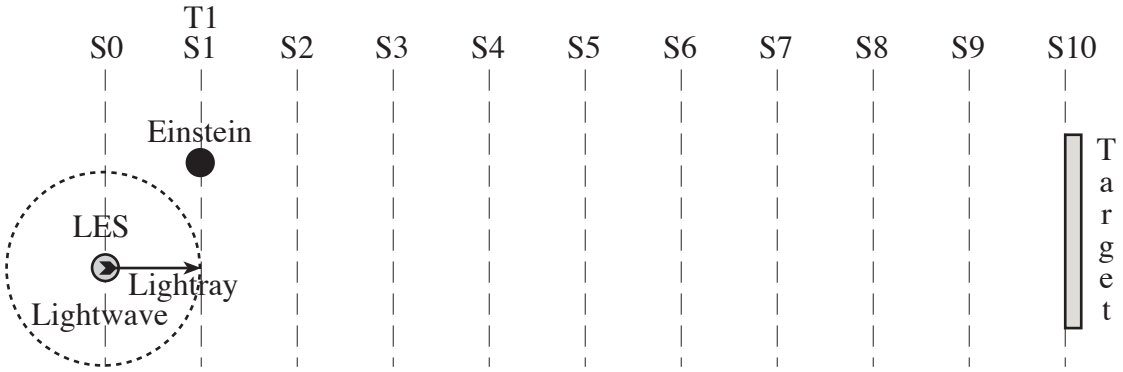
To a great extent Newton was right inre the ticking of a universal clock. Any unchanging cycle such as the unchanging duration of the motion of a photon from the Sun to the Earth over an unchanging distance would serve as a universal time-interval or invariable time-interval (ITI) and as a result the unchanging space distance from the Sun to the Earth could serve as a universal space-interval or invariable space-interval (ISI).

Einstein & A Lightwave

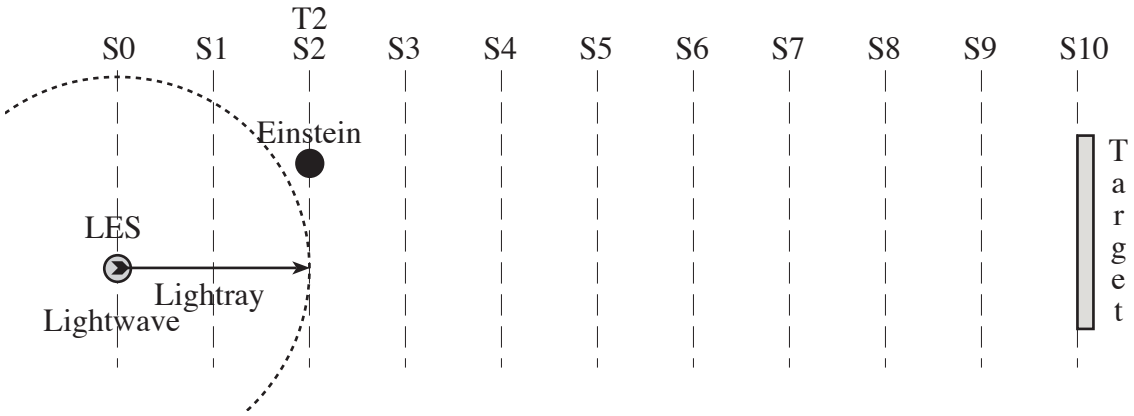
Einstein, as a teenager, wondered what would happen if he were to be in motion traveling alongside a lightray. He concluded that because he would be traveling at the same velocity as the lightray he would not see/observe the lightray. In this thought experiment he, Einstein, was effectively functioning as a Perfect Observer (PO) and not as a relativistic observer (RO) and he used intuition instead of observation or measurement to deduce his conclusion.

If light is intuited to be emitted from an LES as a lightwave and a lightray, then the lightwave could be conceived to be a circle that expands from the the center of the LES whose wavefront would keep pace with the arrowhead of the lightray. As Einstein intuited, the expanding lightwave and the extending lightray travel together at 186,000 mps the expanding lightwave circle never catches him (Einstein in the illutrations). Meanwhile, the LES does not move. The lightwave/lightray travel at AV = 186k mps relative to its LES. Einstein also travels at AV = 186k mps relative to the lightwave's/lightray's LES.

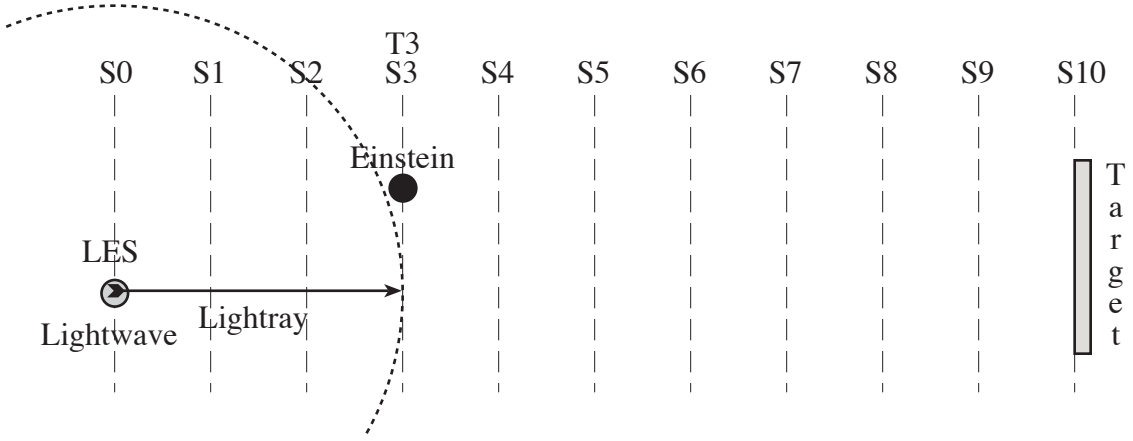
Einstein & Lightwave T0



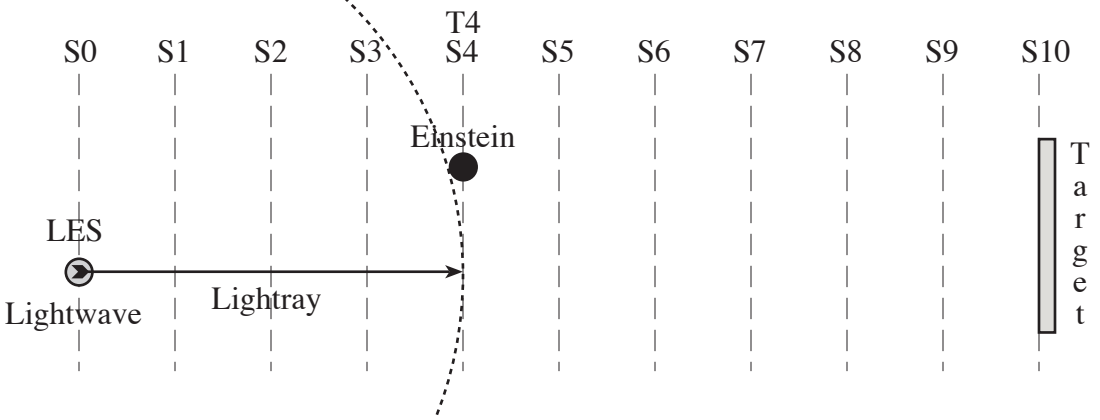
Einstein & Lightwave T1



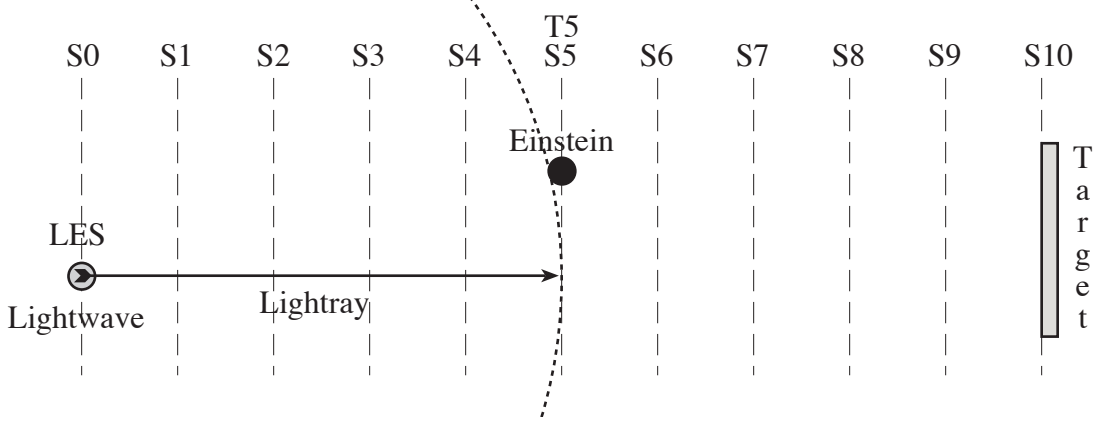
Einstein & Lightwave T2



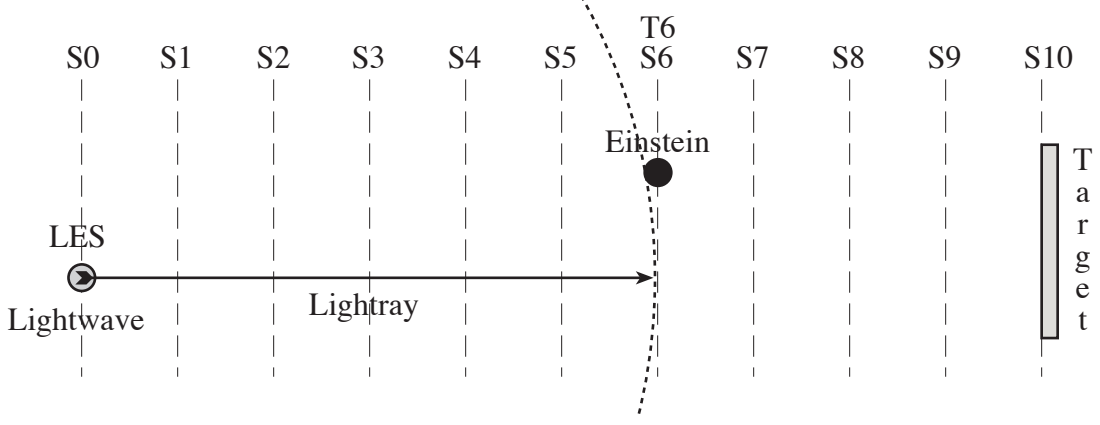
Einstein & Lightwave T3



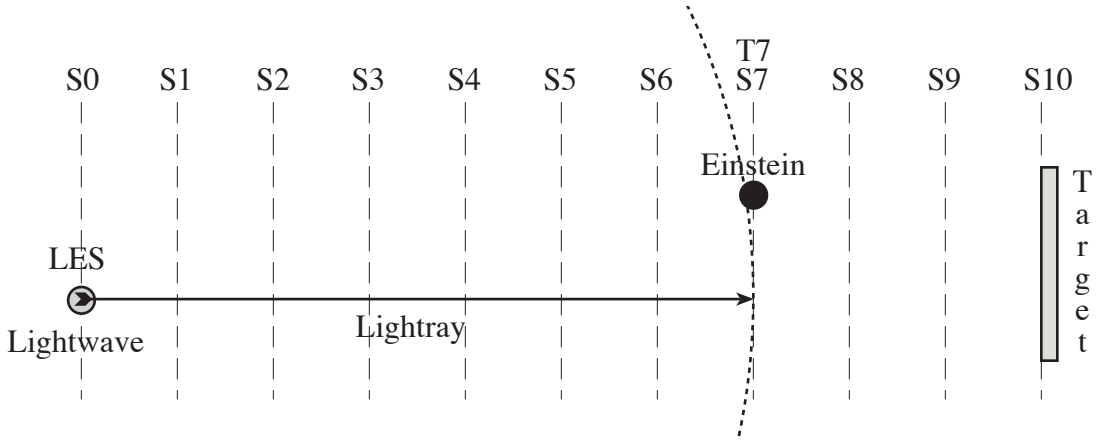
Einstein & Lightwave T4



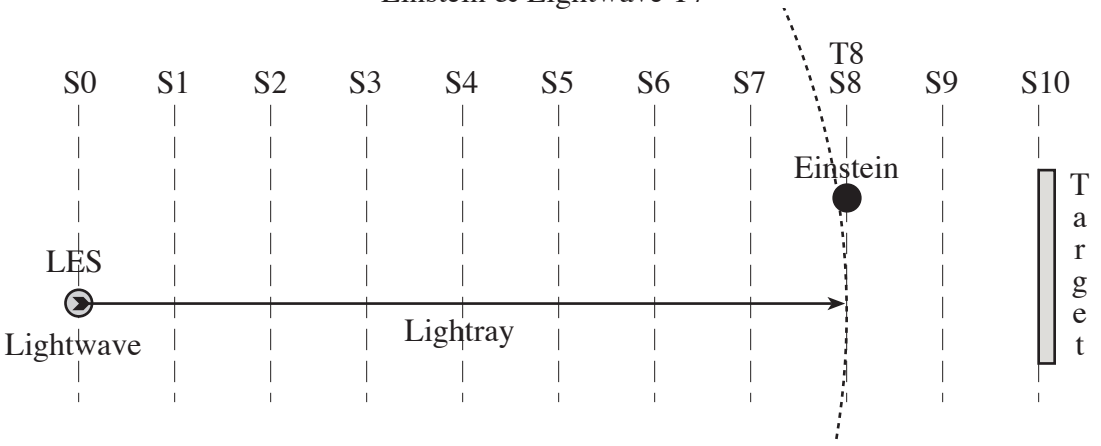
Einstein & Lightwave T5



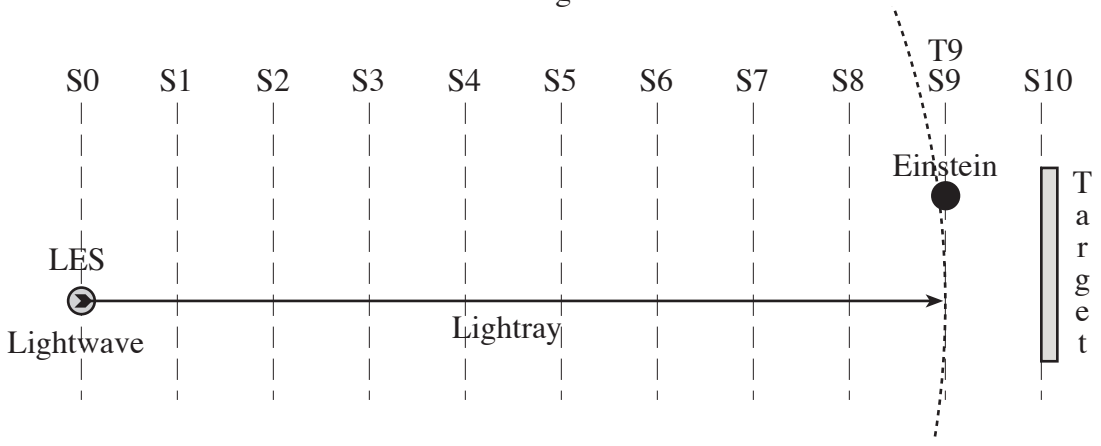
Einstein & Lightwave T6



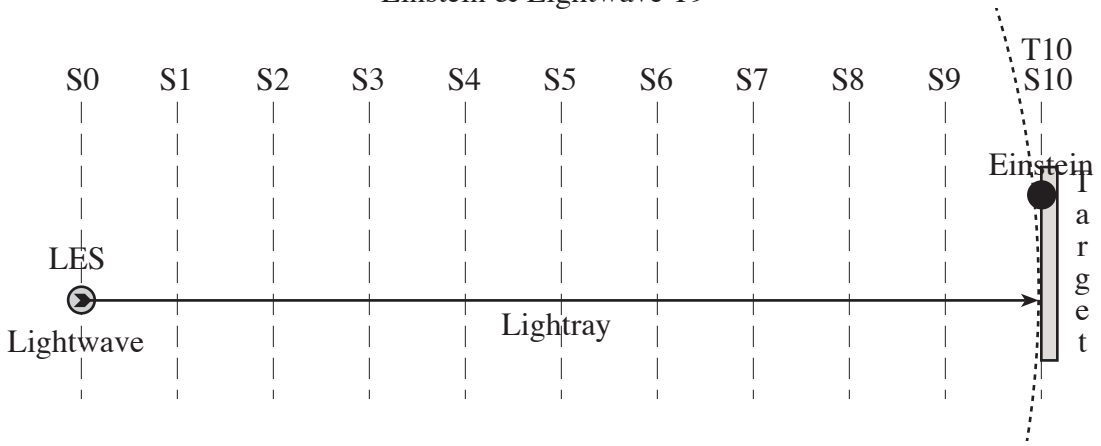
Einstein & Lightwave T7



Einstein & Lightwave T8



Einstein & Lightwave T9



Einstein & Lightwave T10

The expansion of the lightwave and the extension of the lightray at AV = 186k mps occur relative to the LES which is the source of the lightwave and the lightray because the LES has an AV = 0.00 mps and is in the ARRF/LESRF. The lightwave and the lightray are in the LRF.

The motion of the lightwave wavefront and the lightray could not be intuited or observed or measured if the Spacegrid were not a viable intuition if not an outright reality.

The Spacegrid is independent of any "shape" of space claimed by anybody. The Spacegrid izwhatitiz with perfectly straight lines.

The so-called 'straight lines' of relativity's spacetime are recognized by relativistas to be segments of great circles but this recognition contradicts the intuitive and physical fact that those relativistic 'straight lines' are curved lines that cannot possibly ever be intuitive or physical straight lines.

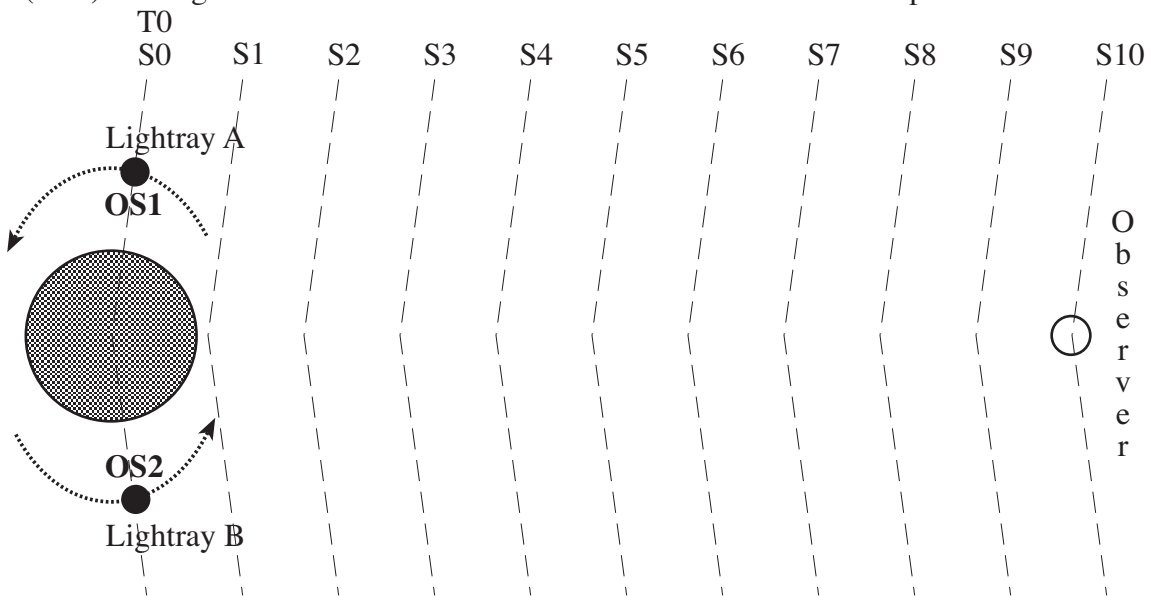
The Law of Inertia and the Corollaries of the Law of Inertia show clearly that any observation of a change of inertial state is inferred to be an effect caused by a cause which is a force of some kind – a push-force or a pull-force. Thus, inre any observed inertial state changes inre 'spacetime', the inertial state change is an effect caused by a cause which is a force of some kind – a push-force or a pull-force. Thus there are forces inre 'spacetime' and therefore the claim that the changes of inertial states inre 'spacetime' are caused by a 'geometry' of 'spacetime' are false, and, instead, those inertial state changes are caused by forces that have to be accounted for.

Note that if the pathway of the lightray were to twist and turn but retain its speed – the DoM would change but the speed would not, then the lightray would continue to travel at 186k mps relative to its LES. If the lightray were to reverse its course and travel towards its LES at 186k mps it would continue to travel at 186K mps relative to the LES from both its departure DoM (DDoM)and its approach DoM (ADoM), which means, in other words, that regardless of changes of its DoM the lightray would travel away from its LES at RV = 186k mps and towards its LES at RV = 186k mps.

The Orbiting Stars Diagrams

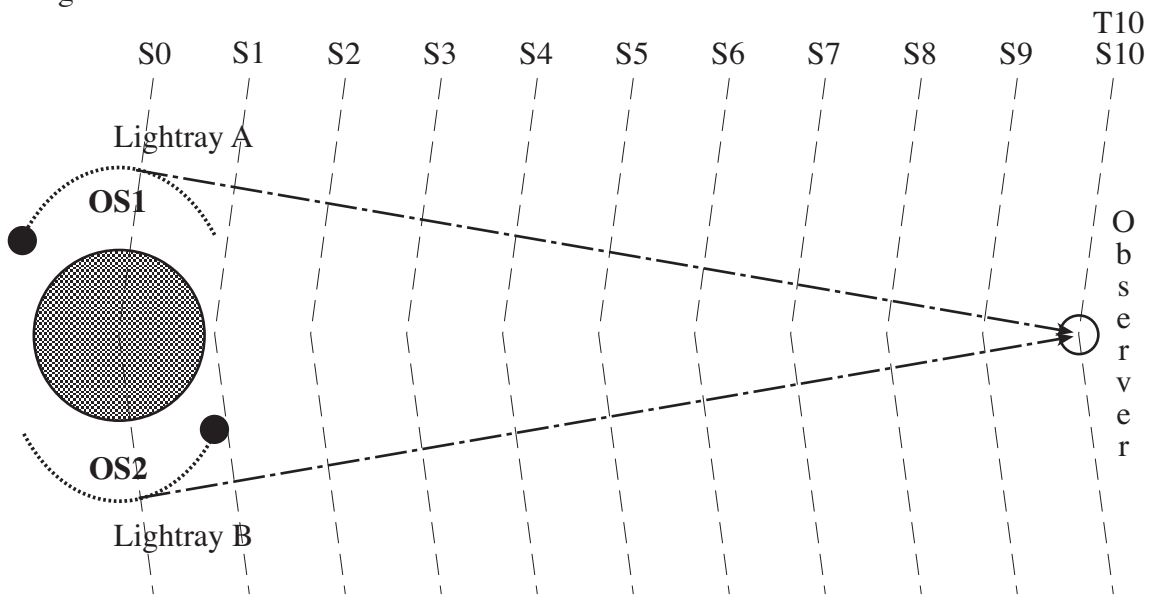
The Orbiting Stars 0ax-0f Diagrams

De Sitter has determined that the speed of light is not affected by the motion (speed) of the light source which emits a light pulse. De Sitter observed that the travel time to an observer required for a light pulse emitted from a orbiting star (OS1) moving counterclockwise about a massive star (MS) and away from the observer is identical to the travel time to the same observer required for a light pulse emitted from another orbiting star (OS2) moving counterclockwise about the same MS and in the same plane towards that observer.



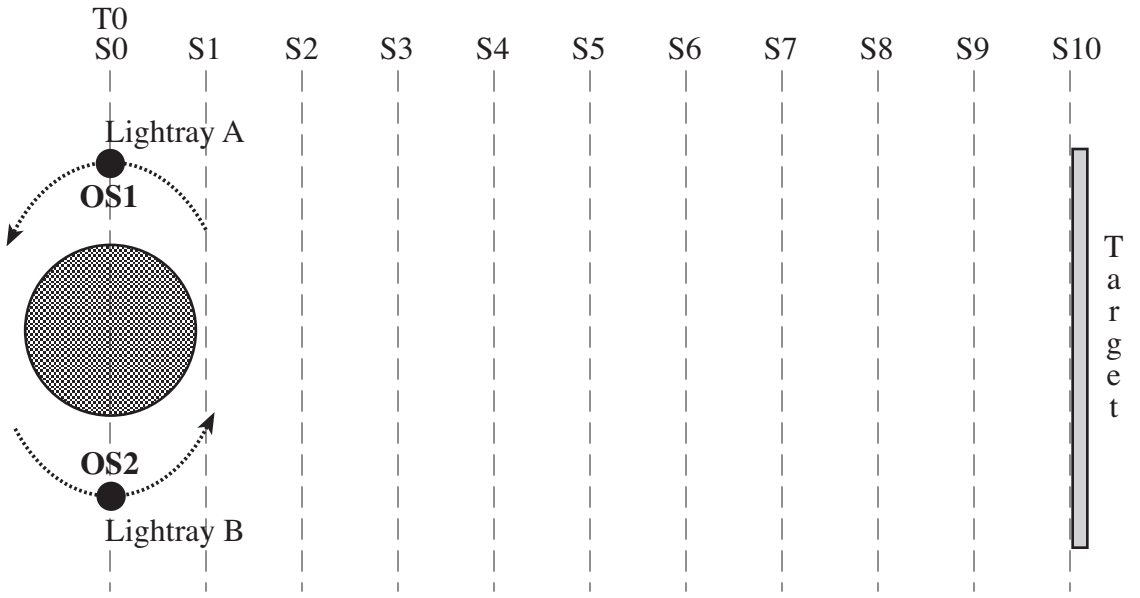
Orbiting Stars 0ax

The fact that when Lightrays A and B are emitted simultaneously towards Observer the same amount of time (the same temporal duration) is required for Lightray A from OS1 to strike Observer as the amount of time required for Lightray B from OS2 to strike Observer proves that the speed of light is independent of the state of motion of the light source.



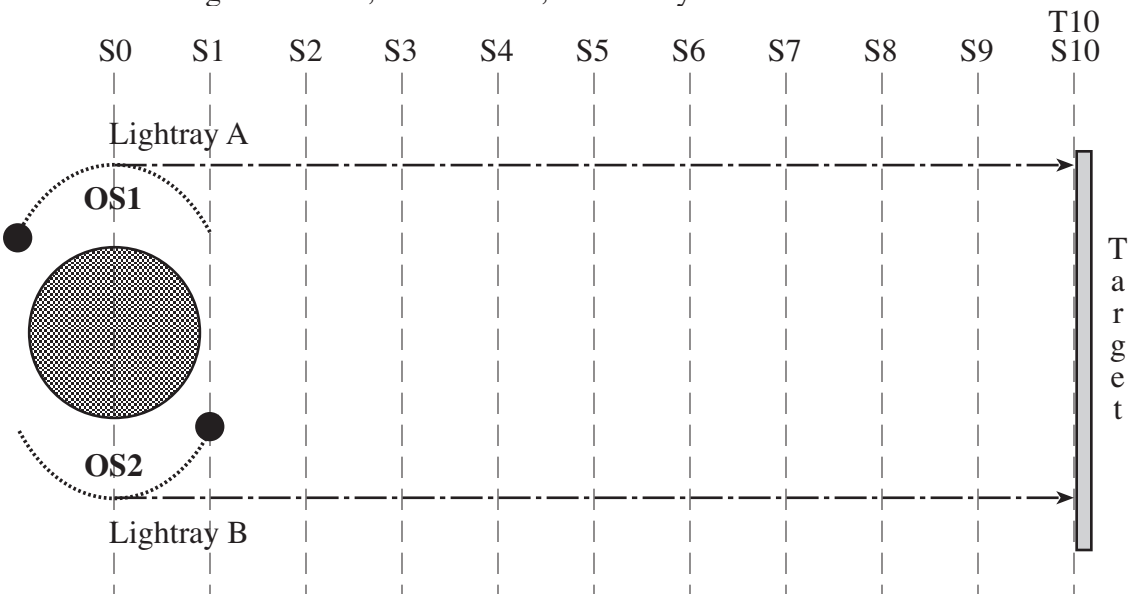
Orbiting Stars 0bx

The Orbiting Stars 0ax and 0bx Diagrams can be adapted so the light pulses are emitted parallel to each other and aimed at a massive Target aligned in the plane of the motions of Lightrays A and B perpendicularly to the motions of Lightrays A and B.



Orbiting Stars 0c

When Lightrays A and B are emitted simultaneously from OS1 and OS2 they travel parallel to each other and perpendicular to Target and will strike Target simultaneously if one or the other is not accelerated or decelerated or otherwise caused to change its course, inertial state, or velocity.

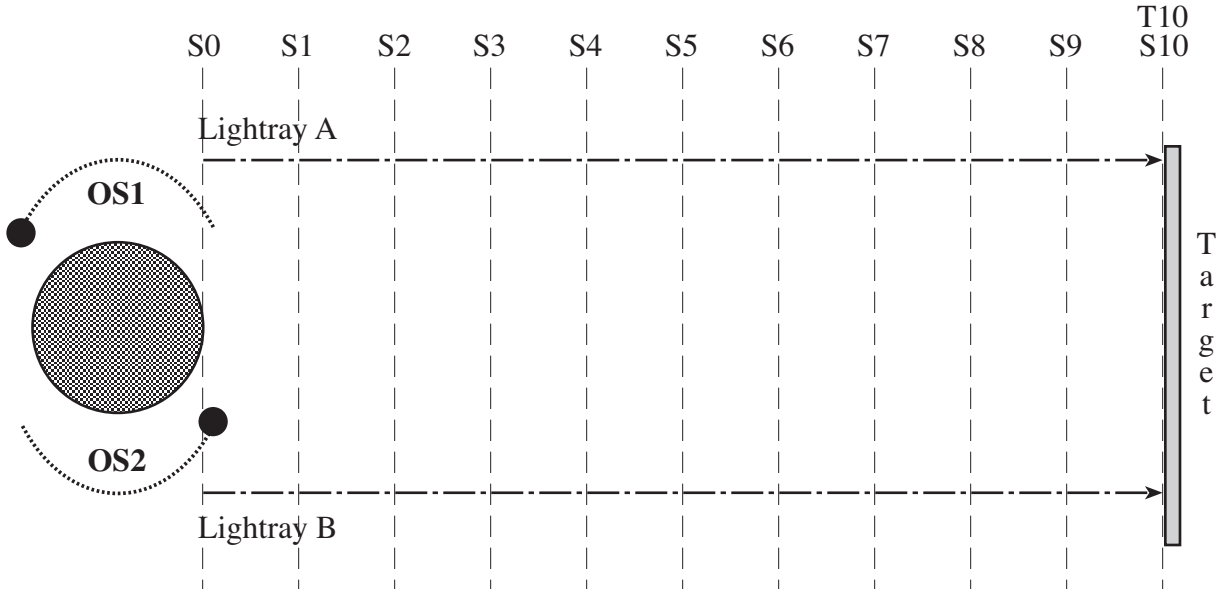


Orbiting Stars 0d

Because the motions (velocities) of lightsources do not affect the motions (velocities) of lightrays (light photons, lightpulses, etc.) the spacepoints at which lightrays are emitted are essentially at-rest at AV = 0 mps and the Lightrays have an AV = RV = MV = 186,000 mps relative to their emission spacepoints.

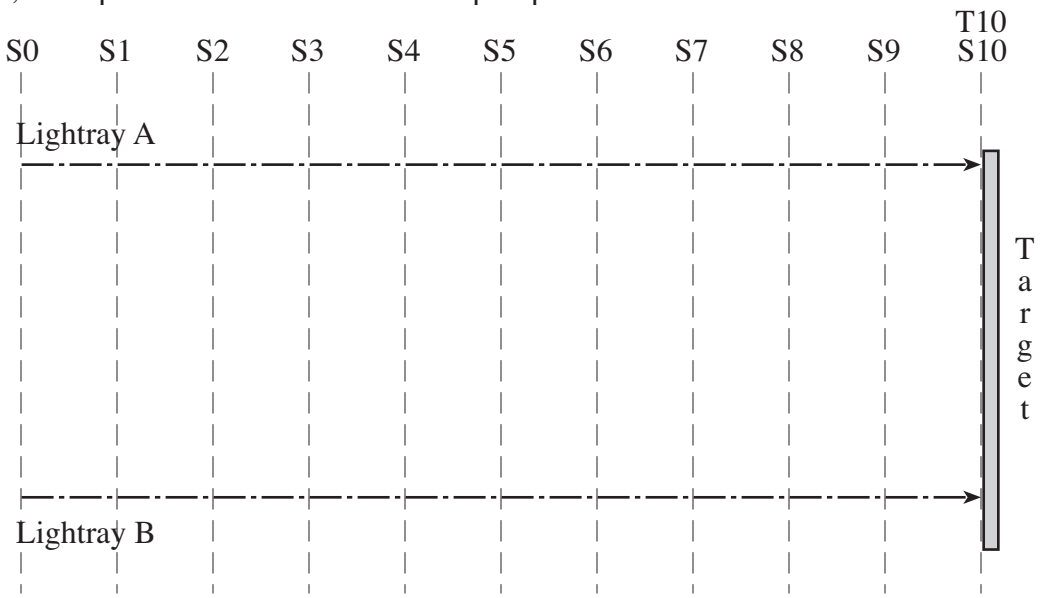
If the Orbiting Star System were to move relative to S0, then the spacepoints at which Lightrays A and B were emitted would nevertheless remain in the same location/position in space, e.g. they would not have moved, and therefore they would have an AV= 0 mps.

In the OrbitingStars 0e Diagram, the Orbiting Star System has moved relative to the spacepoints at which Lightrays A and B were emitted on S0; the emission spacepoints have not moved and therefore have an AV = 0 mps and the Lightrays have an AV = RV = MV = 186,000 mps relative to their emission spacepoints.

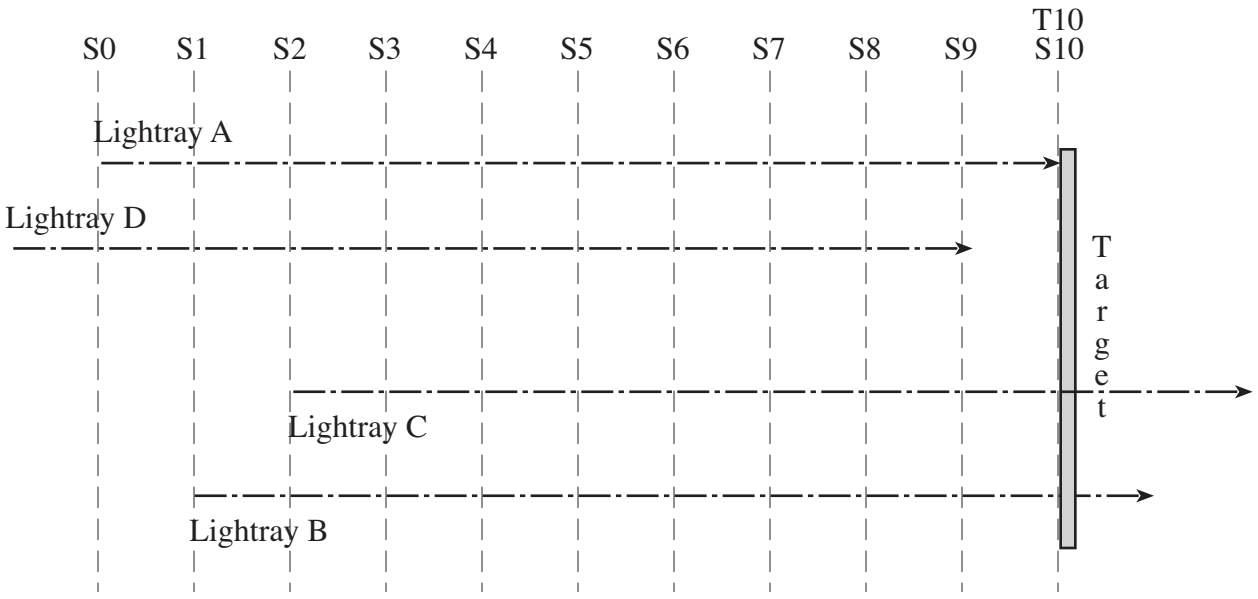


Orbiting Stars 0e

In the Orbiting Stars 0f Diagram, the Orbiting Star System has disappeared while the spacepoints at which Lightrays A and B were emitted on S0 have not moved and have an AV = 0 mps and the Lightrays have an AV = RV = MV = 186,000 mps relative to their emission spacepoints.



Orbiting Stars 0f



Orbiting Stars 0g

The Orbiting Stars Diagrams illustrate ...

(1) the fact that light has an absolute velocity (AV) of 186, 000 mps, i.e. AV = 186,000 mps, relative to the spacepoints at which light is emitted from lightsources,
(2) the fact that the motion (velocity) of a lightsource does not affect the motion of light,
(3) the fact that the spacepoints at which light is emitted from lightsources have no motion and are therefore at-rest at AV = 0 mps,
(4) the fact that all lightrays moving at AV = 186,000 mps in the same direction of motion have the same relative velocity (RV) and that RV = 0 mps,
(5) the fact that lightrays which have an AV = 186,000 mps relative to their light emission spacepoints and an RV = 0 mps relative to each other are all in the same reference frame – the reference frame of light – the light reference frame (LRF),

... and ...

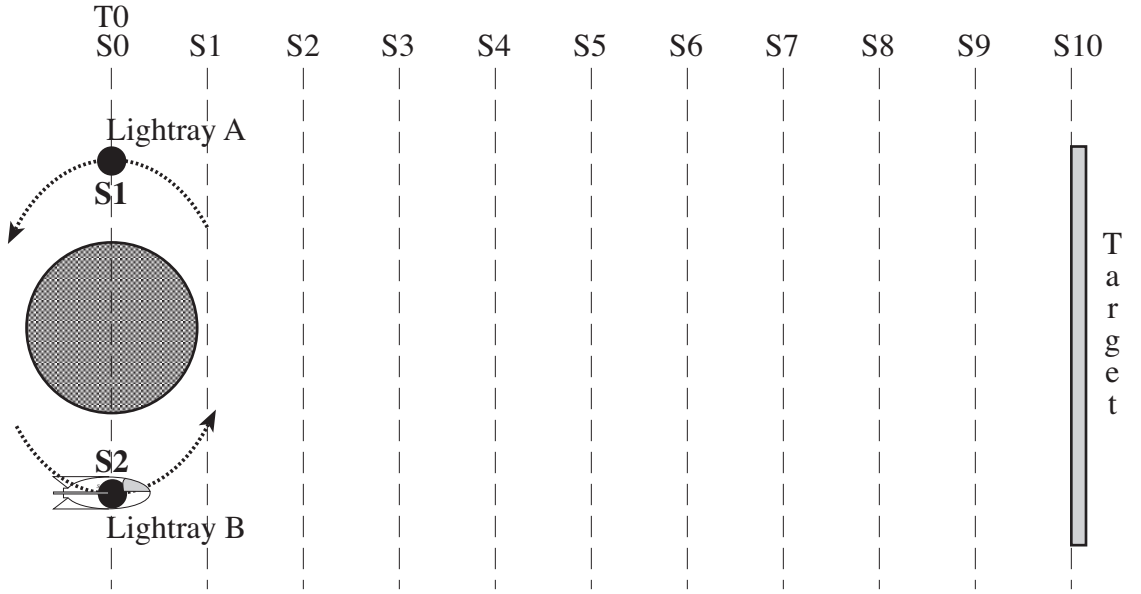
(6) the fact that the light emission spacepoints are at-rest/not-in-motion and therefore all emission spacepoints have an AV = 0 mps which is also an RV = 0 mps which means that all emission spacepoints are at absolute rest (AR) in the same reference frame, the absolute rest reference frame (ARRF).

If all motion is relative, then the absolute motion (AM) of light, i.e. the AV of light, is relative to the spacepoints and objects within the ARRF and therefore the AM/AV of light is relative to the ARRF. With the minimum AV = 0 mps and the maximum AV = 186,000 mps, then there is a Cosmic Speedometer which has a range from AV = 0 mps to AV = 186,000 mps.

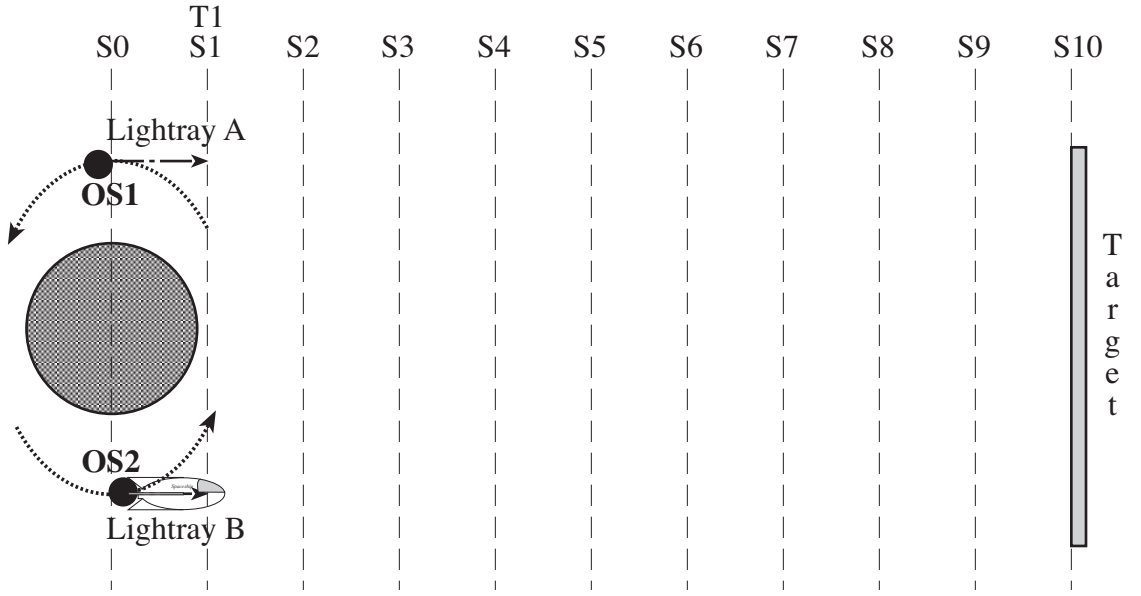
The Cosmic Speedometer	
AV = 0 mps	**AV = 186,000 mps**
AR/ARRF	**AM/AMRF**

The Orbiting Stars 2T0-2T10 Diagrams

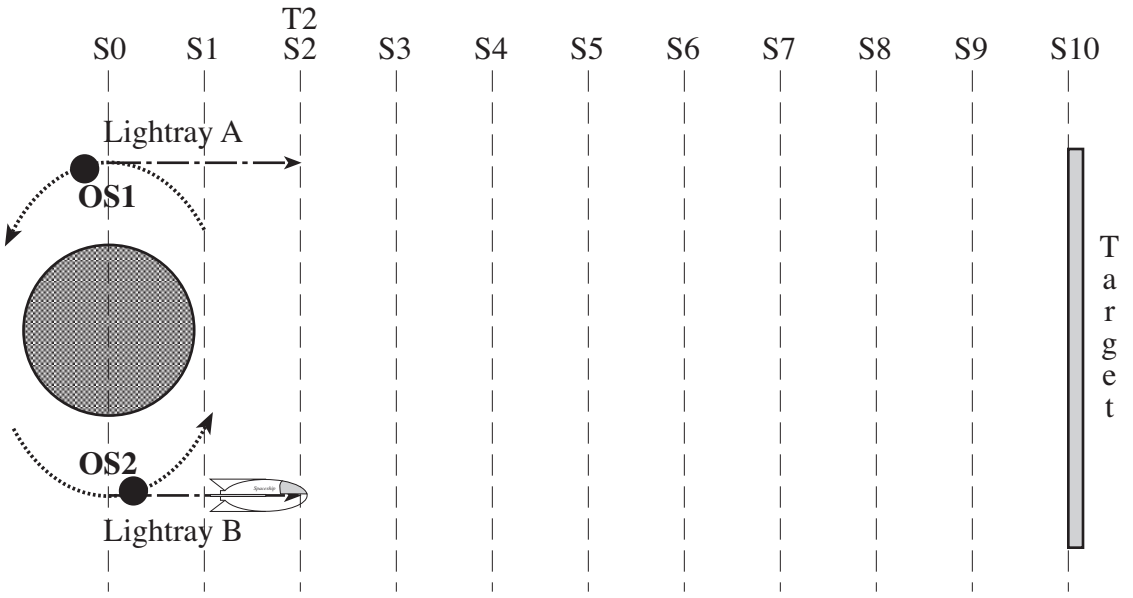
If when OS1 emits Lightray A OS2 emits Lightray B and Spaceship passes OS2 traveling at .86***c*** or 159,960 mps relative to the spacepoint at which Lightray B was emitted and relative to Target, then Lightrays A and B will travel at AV = ***c*** or 186,000 mps relative to the spacepoints at which they were emitted and at AV = ***c*** relative to Target but will travel past Spaceship at RV > ***c*** or 186,000 mps - 159,960 mps or 26,040 mps.



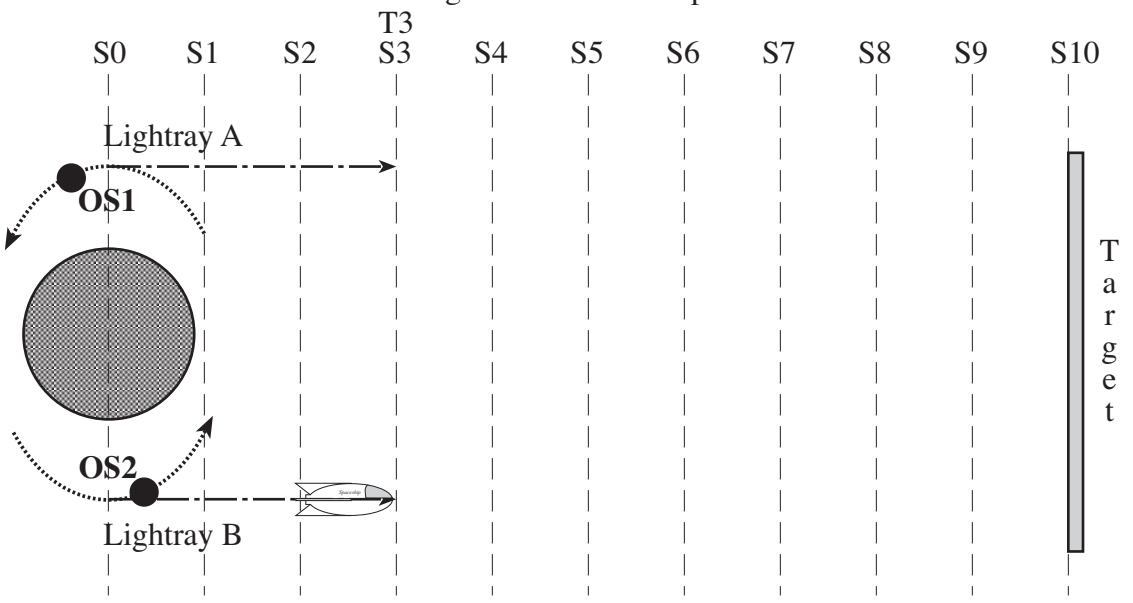
Orbiting Stars 2T0 – Timepoint 0



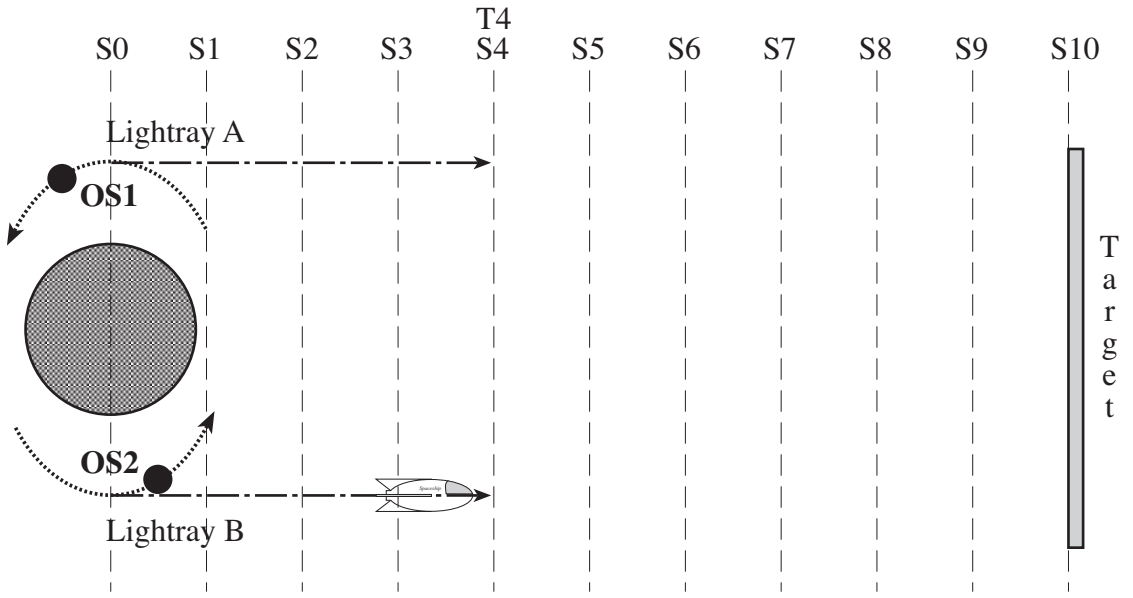
Orbiting Stars 2T1 – Timepoint 1



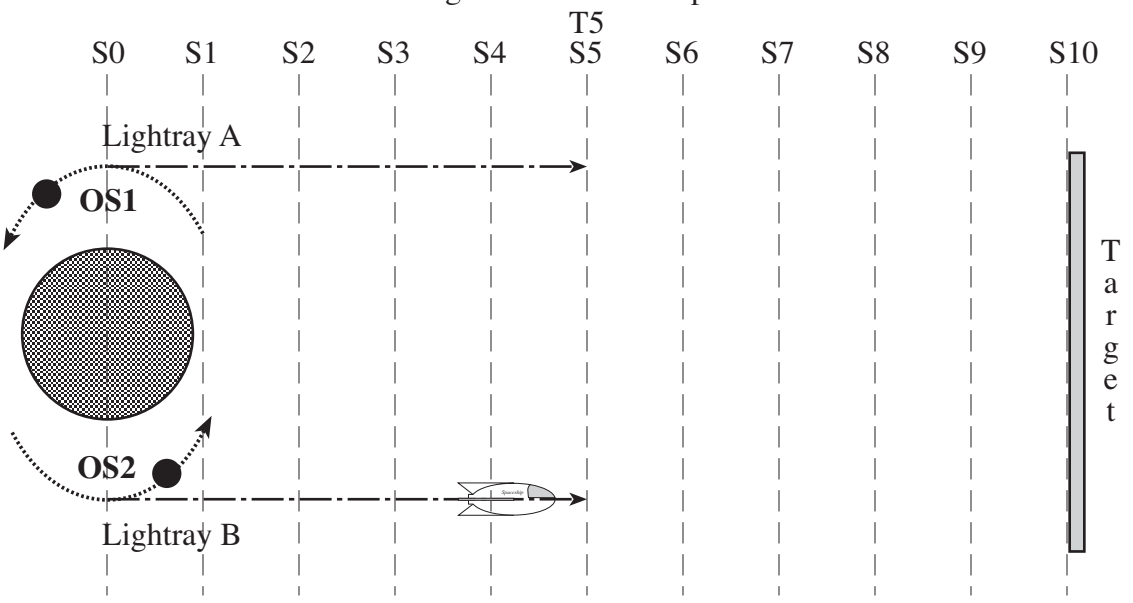
Orbiting Stars 2T2 – Timepoint 2



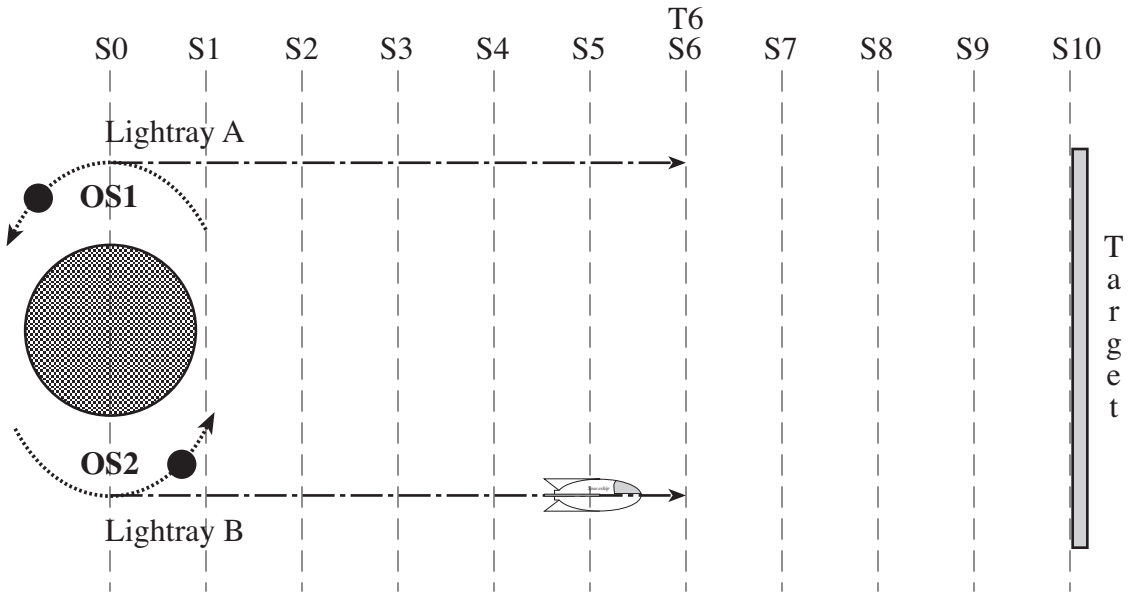
Orbiting Stars 2T3 – Timepoint 3



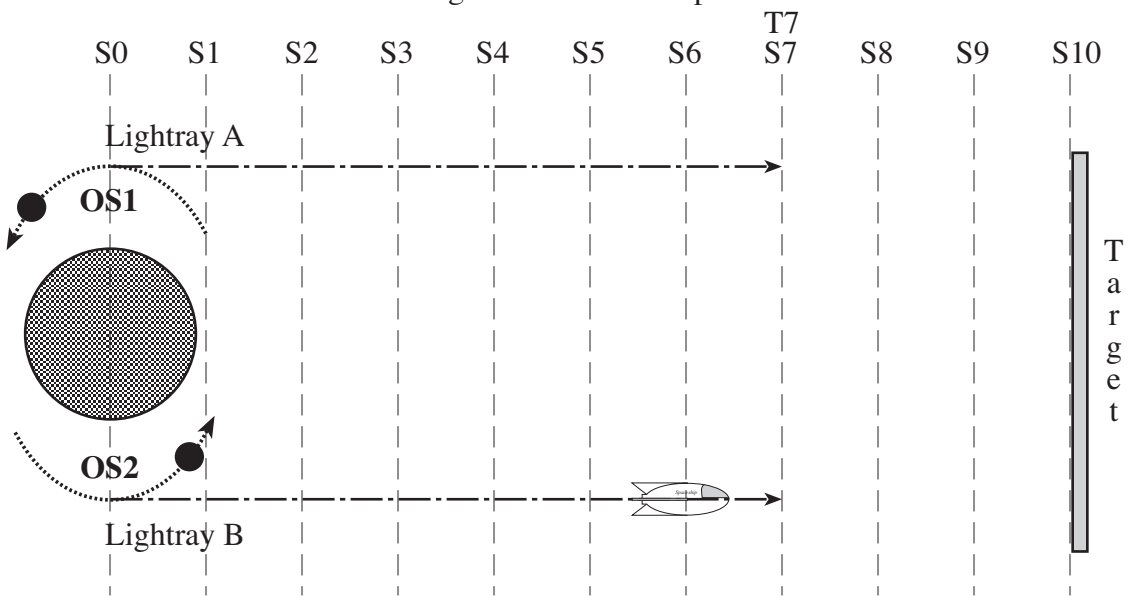
Orbiting Stars 2T4 – Timepoint 4



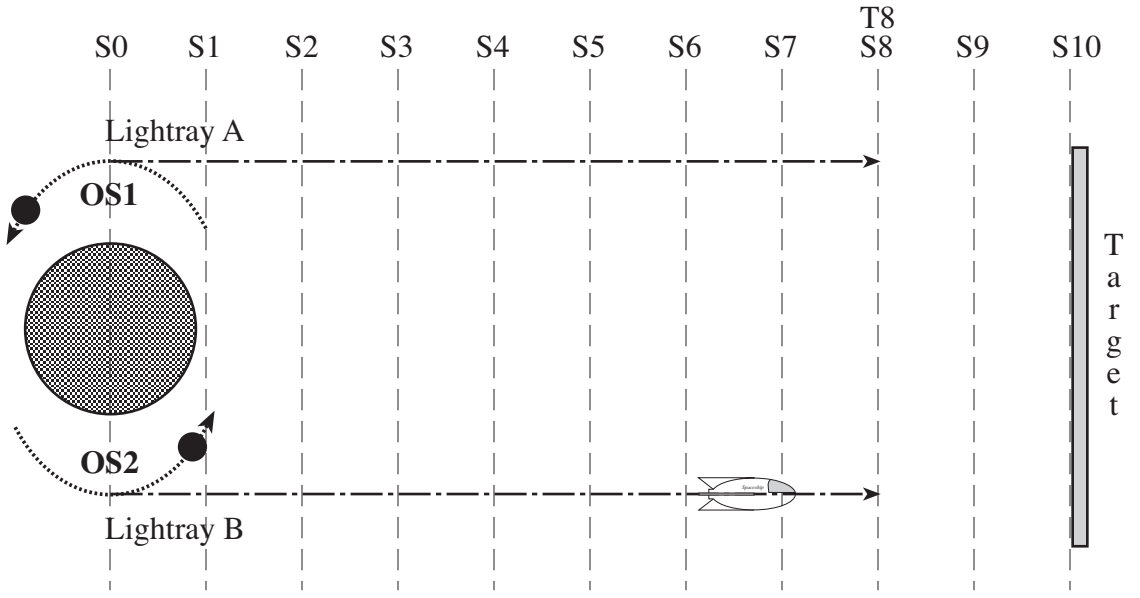
Orbiting Stars 2T5 – Timepoint 5



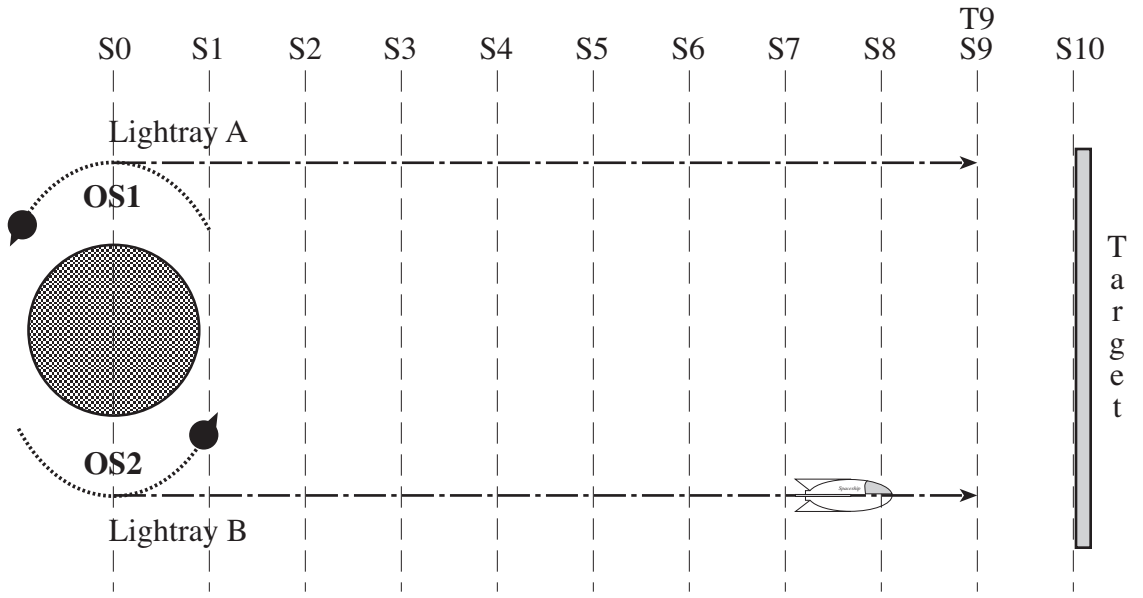
Orbiting Stars 2T6 – Timepoint 6



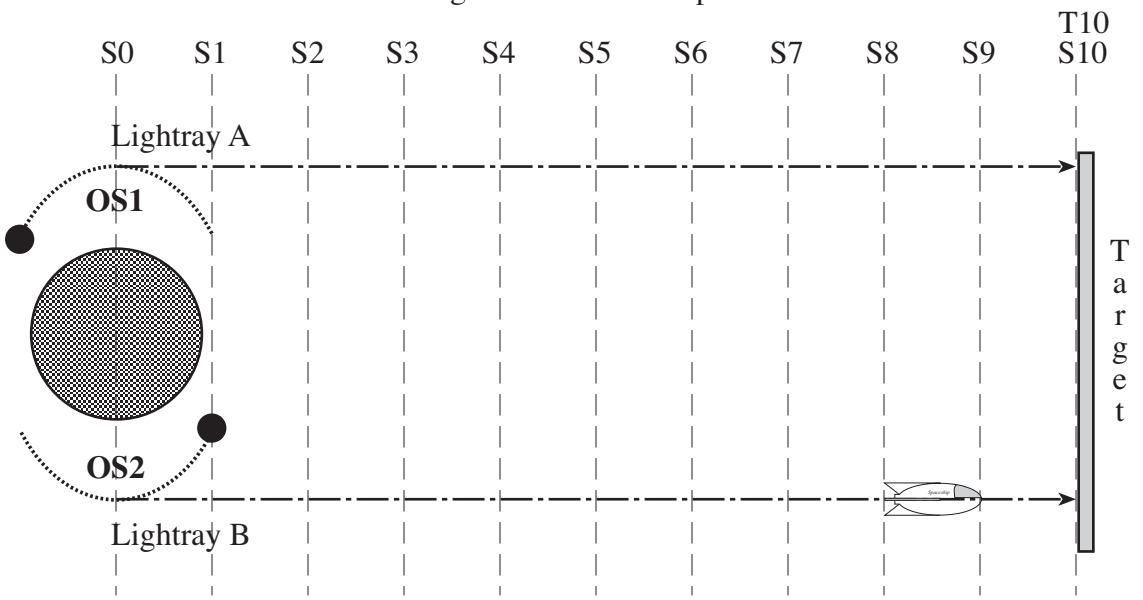
Orbiting Stars 2T7 – Timepoint 7



Orbiting Stars 2T8 – Timepoint 8



Orbiting Stars 2T9 – Timepoint 9



Orbiting Stars 2T10 – Timepoint 10

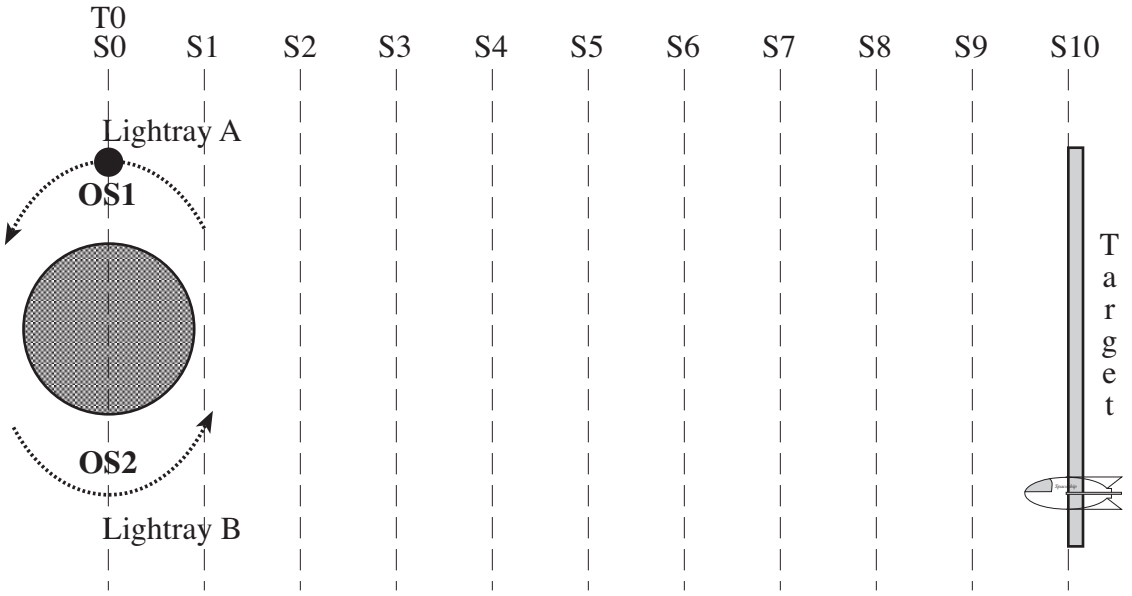
At Timepoint 10, Lightrays A and B strike Target simultaneously – at the same Timepoint.

The fact that Lightrays A and B were traveling at AV = 186,000 mps and struck Target simultaneously proves that they were neither accelerated nor decelerated and that they traveled past Spaceship at RV < 186,000 mps e.g. Lightrays A and B traveled past Spaceship at an RV = 26,040 mps or .14***c*** (186,000 mps - 159,940 mps = 26,040 mps or 14% of ***c***).

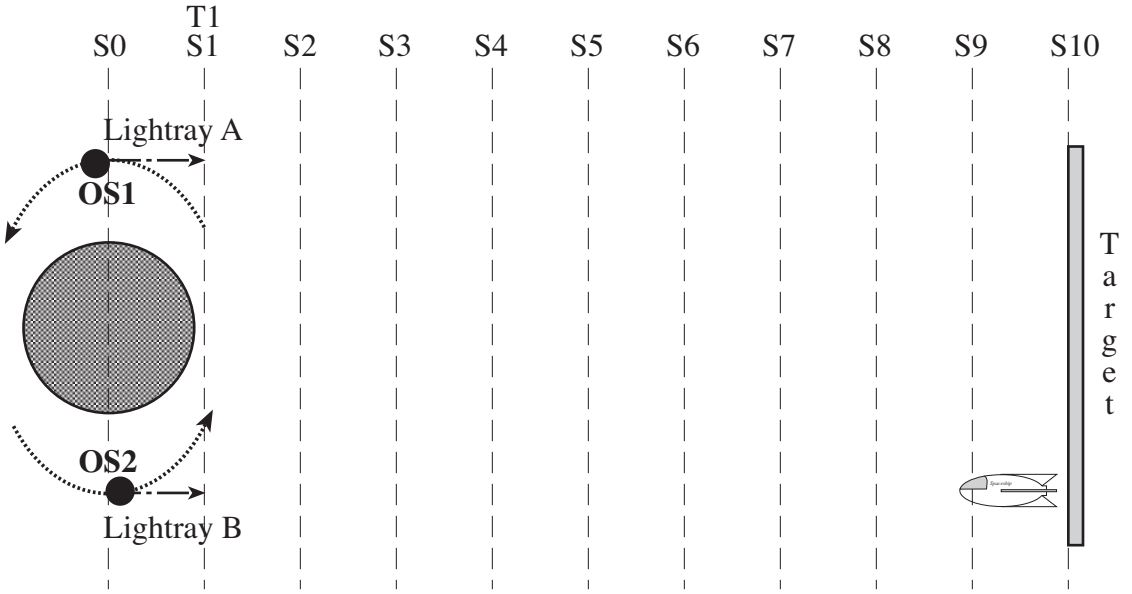
This fact proves that Lightrays A and B traveling parallel to and in the same direction of motion as a Spaceship traveling at AV = .86***c*** or 159,960 mps (86% of ***c***) could not travel past the Spaceship at an RV = 186,000 mps but instead have to travel past the Spaceship at an RV = 26,040 mps or .14***c*** (186,000 mps - 159,940 mps = 26,040 mps or 14% of ***c***).

The Orbiting Stars 4T0-4T10 Diagrams

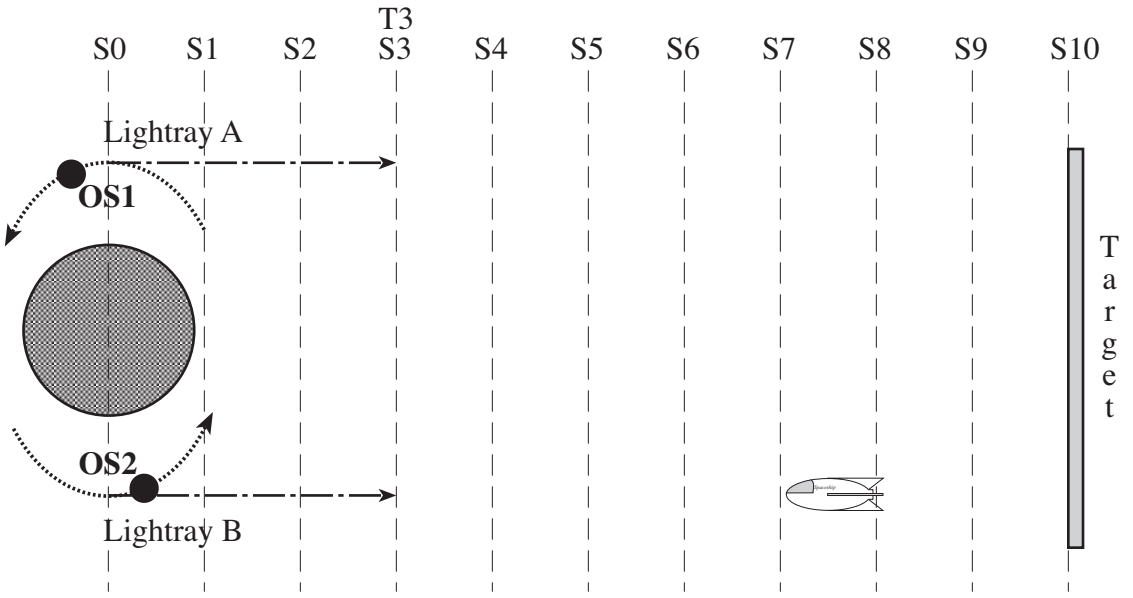
In the Orbiting Stars Diagrams 4T0-4T10, Spaceship is moving at AV = .86***c*** right-to-left away from Target towards the Orbiting Stars; Lightrays A and B are moving at AV = 186,000 mps.



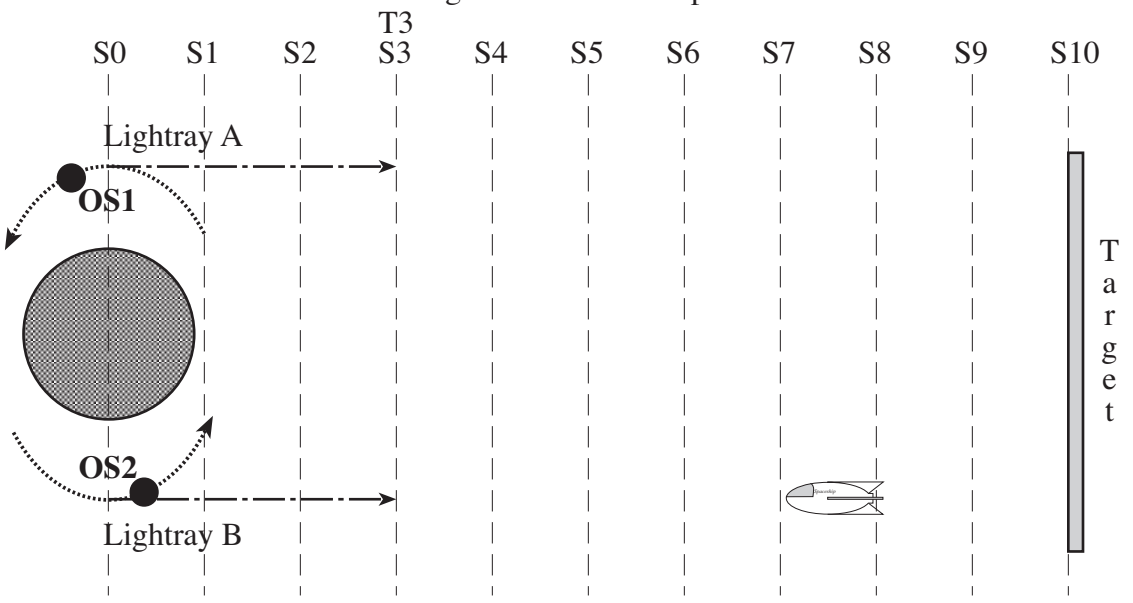
Orbiting Stars 4T0 – Timepoint 0



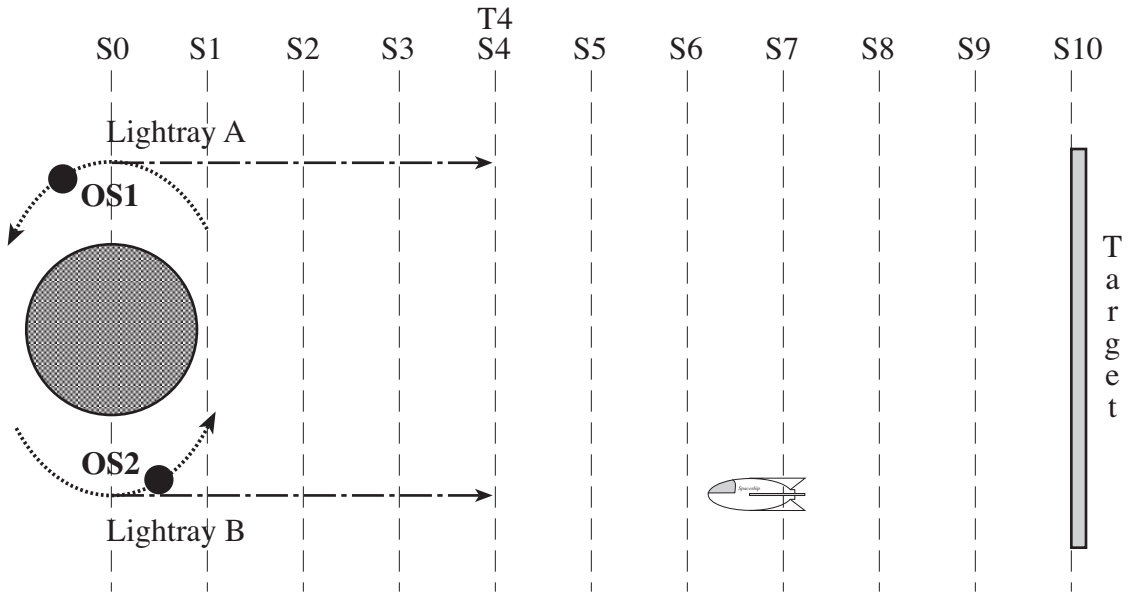
Orbiting Stars 4T1 – Timepoint 1



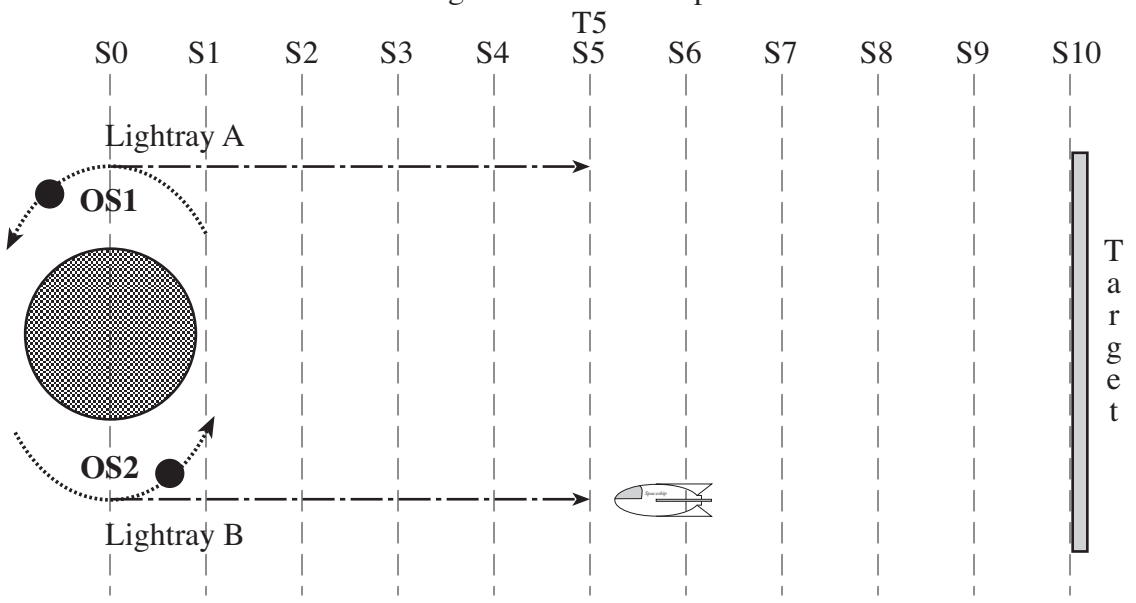
Orbiting Stars 4T2 – Timepoint 2



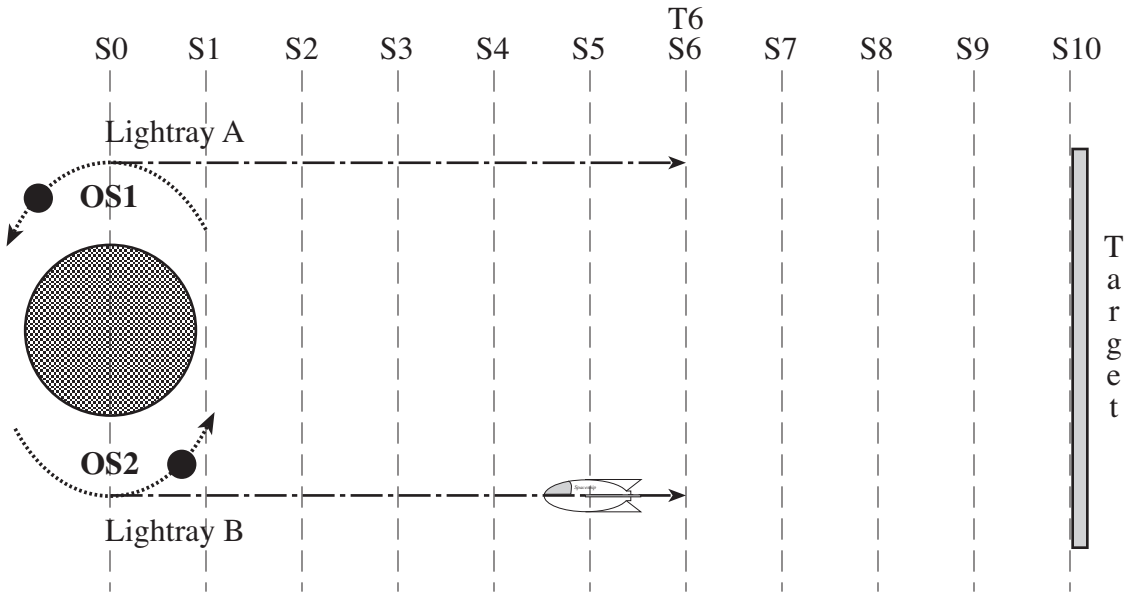
Orbiting Stars 4T3 – Timepoint 3



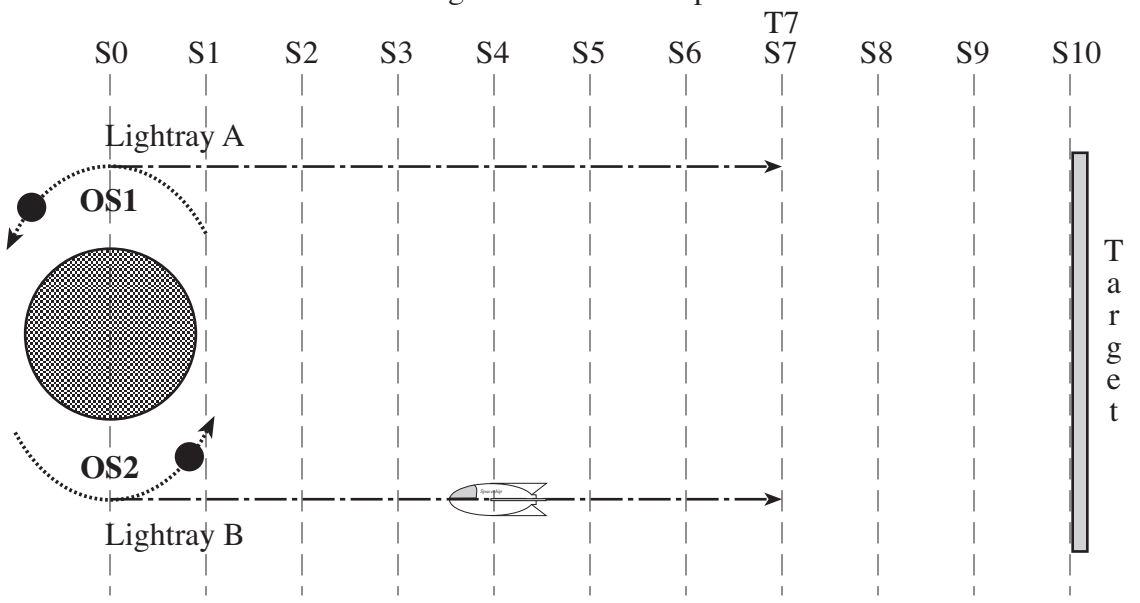
Orbiting Stars 4T4 – Timepoint 4



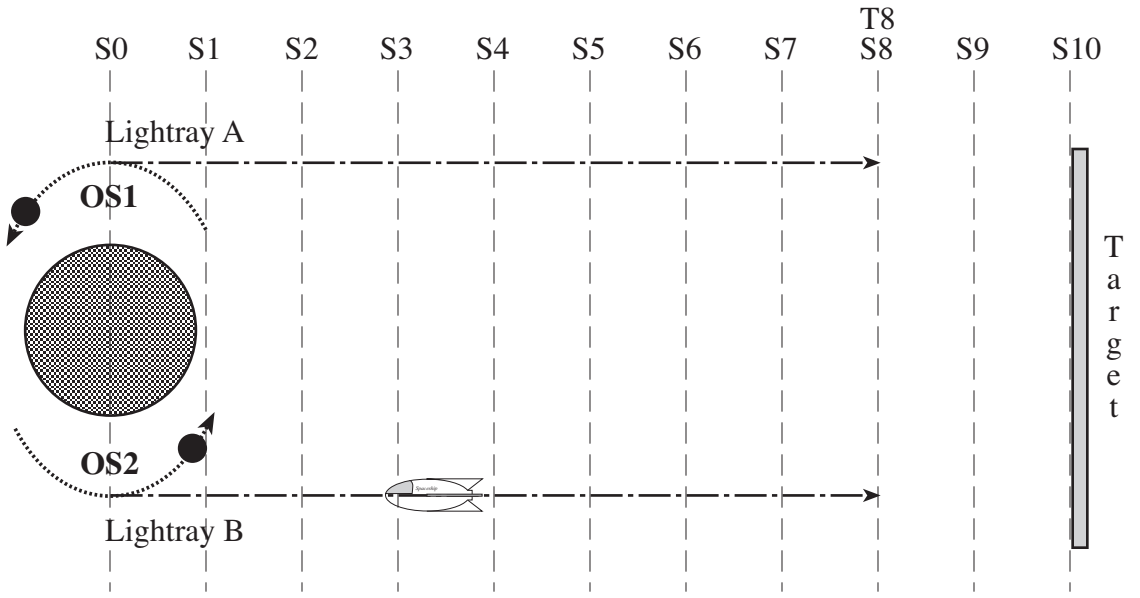
Orbiting Stars 4T5 – Timepoint 5



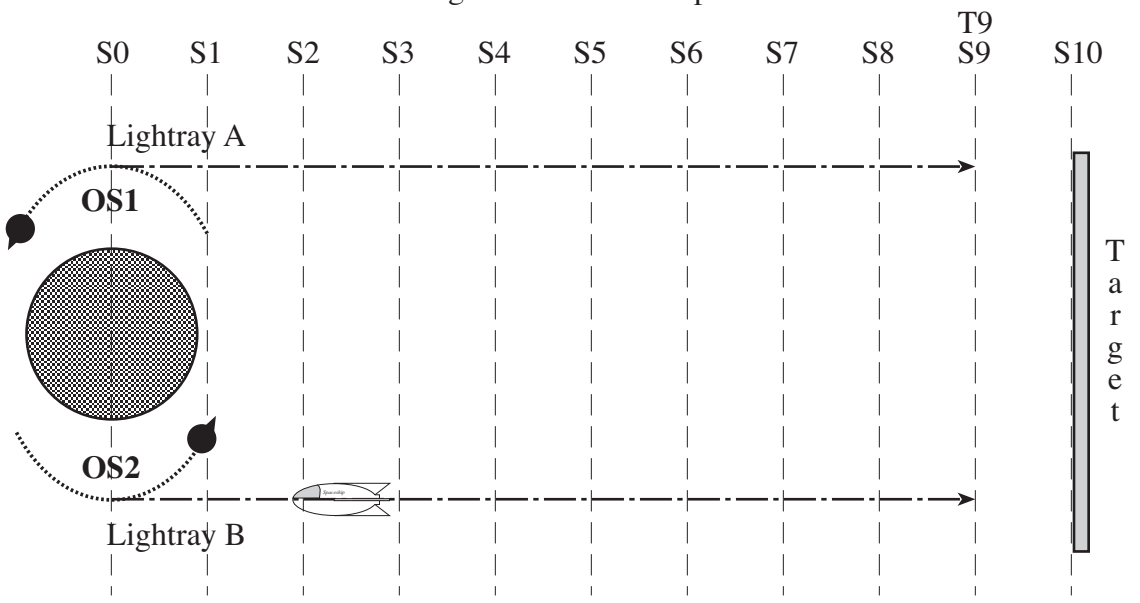
Orbiting Stars 4T6 – Timepoint 6



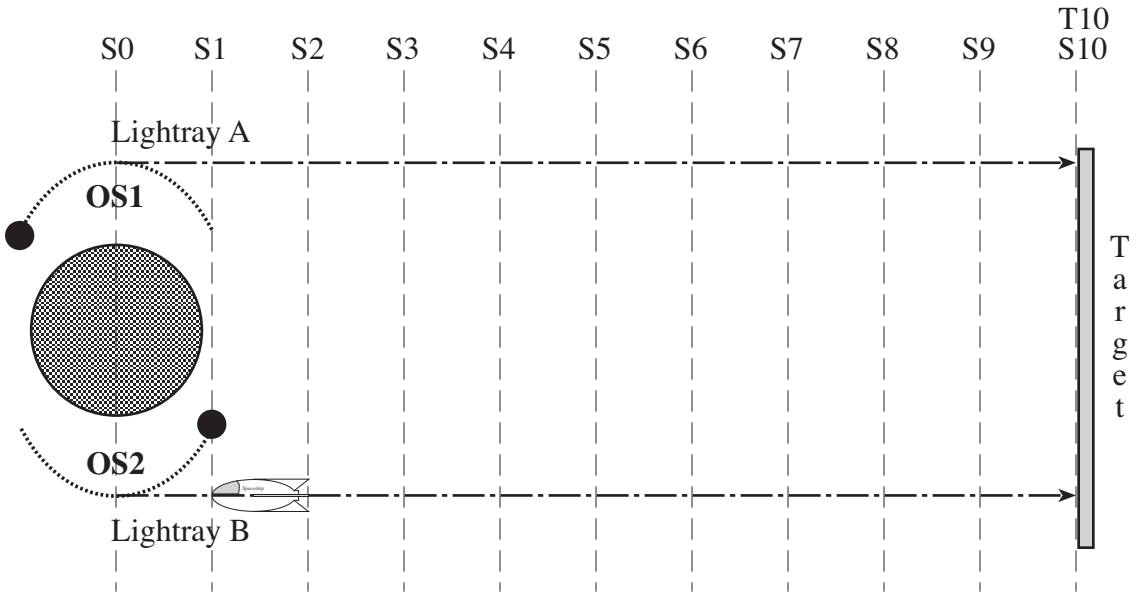
Orbiting Stars 4T7 – Timepoint 7



Orbiting Stars 4T8 – Timepoint 8



Orbiting Stars 4T9 – Timepoint 9



Orbiting Stars 4T10 – Timepoint 10

The RV inre the motion of Lightray B and Spaceship is 1.86***c*** or 345,960 mps (186,000 + 159,960 mps).

An RV (relative velocity) can be RV < ***c*** down to but not less than 0 mps or RV > ***c*** up to but not more than 2***c***. Neither Lightray B nor Spaceship exceed ***c*** or 186,000 mps inre RV = 345,960 mps.

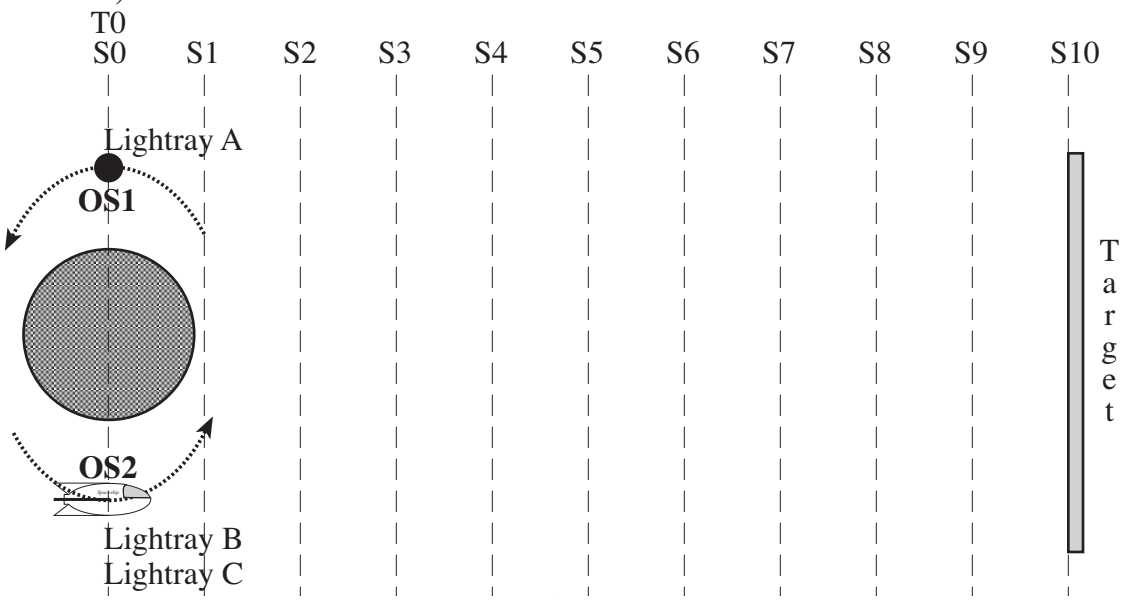
The Orbiting Stars 4T0-4T10 Diagrams prove that it is not possible for a Lightray traveling at AV = 186,000 mps and a Spaceship traveling at AV = 159,960 mps moving parallel to each other but in opposite directions to pass each other at RV = ***c*** or 186,000 mps.

The Orbiting Stars 5T0-5T6 Diagrams

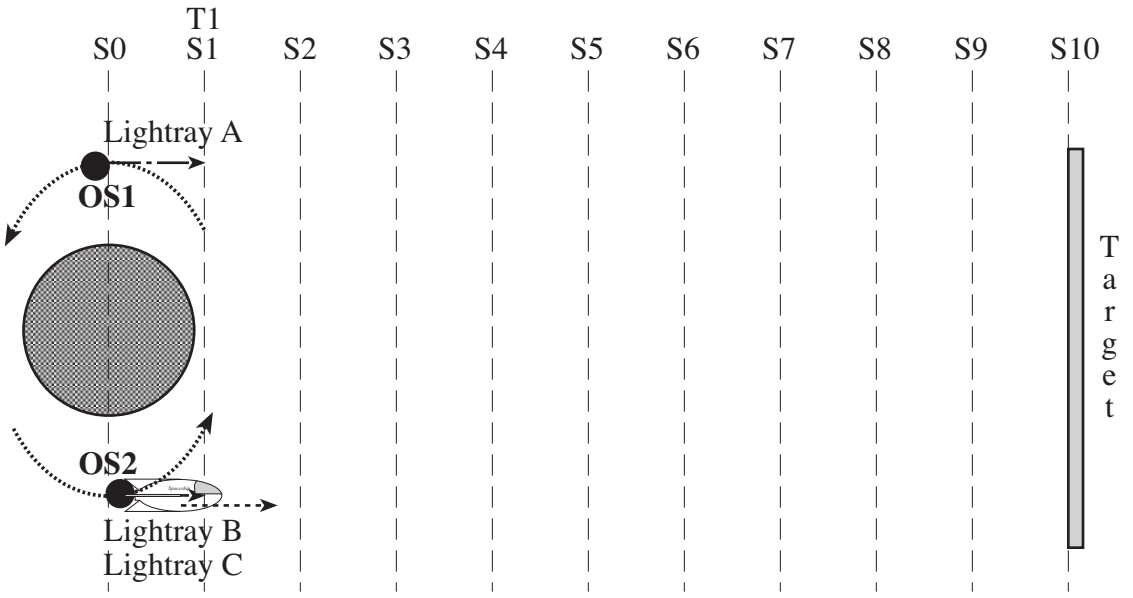
If when Lightsource OS1 emits Lightray A Lightsource OS2 emits Lightray B and Spaceship passes OS2 traveling at .86***c*** or 159,960 mps relative to the spacepoint at which Lightray B was emitted and relative to Target, then Lightrays A and B will travel at AV = ***c*** or 186,000 mps relative to the spacepoints at which they were emitted and at AV = ***c*** relative to Target but will travel past Spaceship at RV < ***c*** or RV < 186,000 mps, e.g. 159,960 mps or 26,040 mps.

If Lightray C is emitted from a Lightsource within Spaceship and Lightray C travels at ***c*** or 186,000 mps relative to the Lightsource within Spaceship and the spacepoint within Spaceship from which it was emitted, then Lightray C will travel past Lightrays A and B and therefore Lightray C will strike Target ahead of/before Lightrays A and B.

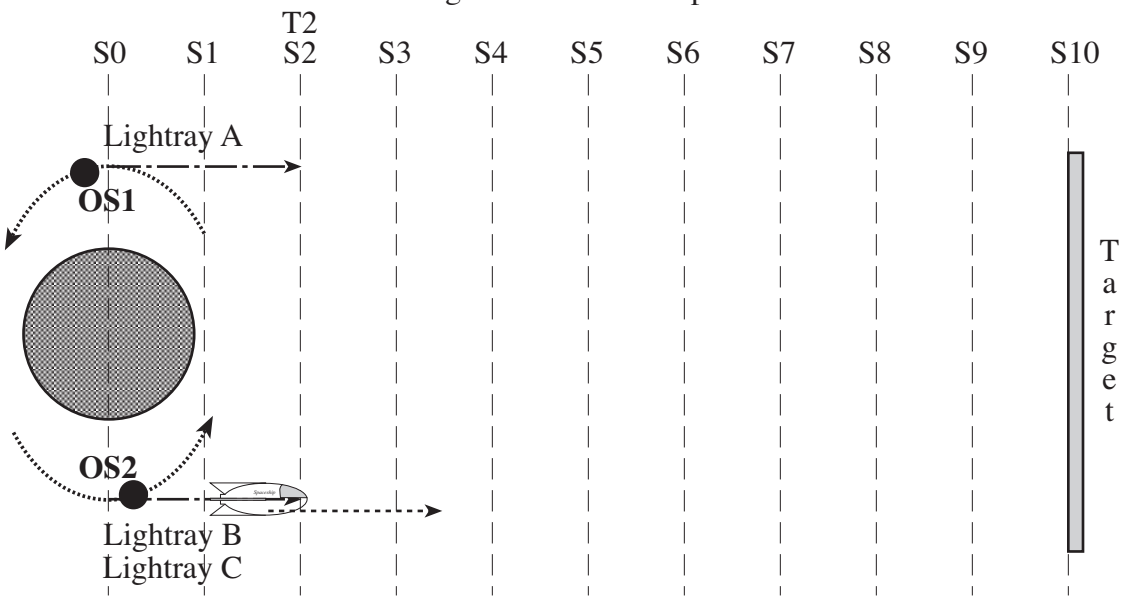
At T0, Spaceship is traveling at .86***c*** or 159,960 mps, Lightrays A and B are emitted simultaneously, and have AVs = RVs = 186,000 mps relative to their emission spacepoints, Lightray C is emitted from a Lightsource within Spaceship simultaneously with the emissions of Lightrays A and B (Lightrays A, B and C are emitted simultaneously from their Lightsources when the Lightsources are aligned with S0), and Lightray C has an AV = 186,000 mps relative to its emission spacepoint within Spaceship (Lightray C's emission spacepoint is moving at AV = RV = 0 mps relative to Spaceship but at RV = 26,040 mps relative to the emission spacepoints of Lightrays A and B).



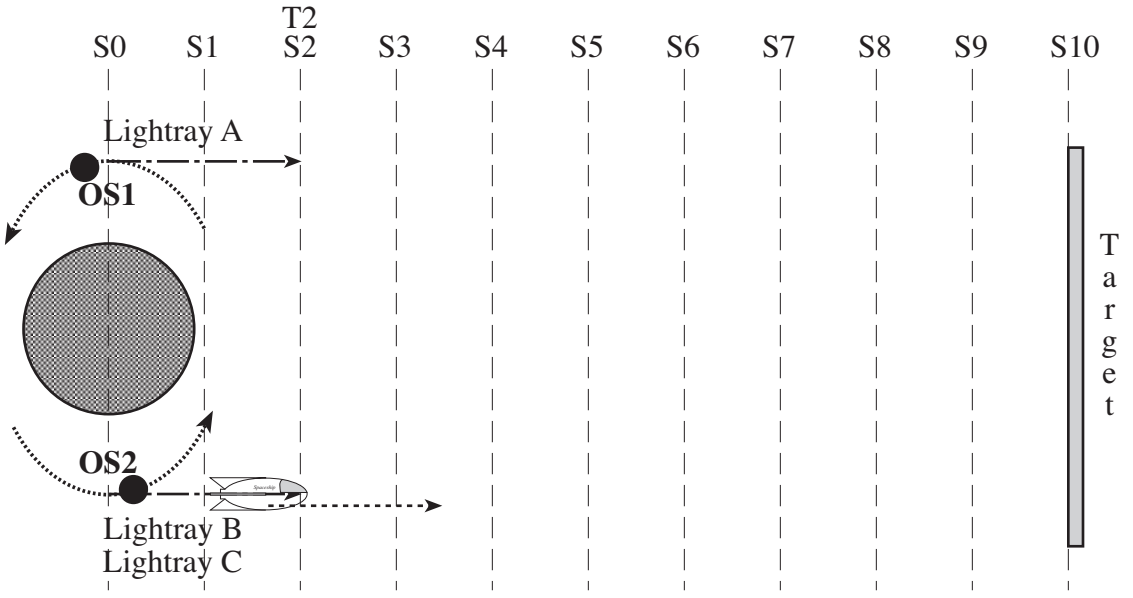
Orbiting Stars 5T0 – Timepoint 0



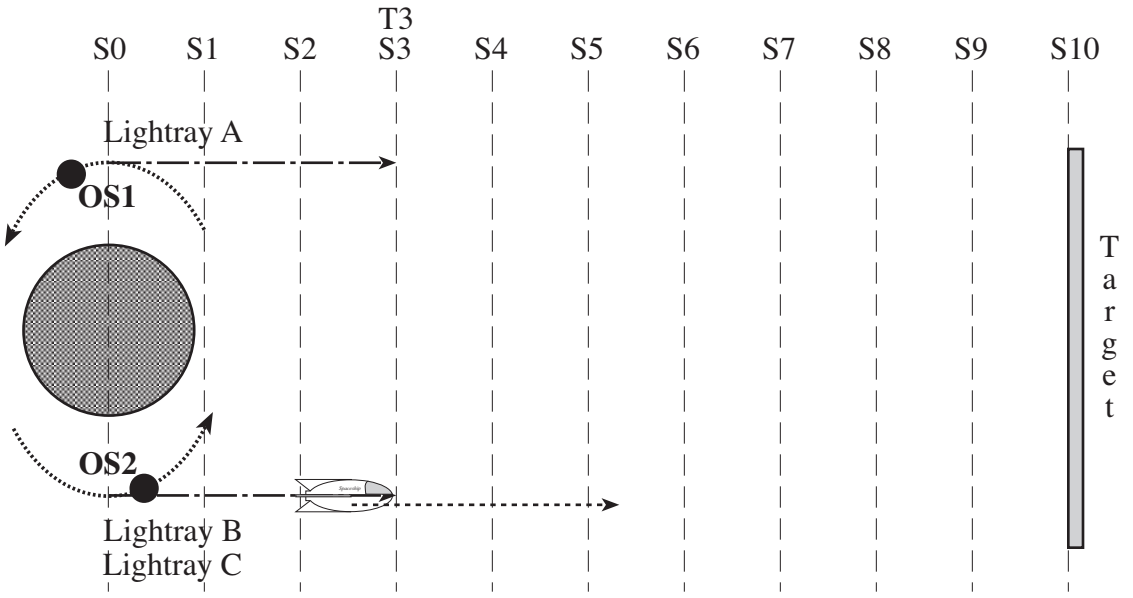
Orbiting Stars 5T1 – Timepoint 1



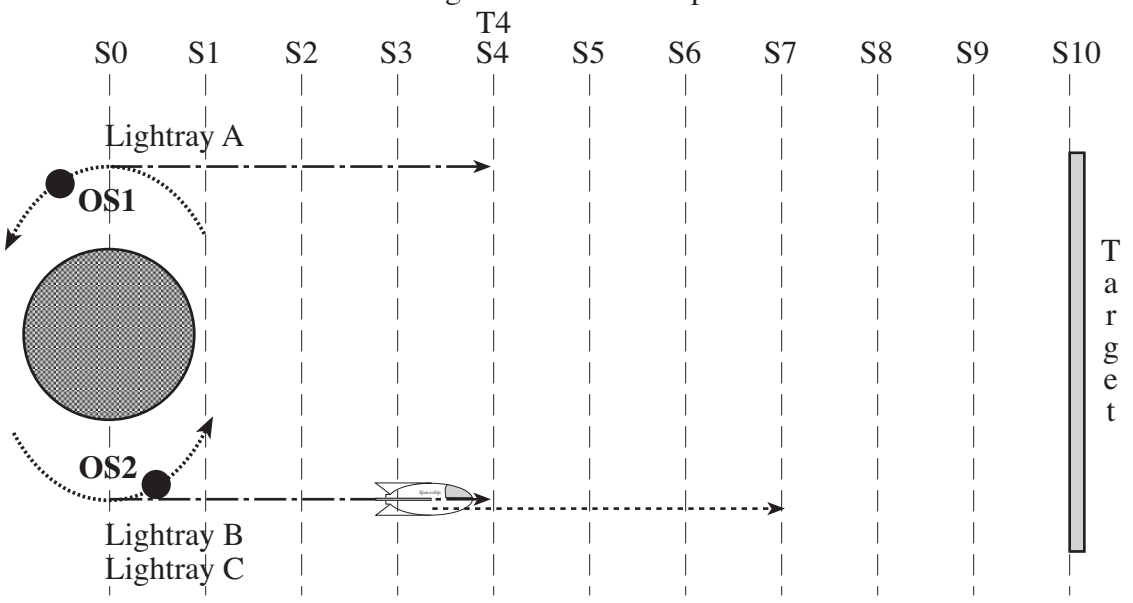
Orbiting Stars 5T2 – Timepoint 2



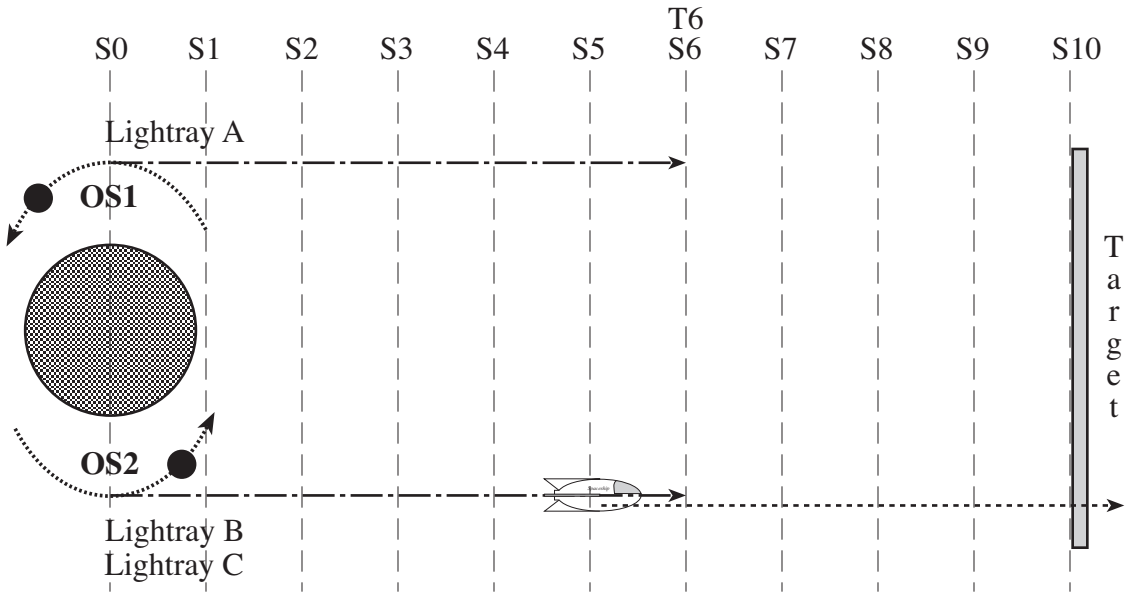
Orbiting Stars 5T3 – Timepoint 3



Orbiting Stars 5T4 – Timepoint 4



Orbiting Stars5T5 – Timepoint 5



Orbiting Stars 5T6 – Timepoint 6

At T6, Lightray C has struck and traveled past Target ahead of Lightrays A and B.

At least in theory, all lightrays (lightpulses) travel as the same AV = ***c*** or 186,000 mps relative to the spacepoints at which the lightrays were emitted from their lightsources because the motions of their lightsources do not affect the motions of the lightrays.

Therefore, the motion of Lightray C cannot be and therefore is not affected by the motion of the Lightsource within Spaceship (the motion of Lightray C is not affected by the motion of Spaceship which carries Lightray C's Lightsource).

Therefore, Lightray C can only travel in such a way as to keep up with but not move ahead or behind Lightrays A and B.

If there were to be a physical phenomenon which is a force – a form of m/e – which decelerates a lightray (a force cannot accelerate a lightray), then the decelerated lightray will travel behind other lightrays which were not decelerated.

The Orbiting Stars 6T0-6T10 Diagrams

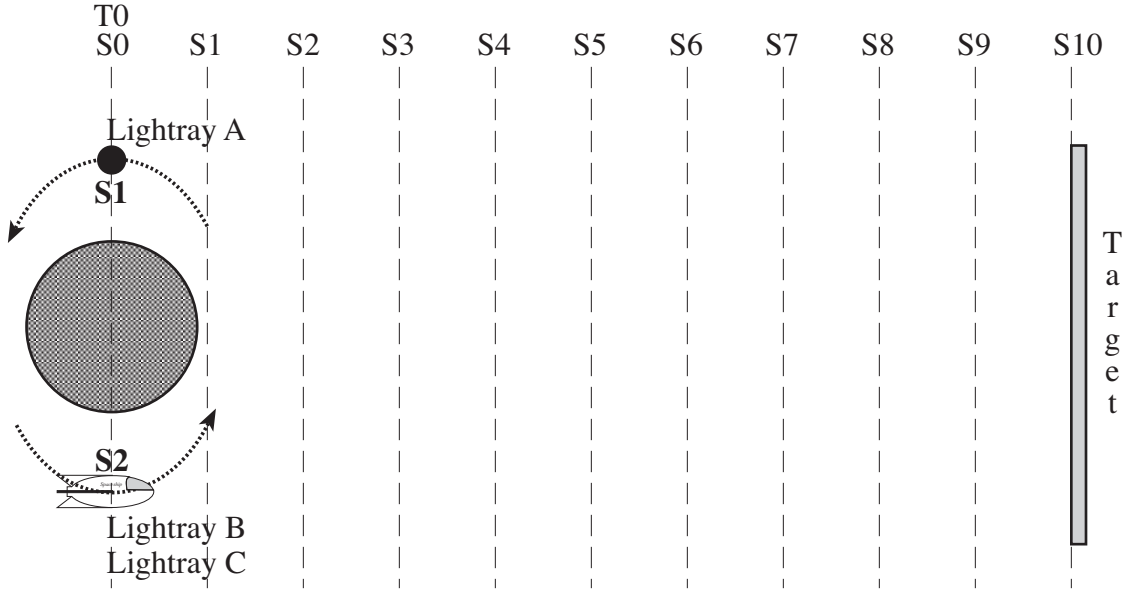
If in theory, all lightrays (lightpulses) travel as the same AV = ***c*** or 186,000 mps relative to the spacepoints at which the lightrays were emitted from their lightsources because the motions of their lightsources do not affect the motions of the lightrays and the motion of a Lightray C cannot be and therefore is not affected by the motion of the Lightsource within Spaceship (the motion of Lightray C is not affected by the motion of Spaceship which carries Lightray C's Lightsource).

Therefore, Lightray C can only travel in such a way as to keep up with but not move ahead or behind Lightrays A and B.

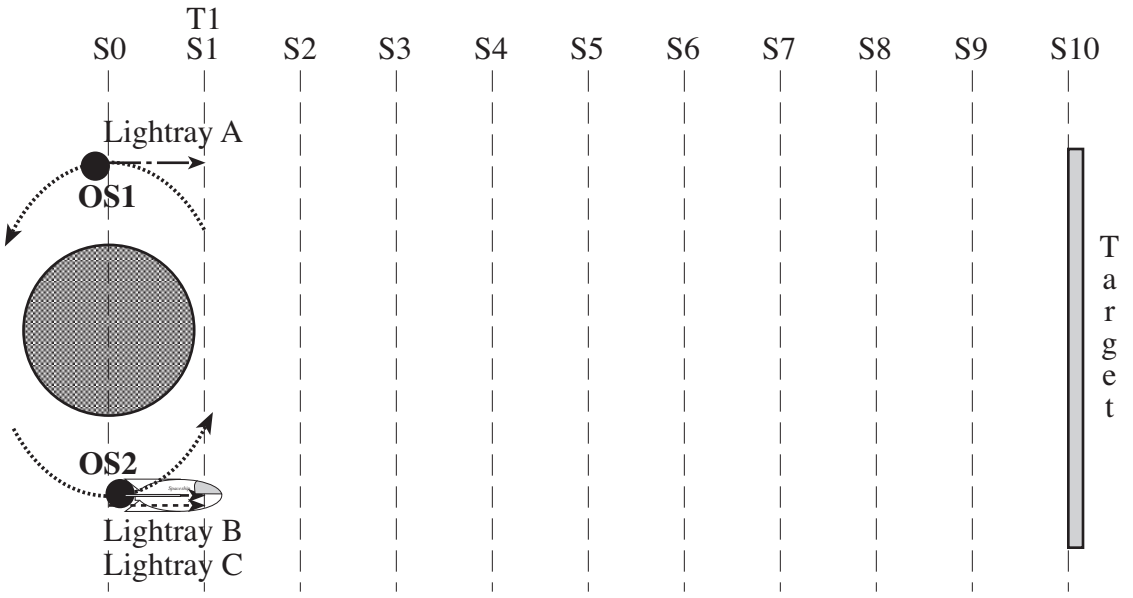
If when Lightsource OS1 emits Lightray A Lightsource OS2 emits Lightray B and Spaceship passes OS2 traveling at .86***c*** or 159,960 mps relative to the spacepoint at which Lightray B was emitted and relative to Target, then Lightrays A and B will travel at AV = ***c*** or 186,000 mps relative to the spacepoints at which they were emitted and at AV = ***c*** relative to Target but will travel past Spaceship at RV > ***c*** or RV < 186,000 mps, e.g. 159,960 mps or 26,040 mps.

If Lightray C is emitted from a Lightsource within Spaceship and Lightray C travels at ***c*** or 186,000 mps relative to the spacepoint from which it was emitted, then Lightray C will travel alongside Lightrays A and B and therefore Lightray C will strike Target simultaneously with Lightrays A and B.

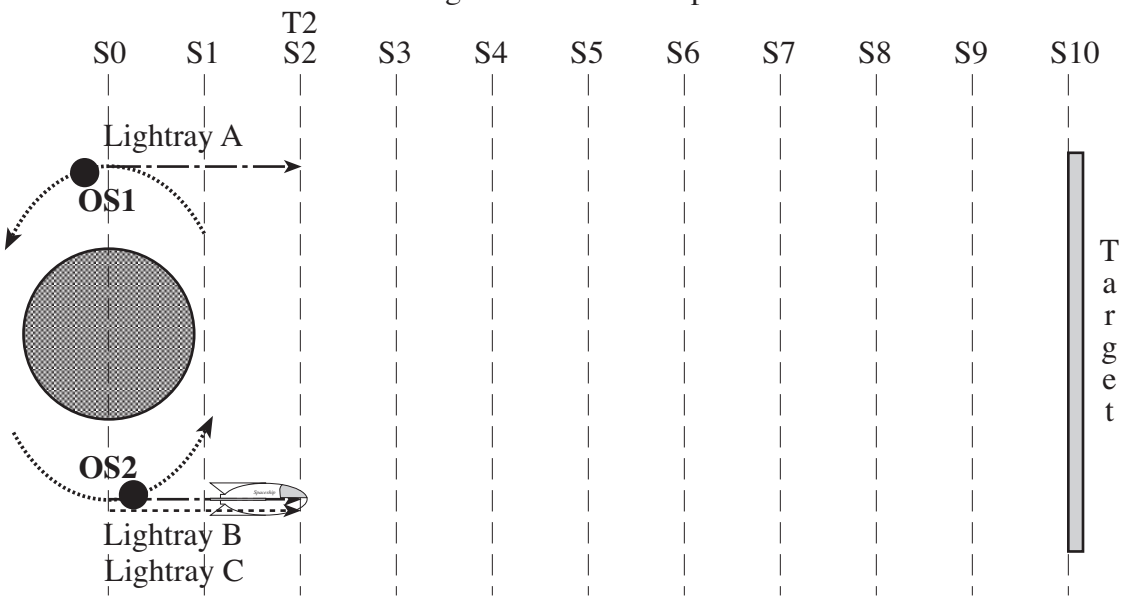
At T0, Spaceship is traveling at .86***c*** or 159,960 mps, Lightray A is emitted from OS1 while Lightray B is emitted from OS2 simultaneously with Lightray A and Lightray C is emitted from a Lightsource within Spaceship simultaneously with Lightrays A and B (Lightrays A, B and C are emitted simultaneously from their Lightsources when the Lightsources are aligned with S0).



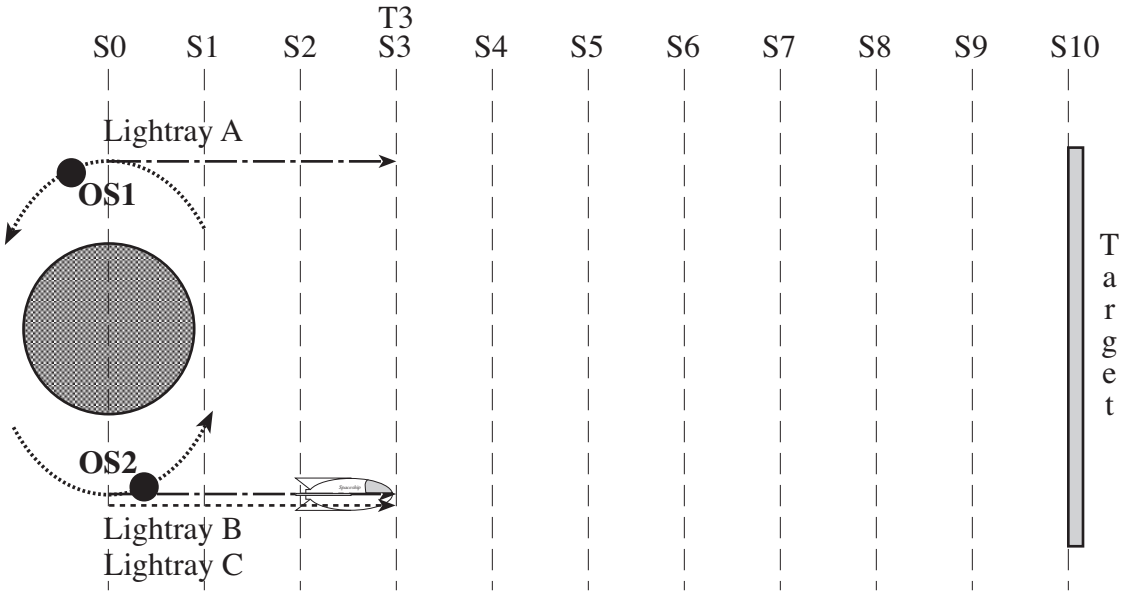
Orbiting Stars 6T0 – Timepoint 0



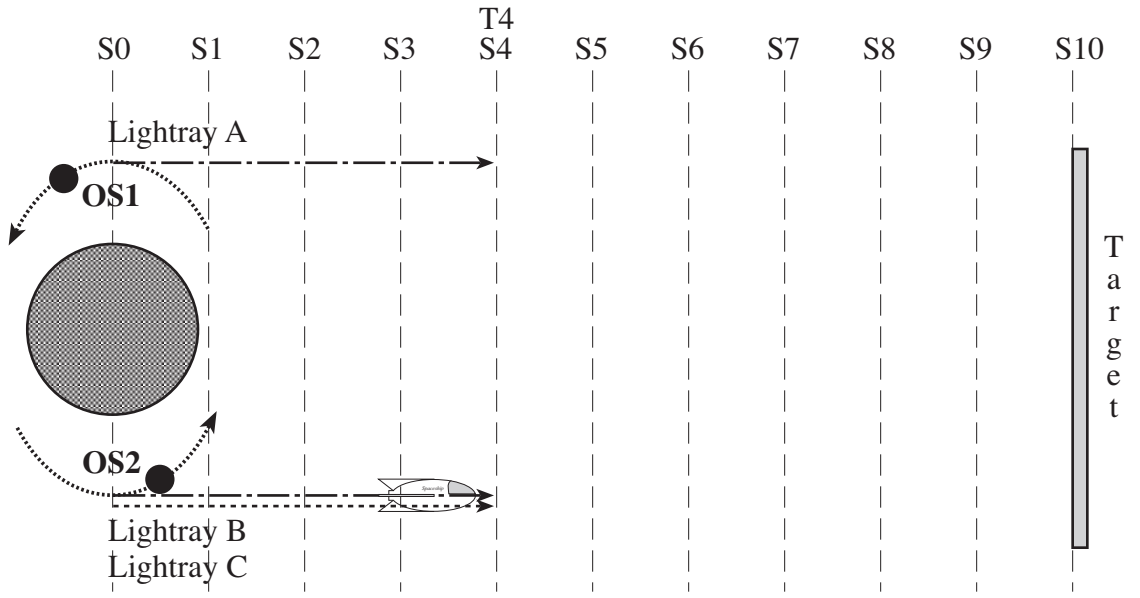
Orbiting Stars 6T1 – Timepoint 1



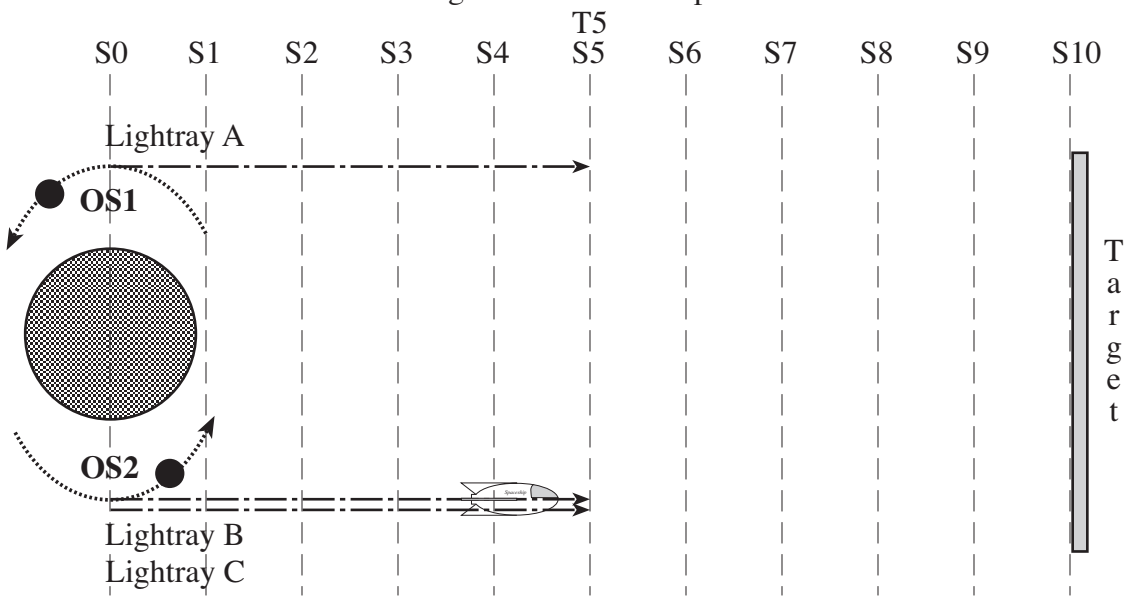
Orbiting Stars 6T2 – Timepoint 2



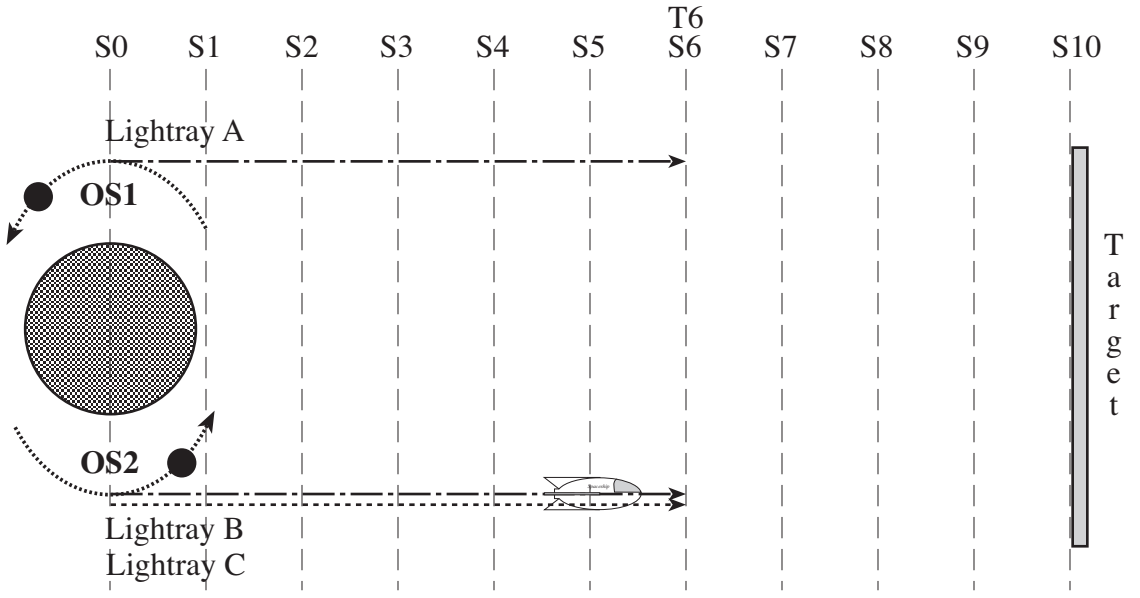
Orbiting Stars 6T3 – Timepoint 3



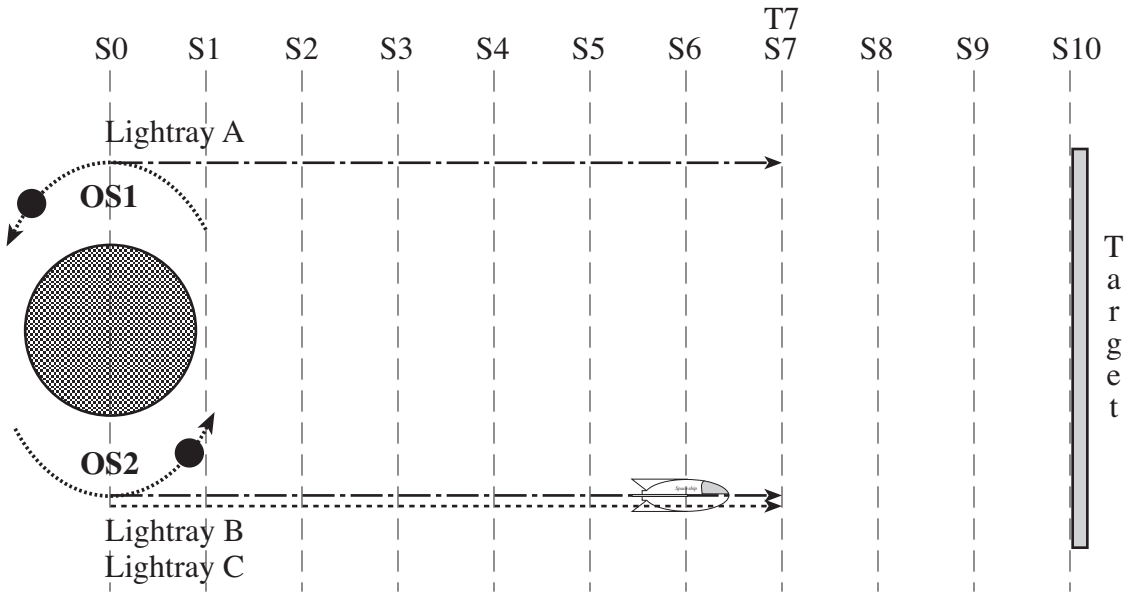
Orbiting Stars 6T4 – Timepoint 4



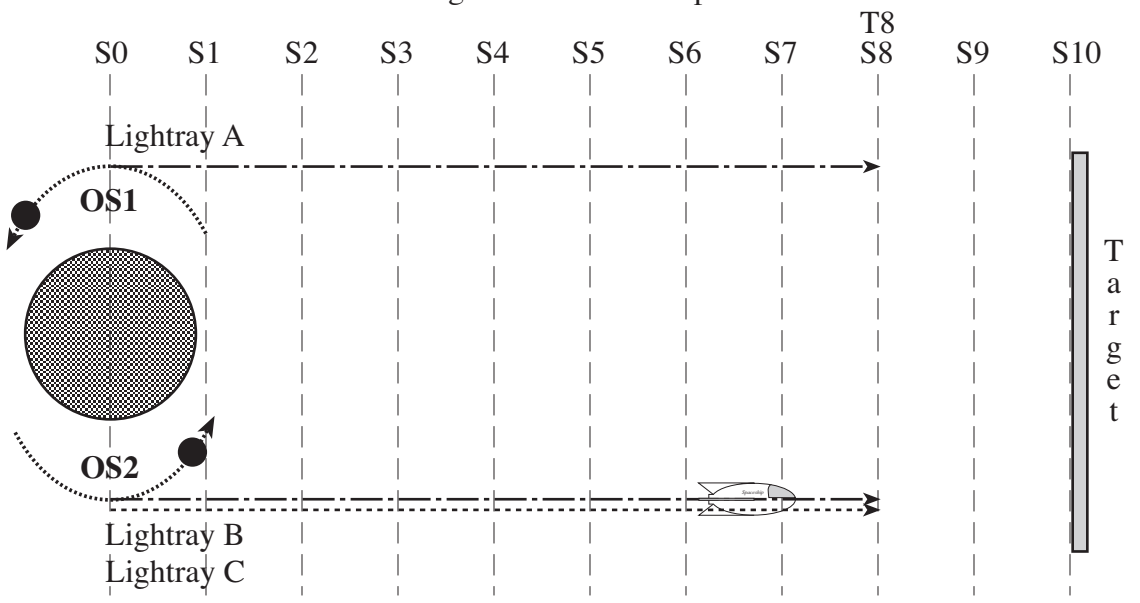
Orbiting Stars 6T5 – Timepoint 5



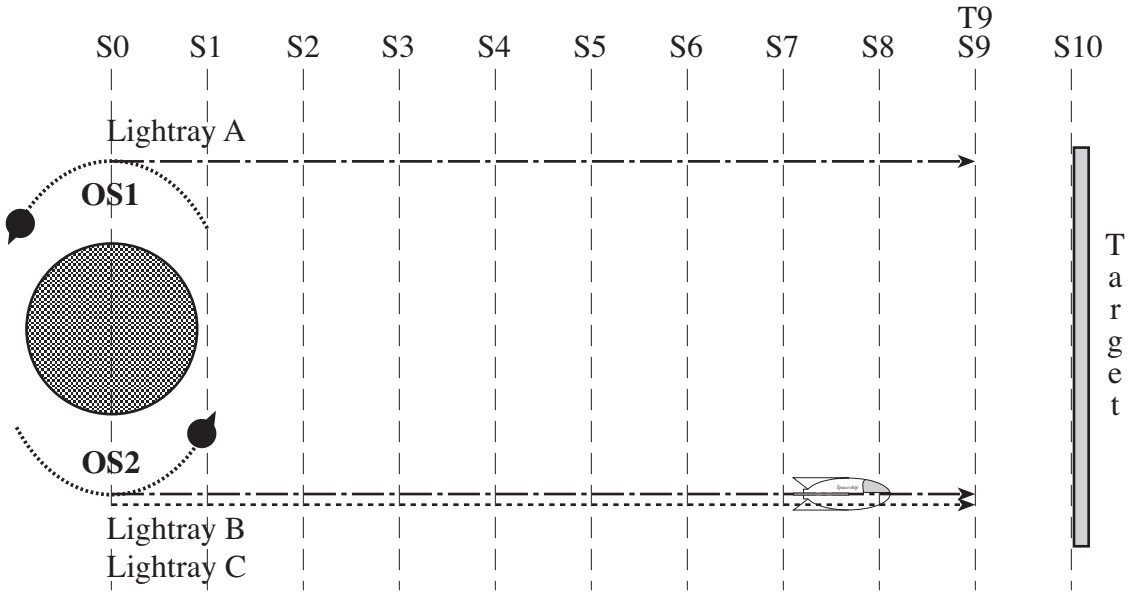
Orbiting Stars 6T6 – Timepoint 6



Orbiting Stars 6T7 – Timepoint 7



Orbiting Stars 6T8 – Timepoint 8



Orbiting Stars 6T9 – Timepoint 9

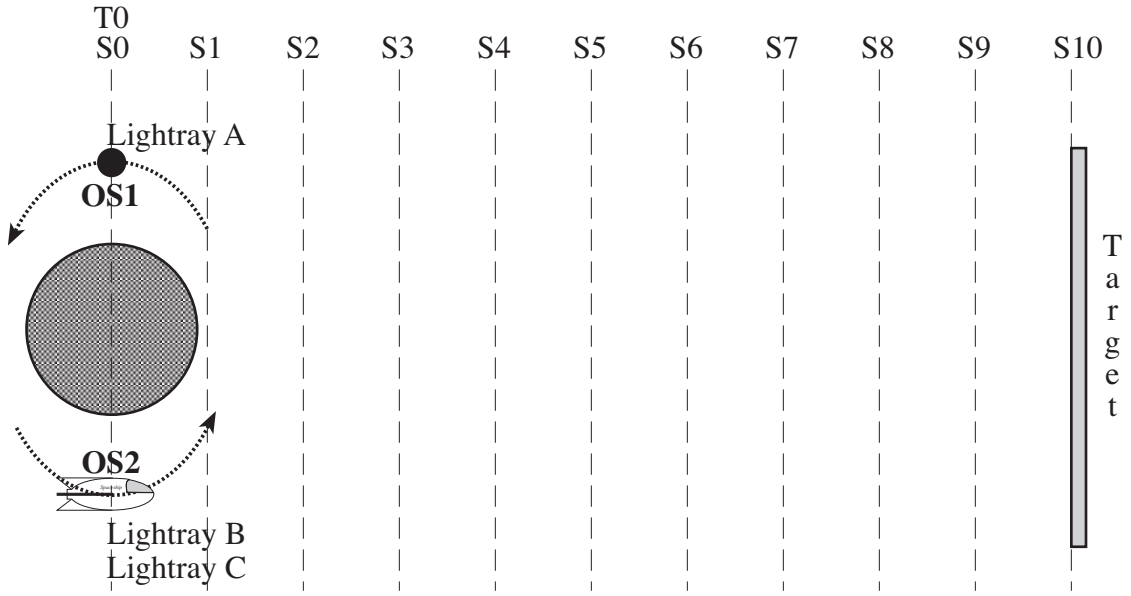
Orbiting Stars 6T10 – Timepoint 10

At T10, Lightrays A, B and C have struck Target simultaneously in accord with the twin light motion facts (TLMFs) – that (1) light travels at an AV = ***c*** or 186,000 mps relative to the spacepoint at which it was emitted and (2) the motion of a lightsource does NOT affect the motion of light.

The fact that at T10 Lightrays A, B and C have struck Target simultaneously proves that the twin light motion facts (TLMFs) – that (1) light travels at an AV = c or 186,000 mps relative to the spacepoint at which it was emitted and (2) the motion of a lightsource does NOT affect the motion of light – are correct.

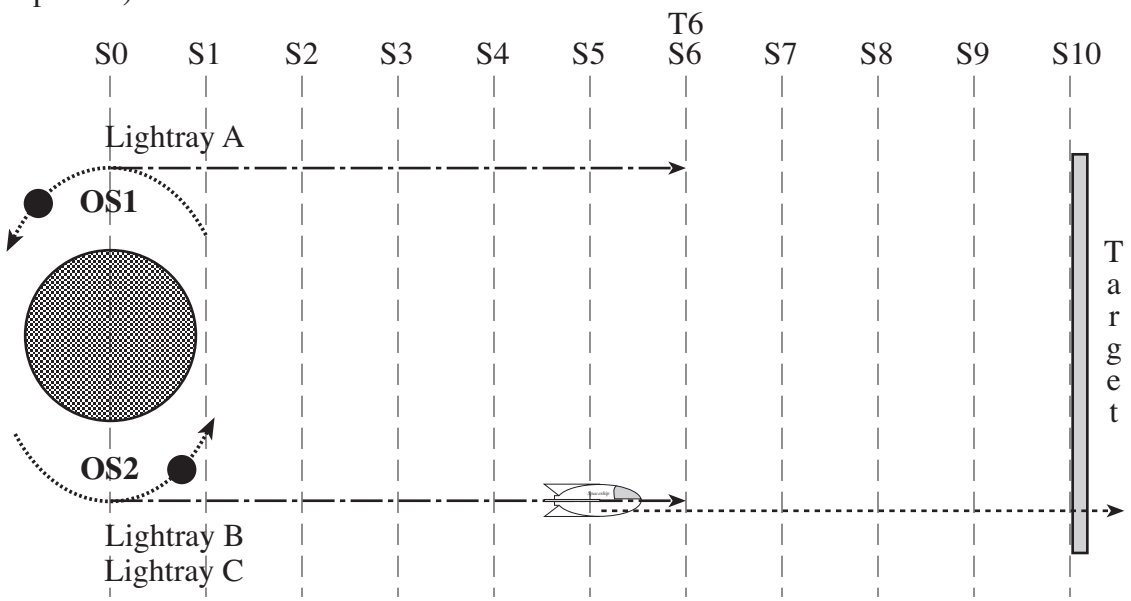
The Orbiting Stars Diagrams: Summary

From this ...



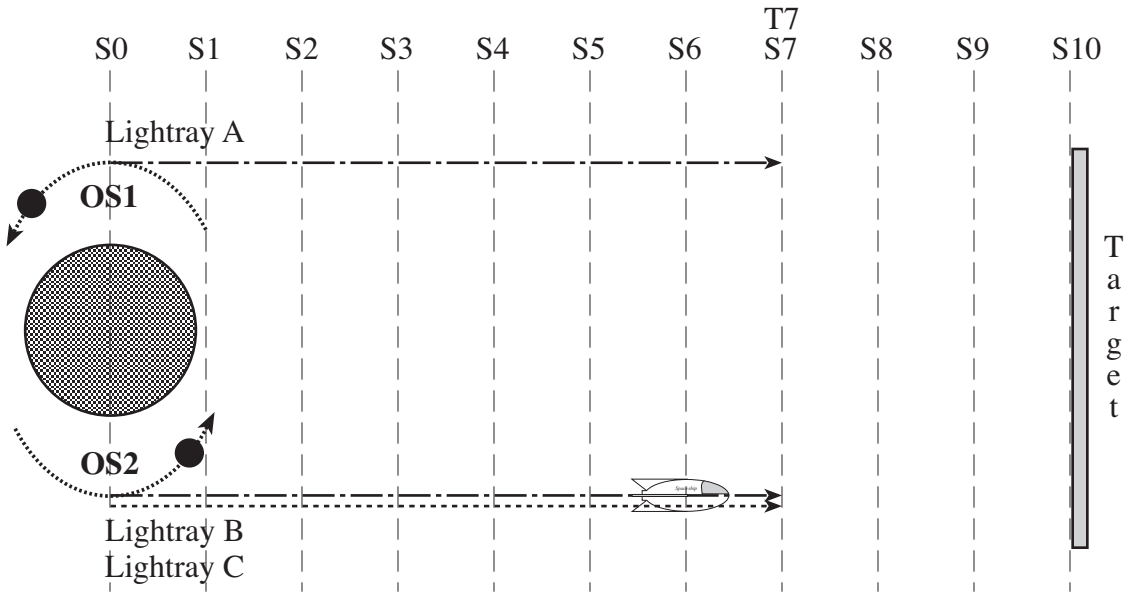
Orbiting Stars 5T0 or 6T0 – Timepoint 0

... at T6 (Timepoint 6) there is either this ...



Orbiting Stars 5T6 – Timepoint 6

... or this ...



Orbiting Stars 6T6 – Timepoint 6

... but not both.

Q: Why not both?
A: Because either a lightpulse travels at AV = ***c*** or 186,000 mps relative to the spacepoint from which it was emitted from a lightsource or it travels at AV= ***c*** or 186,000 mps relative to the lightsource from which it was emitted regardless of the spacepoint at which it was emitted.

The Twin Light Motion Facts

The Orbiting Stars Diagrams reveal that (1) the motion of light is an AV = ***c*** or 186,000 mps relative to the spacepoint at which light was emitted and therefore (2) the motion of a lightsource does NOT affect the motion of light emitted from the lightsource.

These twin facts (observations/measurements) inre the motion of light (twin light motion facts – TLMFs) – (1) light travels at an AV = ***c*** or 186,000 mps relative to the spacepoint at which it was emitted and (2) the motion of a lightsource does NOT affect the motion of light – are fundamental to the objective truth inre the motion of light.

The twin light motion facts cannot be refuted. If there should be experiments which appear to refute the twin light motion facts then those experiments are automatically invalid – thus the appearance of experimental results which are the refutation of the twin light motion facts is a sign/symptom of a problem with an experiment and therefore reason to reject its results.

The Physical Facts Revealed by the Orbiting Stars Diagrams

The Orbiting Stars Diagrams illustrate ...

(1) the fact that light *in vacuo* has an absolute velocity (AV) of 186,000 mps, i.e. Light AV = 186,000 mps, relative to the spacepoints at which light is emitted from lightsources,
(2) the fact that the motion (velocity) of a lightsource does not affect the motion of light,
(3) the fact that the spacepoints at which light is emitted from lightsources, the light emission spacepoints (LESs), have no motion and are therefore at-rest at AV = 0 mps,
(4) the fact that all lightrays moving at AV = 186,000 mps in the same direction of motion have the same relative velocity (RV) and that RV = 0 mps,
(5) the fact that lightrays which have an AV = 186,000 mps relative to their LESs and an RV = 0 mps relative to each other are all in the same reference frame – the reference frame of light – the light reference frame (LRF),
... and ...
(6) the fact that the LESs are at-rest/not-in-motion and therefore all LESs have an AV = 0 mps which is also an RV = 0 mps which means that all LESs are at absolute rest (AR) in the same reference frame, the absolute rest reference frame (ARRF), which is also the light emission spacepoint reference frame (LESRF).

If all motion is relative, then the absolute motion (AM) of light, i.e. the AV of light, is relative to the spacepoints and objects within the ARRF/LESRF and therefore the AM/AV of light is relative to the ARRF/LESRF.

With the minimum AV = 0 mps and the maximum AV = 186,000 mps, then there is a Cosmic Speedometer which has a range from AV = 0 mps to AV = 186,000 mps.

The Cosmic Speedometer	
AV = 0 mps	**AV = 186,000 mps**
AR/ARRF	**AM/AMRF**

Rotating Disks

Einstein claimed that when a solid disk, a disk comprised of m/e, begins to rotate, its increased rotation is an acceleration and the disk's circumference decreases but its diameter/radius (take your pick) does not decrease (or increase).

This thinking is in accord with FitzGerald-Lorentz contraction theory wherein accelerated or decelerated entities comprised of m/e contract or expand only in the x-axis direction of motion.

This idea makes no logical or physical sense.

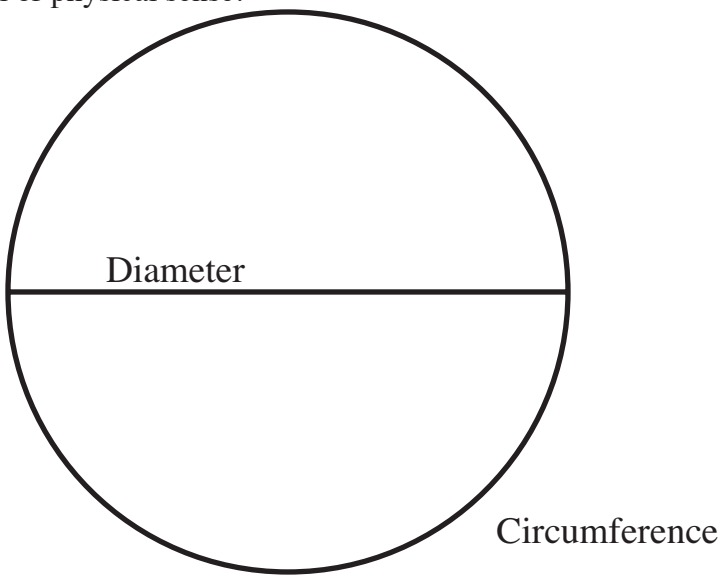


Fig 1. Solid Disk 1

In Fig 1, a non-rotating solid disk has a specific diameter and resulting circumference of πr^2.

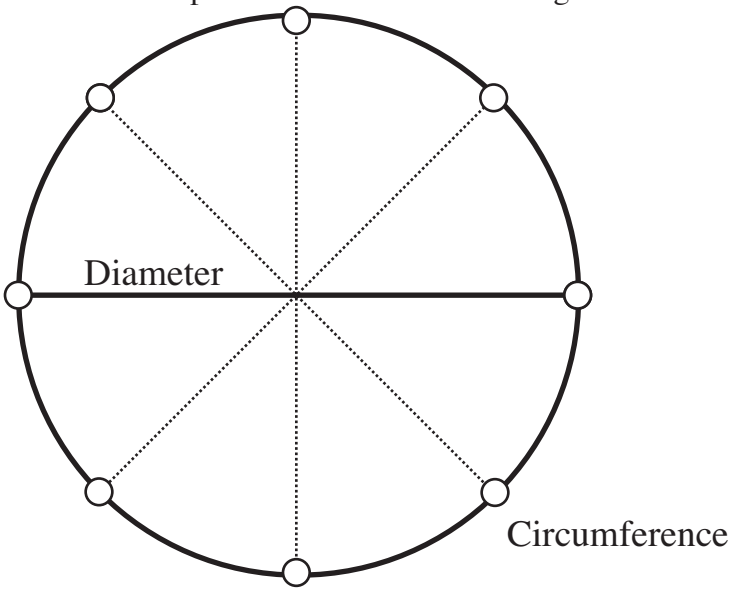


Fig 2. Solid Disk 2

In Fig 2, additional diameters have been added in preparation for rotation.

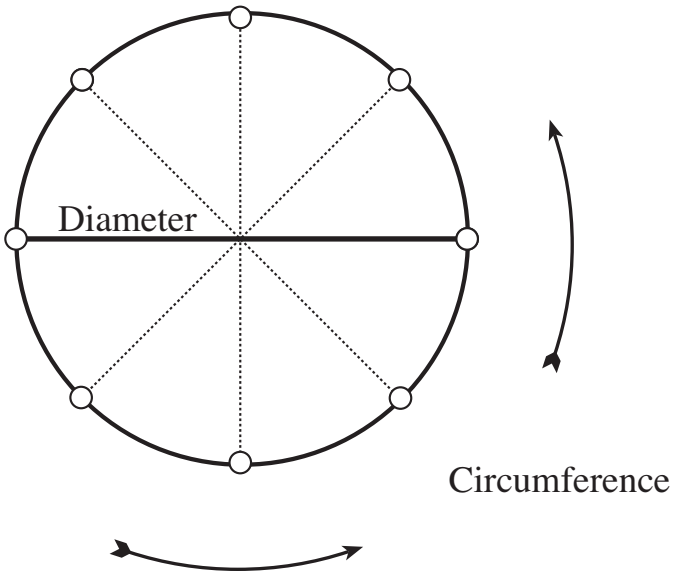


Fig 3. Solid Disk Rotating Counterclockwise

In Fig 3, the disk is rotated counterclockwise and the circumference and diameter have decreased.

This decrease of both diameter and circumference is logical and physical – both have to happen and therefore both do happen.

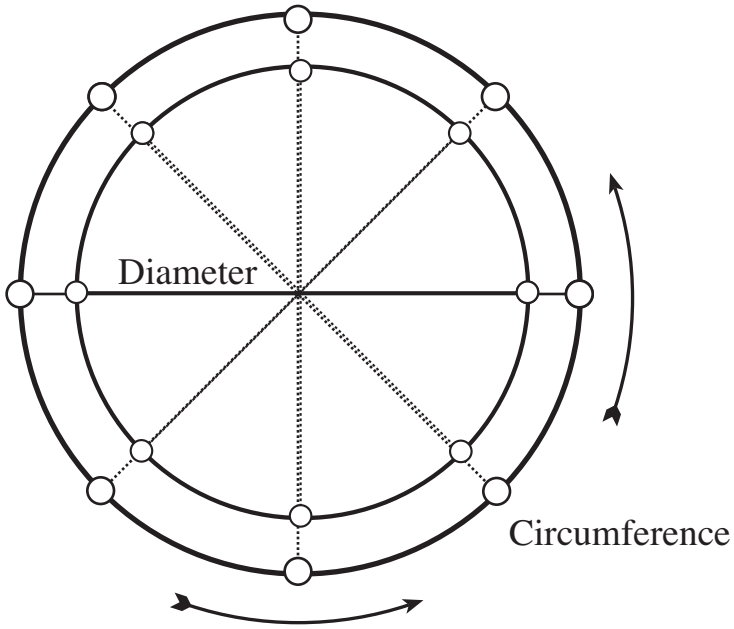


Fig 4. Solid Disk Before and After Rotation

In Fig 4, the solid disk is represented as having its non-rotating circumference/diameter and its smaller rotating circumference/diameter.

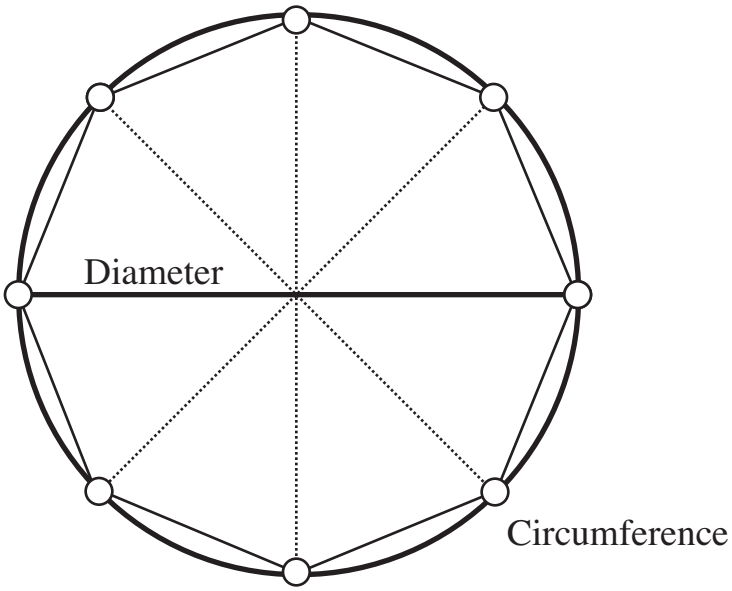


Fig 5. Solid Disk with Circumference Lines

In Fig 5, the non-rotating solid disk has straight lines drawn from the points at which diameters intersect the circumference. These straight lines help to visualize howitiz that when the disk is rotated the circumference decreases and the diameters decrease.

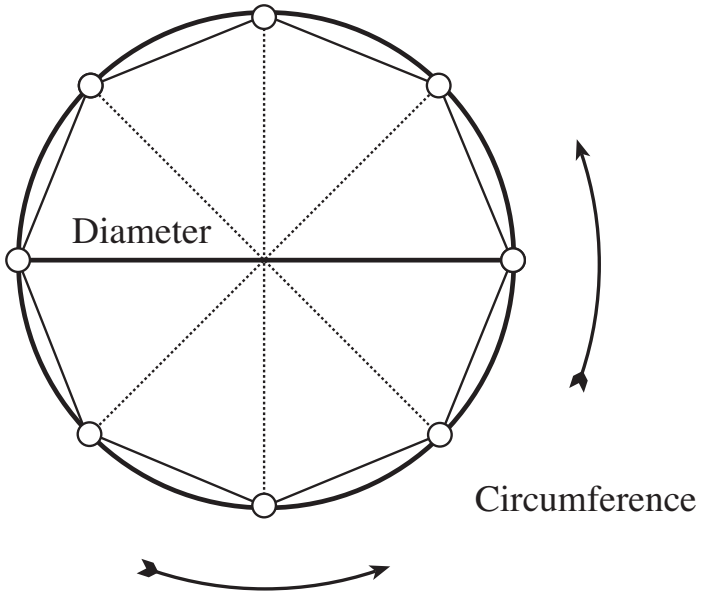


Fig 6. Solid disk Rotating Counterclockwise

In Fig 6, the solid disk is again rotating counterclockwise and the straight lines on the circumference, the circumference itself, and the diameters are all decreasing in length.

If the circumference were to decrease without a decrease in the diameter, then, somehow, the circumference would have to break apart and the solid disk itself would have to break apart.

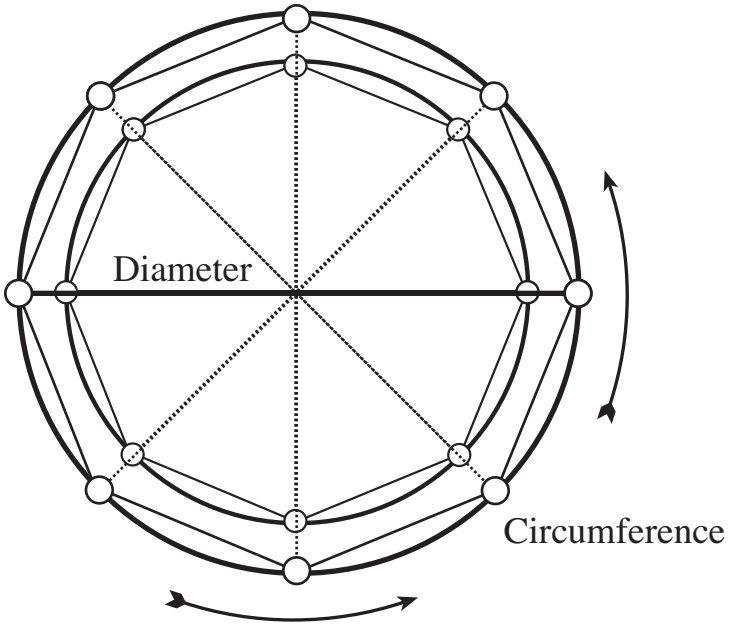


FIG 7. Solid Disk At-Rest and In-Motion Rotating

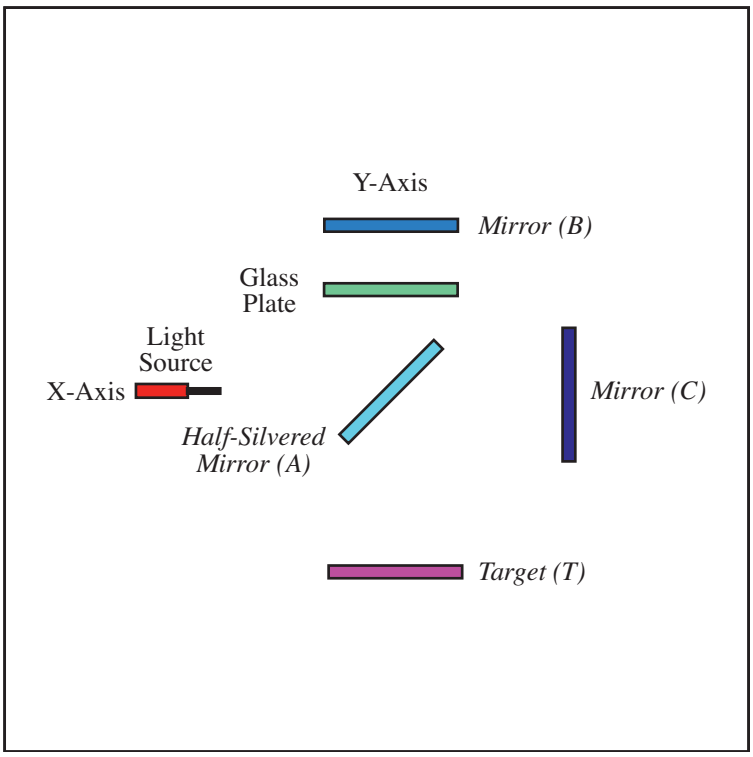
In FIG 7, the solid disk is illustrated as both at-rest/not-in-motion/non-rotating (illustrated by the larger solid disk) and in-motion/rotating (illustrated by the smaller solid disk). As a result of rotation, the straight lines on the circumference, the circumference itself, and the diameters all are decreasing in length compared to the straight lines, circumference and diameters of the non-rotating solid disk.

These diagrams illustrate howitiz that if a solid disk rotates then both its circumference and its diameter must decrease in length.

This result illustrates howitiz that when an entity is in motion, it will expand or contract in all axes, the x-axis, the y-axis, and the z-axis.

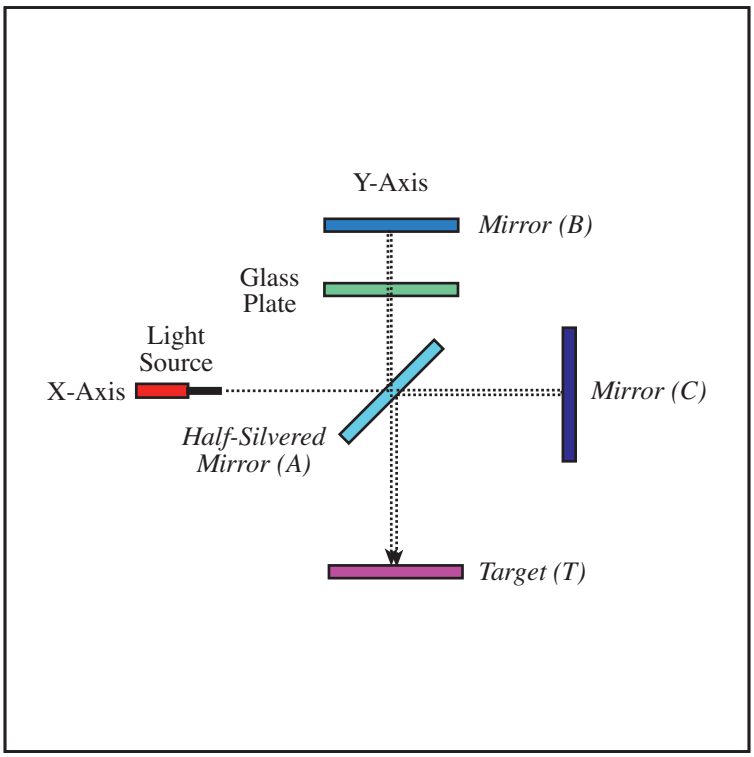
The Interferometer Files

Here is a block diagram of a Michelson-Morley Interferometer.



Interferometer 1

A Michelson-Morley Interferometer features a light source, which is a photon gun, that shoots a stream of photons at a half-silvered mirror, Mirror A (A), which is angled at 45º to the direction of motion of the photons and permits some of the photons to be reflected 90º through the Glass Plate to Mirror B (B) and the other photons to pass straight through to Mirror C (C). The photons reflected by Mirror B are sent back through the Glass Plate to the Half-Silvered Mirror straight through to the Target (T); the photons reflected by Mirror C are sent to the Half-Silvered Mirror (A) and angled towards the Target (T).



Interferometer 2

Thus, the Michelson-Morley Interferometer has the following features ...

Light Source: Photon Gun

Half-Silvered Mirror (Mirror A)

Glass Plate

Mirror B

Mirror C

Target (T)

An x-axis: Light Source - Mirror A - Mirror C

A y-axis: Mirror B - Glass Plate - Mirror A - Target

A Michelson-Morley Interferometer also has a z-axis that is the overhead viewpoint of an observer who is looking straight down upon the x- and y-axes and the interferometer configuration of the photon gun, the mirrors, the glass plate, and the target.

The glass plate is placed to recreate for photons reflected 90° by Mirror A any light motion retardation factors relevant to the glass in Mirror A through which photons not reflected by Mirror A must nevertheless endure while passing through Mirror A after being reflected by Mirror C.

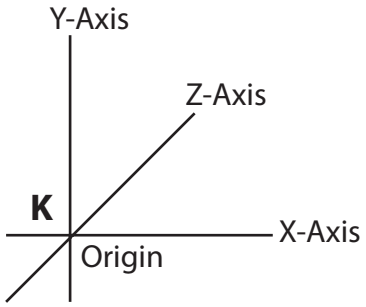
An interferometer is a reference frame.

A *reference frame* is a set of co-ordinates that can be used for making measurements.

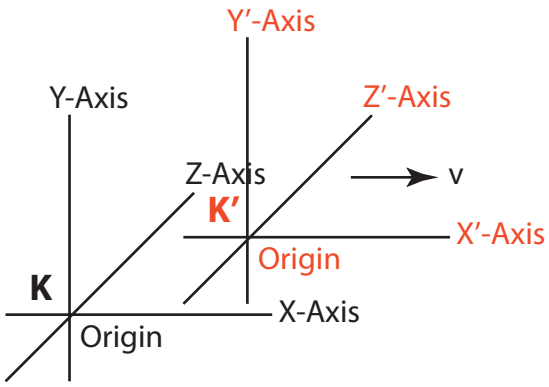
Entities (objects) within a reference frame are said to have relative velocities (RVs) of 0.00 mps inre (in regards, in regards to, about, concerning) each other and the reference frame. Entities which have RVs > 0.00 mps inre each other or the reference frame are said to not be in the reference frame (are not in the same reference frame).

The phrase *reference body* is used to refer to the reference frame of an entity.

Any reference frame will have an x-axis, a y-axis, and a z-axis.



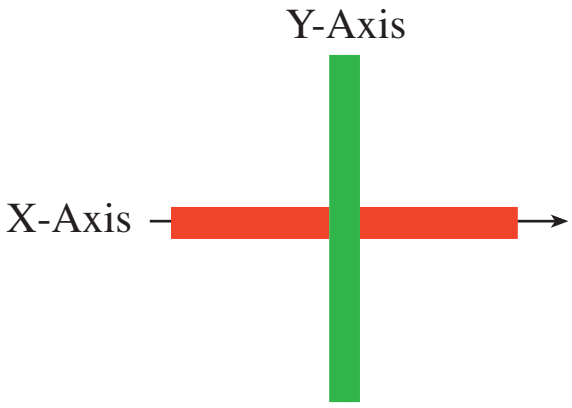
When a reference frame is is in-motion or otherwise is accelerated or decelerated, its direction of motion is considered to be parallel to the x-axis.



Thus, for any reference frame, including an interferometer, the x-axis is aligned parallel to the direction of motion.

For the interferometer illustrations, the viewpoint is from the z-axis looking down upon the x- and y-axes.

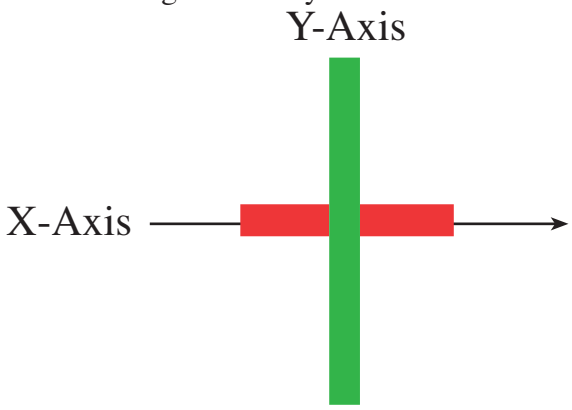
A reference frame can be illustrated as having an arm aligned parallel to the x-axis and another arm aligned parallel to the y-axis.



Reference Frame 1: Cross Orientation (+)

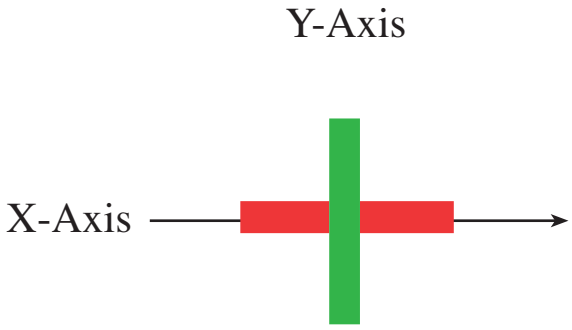
When aligned with the x- and y-axes, the reference frame arms form the shape of a cross or plus sign: +.

Theoretically, when a body is accelerated, its length changes along the x-axis. The x-axis length shortens. Theoretically, there are no changes inre the lengths of the y- and z-axes.



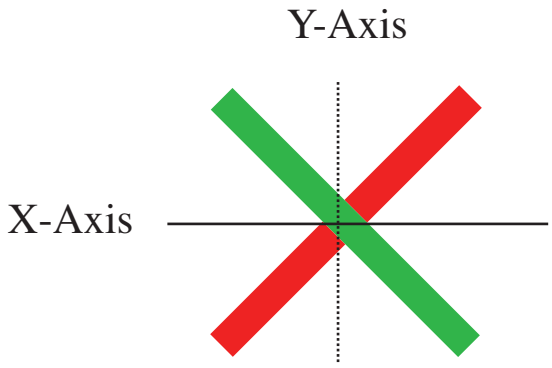
Reference Frame 2: Cross Orientation (+): Accelerated

If the x-axis, y-axis and z-axis all were to shorten, then there would be shortening of all arms.



The cross-shaped reference frame illustrated can be rotated 45º clockwise.

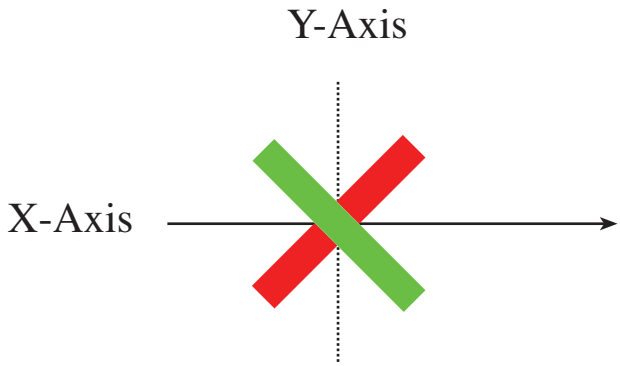
When the arms of a cross-shaped reference frame are rotated, the x- and y-axes maintain their orientation inre their directions of motion.



Reference Frame: X Orientation (x)

When rotated 45º clockwise, the cross-shaped reference frame's arms form the shape of the letter x.

The question that is relevant to the shape of an accelerated body rotated 45º to the x-axis is whether or not both arms shorten. According to theory inre the FitzGerald-Lorentz transformation equations, the shortening only occurs in the x-axis direction of motion. But it seems logical that in the x-orientation both arms would have to shorten.



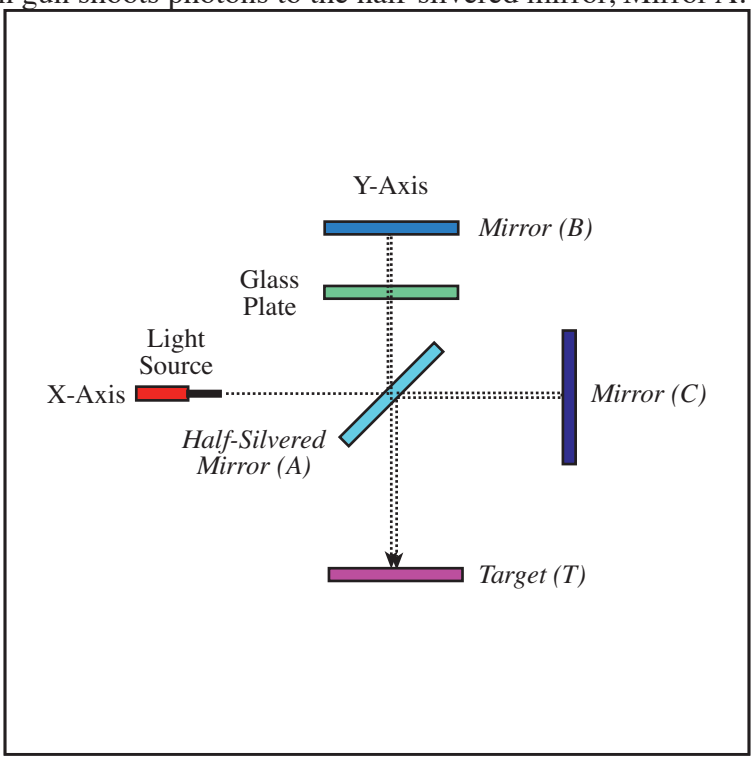
Reference Frame: X Orientation (x): Accelerated

The shortening of both arms of a rotated reference frame may be useful inre explaining the Michelson-Morley Interferometer experimental results.

When accelerated an interferometer ought to undergo a shortening of its components and the shortening of the distances between its components.

The question is whether/not the shortening occurs inre all components and their distances or only those affected by the x-axis orientation.

The interferometer photon gun shoots photons to the half-silvered mirror, Mirror A.



Interferometer 2

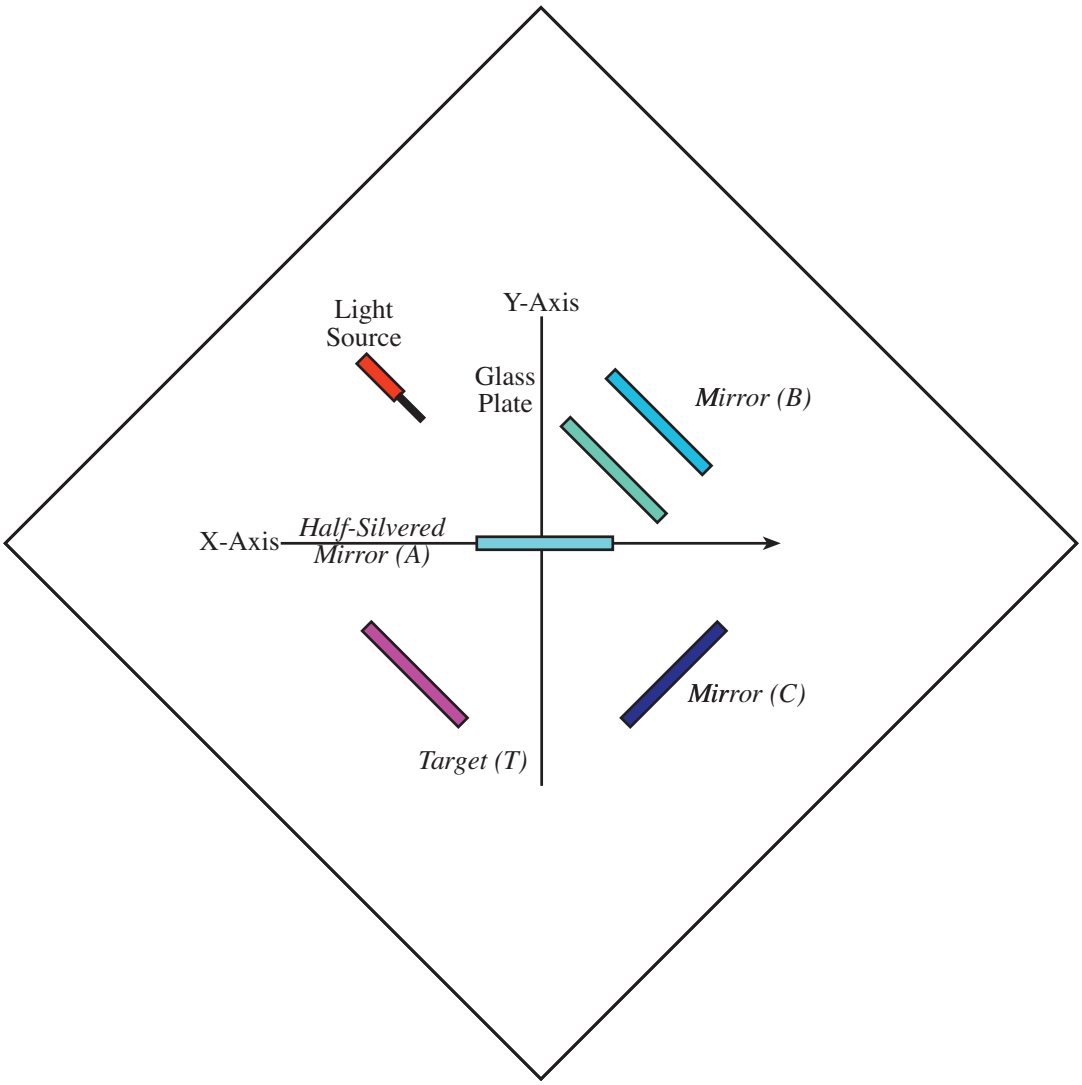
The half-silvered mirror (Mirror A) splits the stream of photons into two directions: ABAT and ACAT.

The ABAT pathway leads from Mirror A to the Mirror B through Mirror A to the Target: A-B-A-T.

The ACAT pathway leads from Mirror A to Mirror C to Mirror A to Target: A-C-A-T.

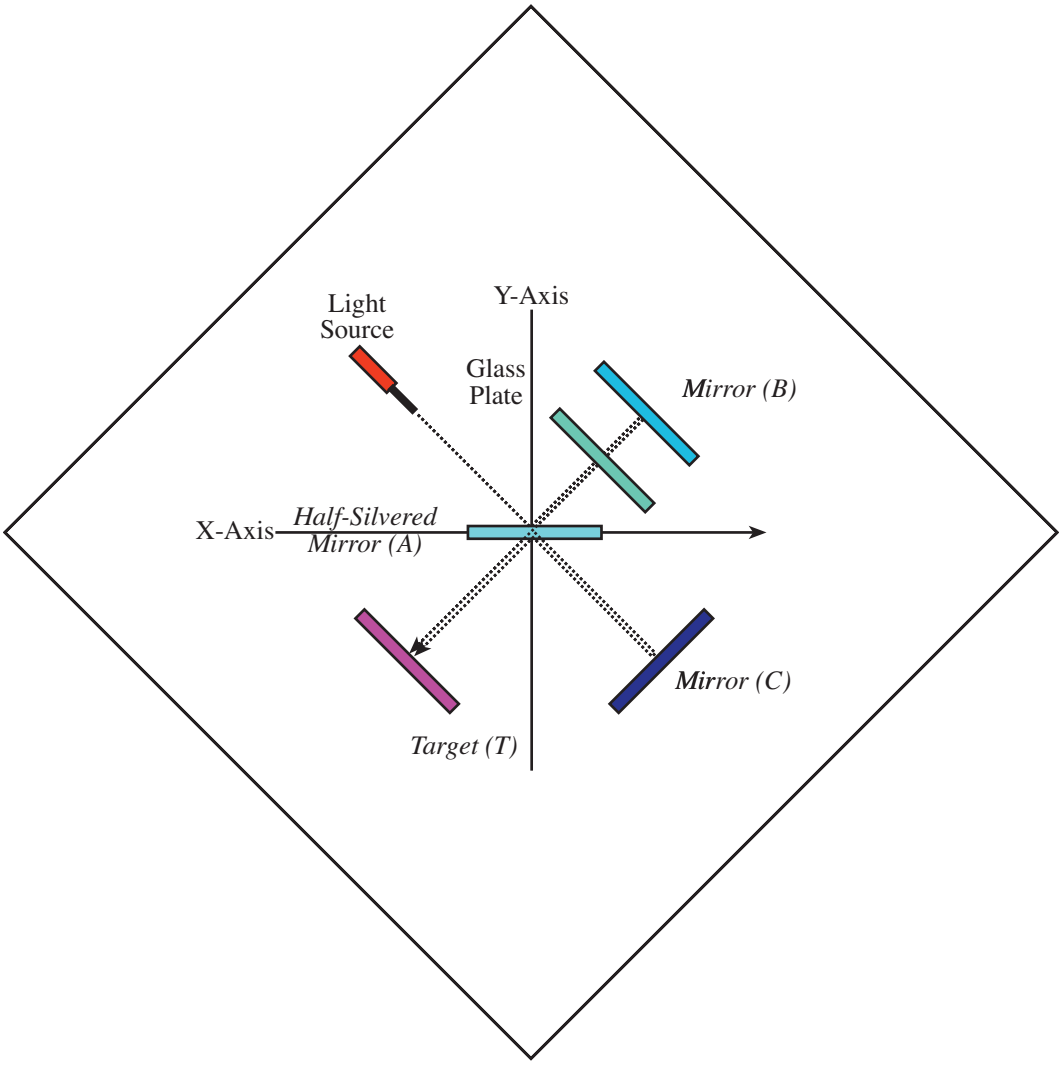
When the ABAT beam is combined with the ACAT beam at the half-silvered mirror, Mirror A, an interference pattern is formed that is observable at the Target.

An interferometer can be rotated 45°



Interferometer 3

When the Light Source is triggered, then photons are shot at the half-silvered mirror.



Interferometer 4

Although the interferometer has been rotated 45º clockwise, the x-axis left-to-right direction of motion has not changed (the left-to-right direction of motion has not been rotated) and is parallel to the direction of motion and the y-axis up-down direction perpendicular to the x-axis also has not changed.

The ABAT and ACAT beams combine at Mirror A and form interference patterns that are observed at the Target to be identical to the interference patterns observed at Target prior to the rotation of the interferometer.

Therefore, the non-rotated and rotated interference patterns are identical.

This result would occur if there were no change in the lengths of the components and the distances between the components when the interferometer is rotated.

When the Michelson-Morley Interferometer was constructed, it was constructed while the earth was in-motion in its orbit about the Sun at 20 miles per second (mps) and the Earth rotated about its axis at a surface or circumference velocity of about 1070 miles per hour (mph). The surface of the Earth is thus rotating at 1070 mph. [The motion of the Earth inre the Milky Way Galaxy and other galaxies is being ignored herein.]

The motion of the Earth created a shape to the MM Interferometer prior to its rotation. This non-rotated shape produced a specific interference pattern. When this pattern was replicated by rotation, this fact suggested that the MM Interferometer shape changed uniformly. The MM Interferometer components' lengths (sizes) and distances apart remained unchanged despite rotation.

The result of the unchanged MM components' lengths (sizes) and distances apart is the unchanged interference pattern that is identical to the non-rotated interference pattern.

This null result suggests that the speed of light is the same for all observers.

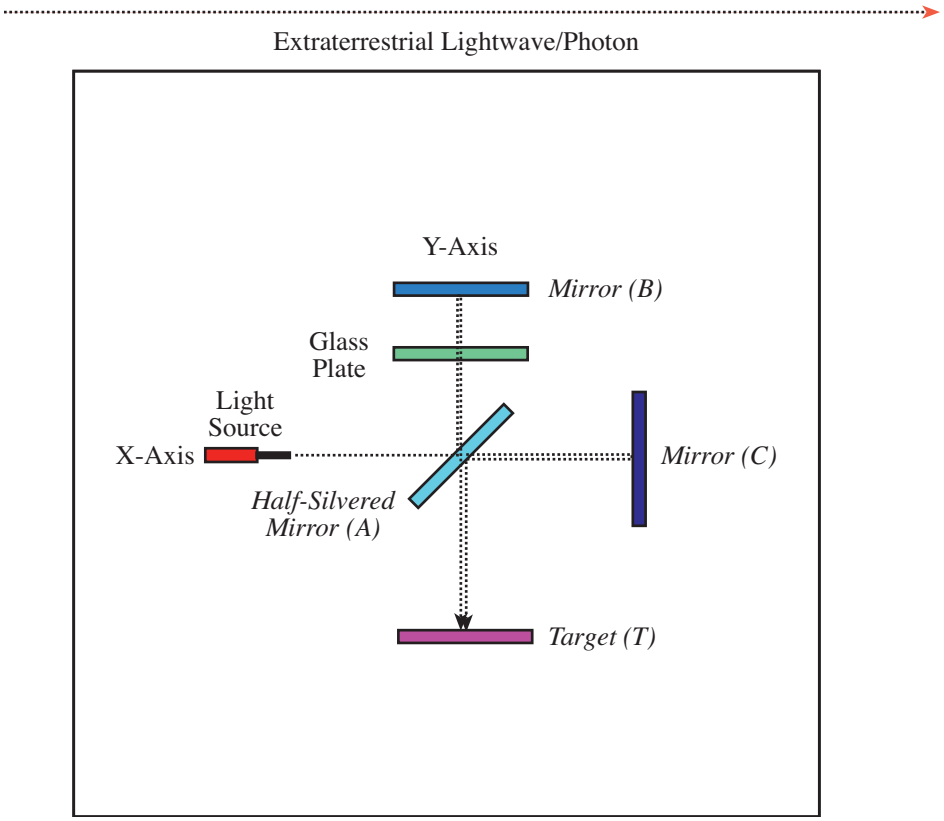
That would mean that unless there is a peculiarity hereto unknown to scientists then the motion of light in any reference frame is always ***c***, 186,000 mps.

A problem develops whenever there is a consideration of the motions of lightwaves in different reference frames.

A relative velocity (RV) is the difference velocity between two entities including two lightwaves or photons.

In the following illustration, the lightwaves in the MM Interferometer are supposed to be in-motion inre the interferometer's reference frame at ***c***.

The MM Interferometer has an AV = 20 mps inre the Sun and 1070 mph inre the earth's axis.



Interferometer 5

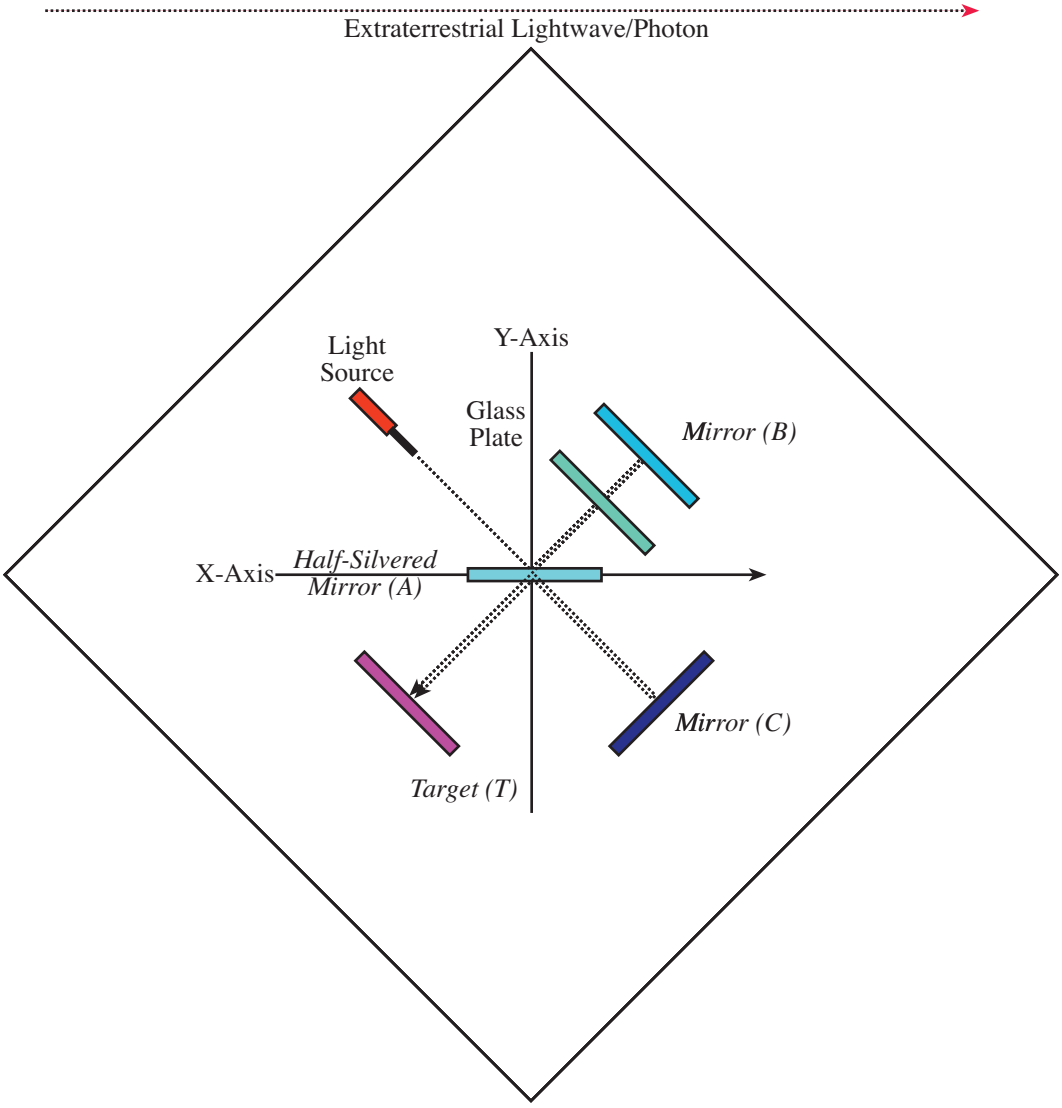
The interferometer is moving left-to-right and the x-axis and the photon gun (light source) are parallel to the direction of motion, and another extraterrestrial photon (designated by the arrow at the top of the illustration) is passing by the interferometer without interacting with it parallel to the interferometer's direction of motion, the x-axis and the photon gun.

The extraterrestrial lightwave/photon traveling past the Earth and therefore past the MM Interferometer has its own AV of ***c***.

The extraterrestrial lightwave/photon is not in the same reference frame as that of the MM Interferometer.

The illustration shows that there has to be an RV inre the velocity of the extraterrestrial lightwave/photon and the MM Interferometer lightwaves/photons traveling in the x-axis direction of motion.

If there is to be no RV difference between the MM Interferometer lightwaves'/photons' AV and the extraterrestrial lightwave's/photon's AV then, somehow, a lightwave/photon, either the extraterrestrial lightwave/photon or the MM Interferometer lightwave/photon, is speeding up or slowing down to match the AV of another lightwave/photon. That simply cannot and therefore does not happen.



Interferometer 6

The MM Interferometer has been rotated 45º clockwise, the x-axis is parallel to the left-to-right direction of motion, and another extraterrestrial lightwave/photon is traveling parallel to the x-axis direction of motion without interacting with the Interferometer.

The rotation of the MM Interferometer has to cause an RV difference between the Interferometer lightwaves'/photons' AV and the extraterrestrial lightwave's/photon's AV.

This RV difference inre lightwaves/photons in different reference frames negates the MM Interferometer experimental result that the speed of light is the same for all observers in all reference frames.

The Doppler Effect and Light Motion

The Doppler Effect describes what observers observe when a light source (LS) emits light as lightwaves (LWs) or as lightrays (LRs) at light emission spacepoints (LESs).

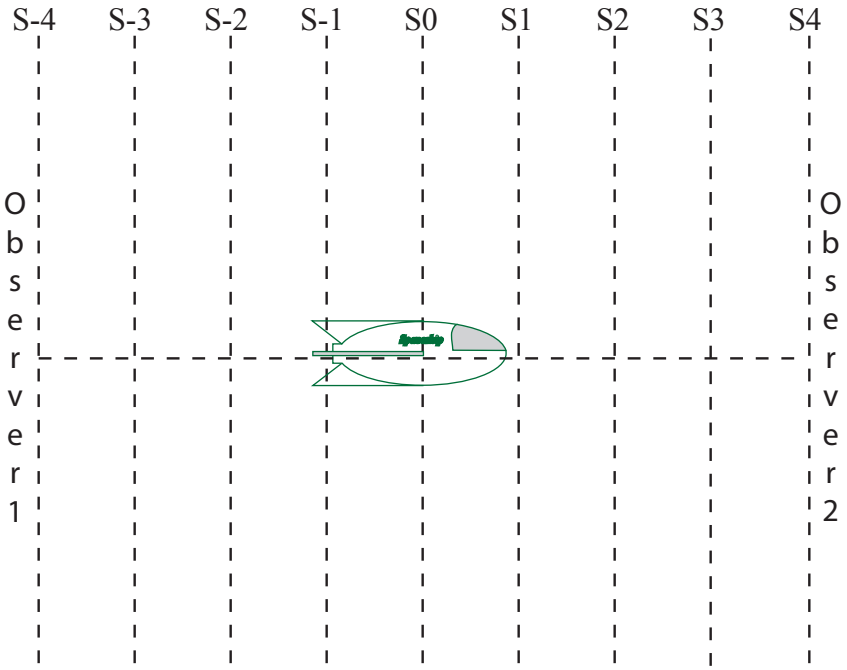
Fact: LSs do not impart accelerations or decelerations to either LWs or LRs.

Assumption: LESs have no motion/are at absolute rest (AR) at $AV_1 = 0.00$ mps.

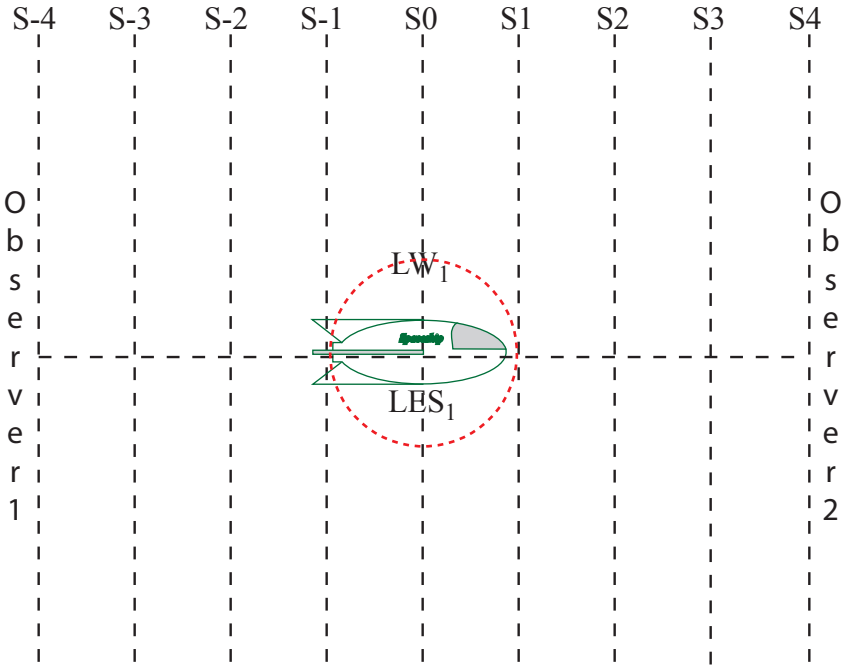
Fact: LWs expand at 186,000 mps and their forward edges move at 186,000 mps from their LESs.

Assumption: The Observers are at-rest at AR at $AV_0 = 0.00$ mps.

When a Spaceship ...

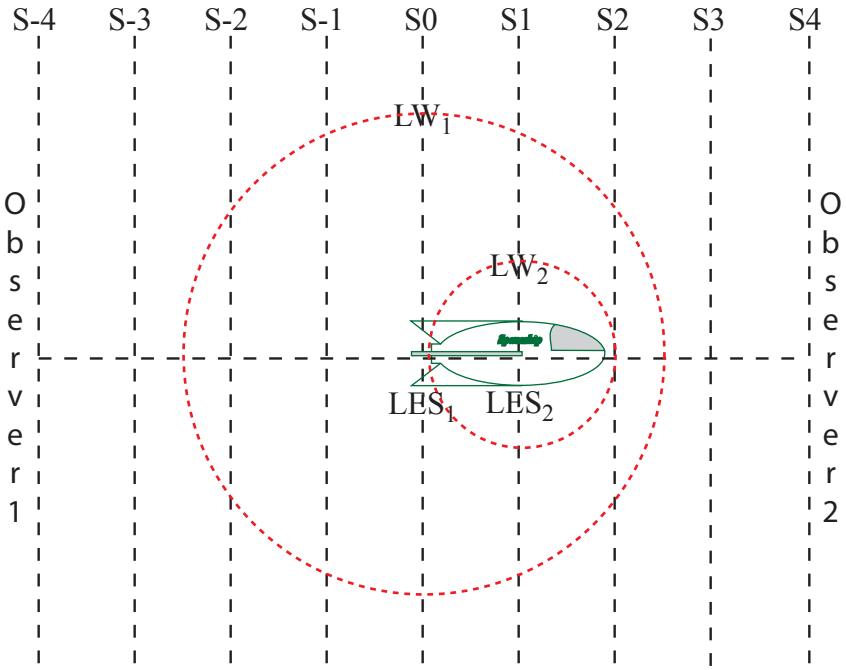


... is in-motion (left to right in the diagrams) away from an Observer 1 and towards an Observer 2 with a steady velocity of $AV_2 < 186{,}000$ mps and $AV_2 > 0.00$ mps, ...

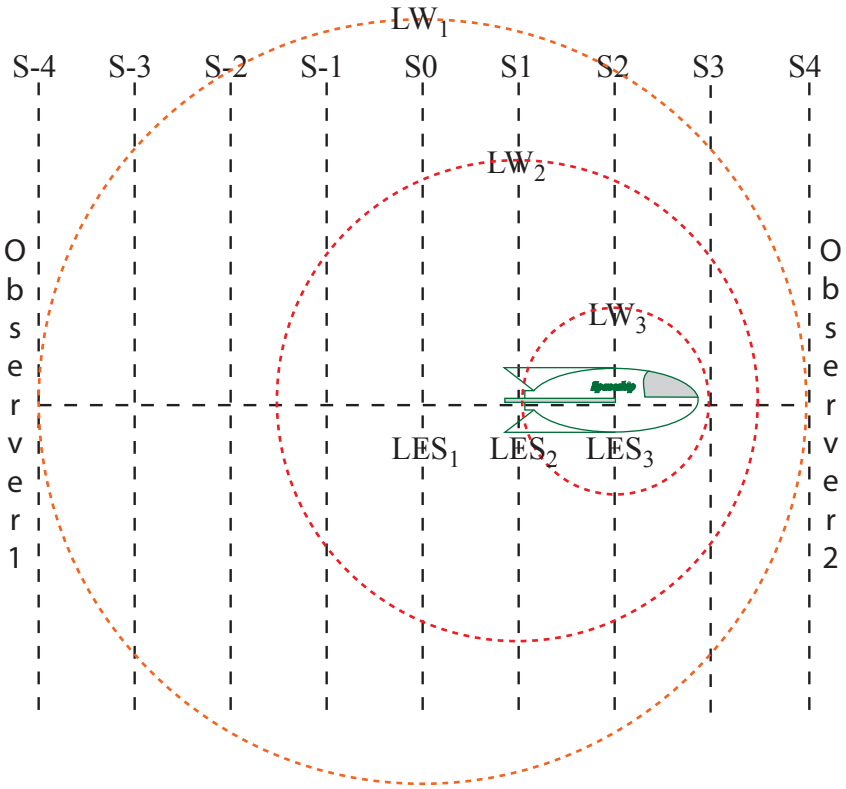


... then a lightwave, LW1, emitted from an LS within the Spaceship located at the Spaceship's center of mass (CoM) at LES_1 will expand from LES_1 at $AV_1 = 186{,}000$ mps but will travel ahead of Spaceship at $RV_1 = AV_1 - AV_2$, while Spaceship travels away from LES_1 at $RV_S = AV_2$, ...

... and another lightwave, LW_2, emitted from the Spaceship at LES_2 will also expand at 186,000 mps and its forward edge will travel ahead of Spaceship at $RV_2 = AV_1 - AV_2$, ...



... and another LW_3 emitted from the Spaceship at LES_3 will also expand at 186,000 mps and its forward edge will travel ahead of Spaceship at $RV_3 = AV_1 - AV_2$ ...

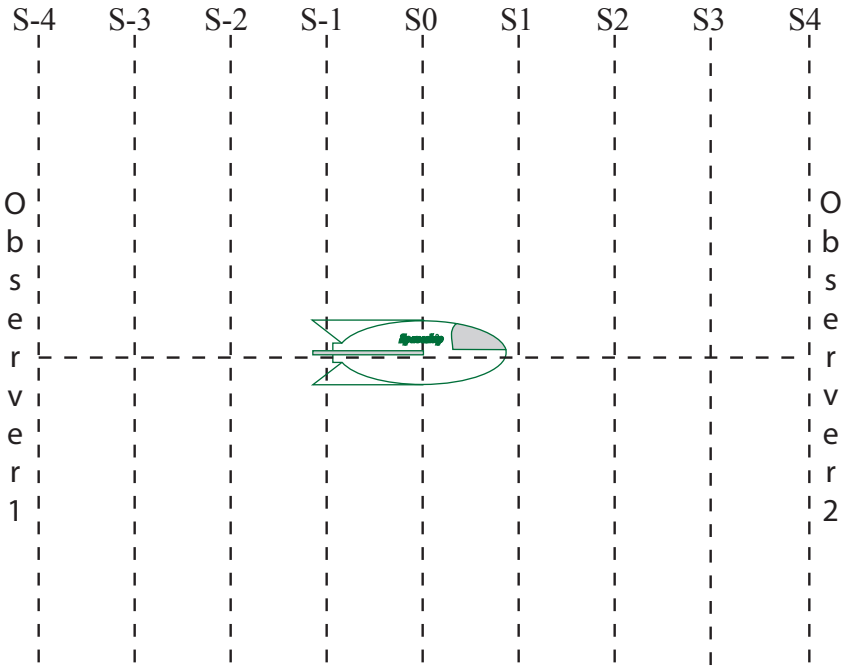


... with the result that the Observer 1 will observe the LW frequency to be shifted towards the red end of the electromagnetic spectrum (red-shifted) while Observer 2 will observe the LW frequency to be shifted towards the blue end of the electromagnetic spectrum (blue-shifted).

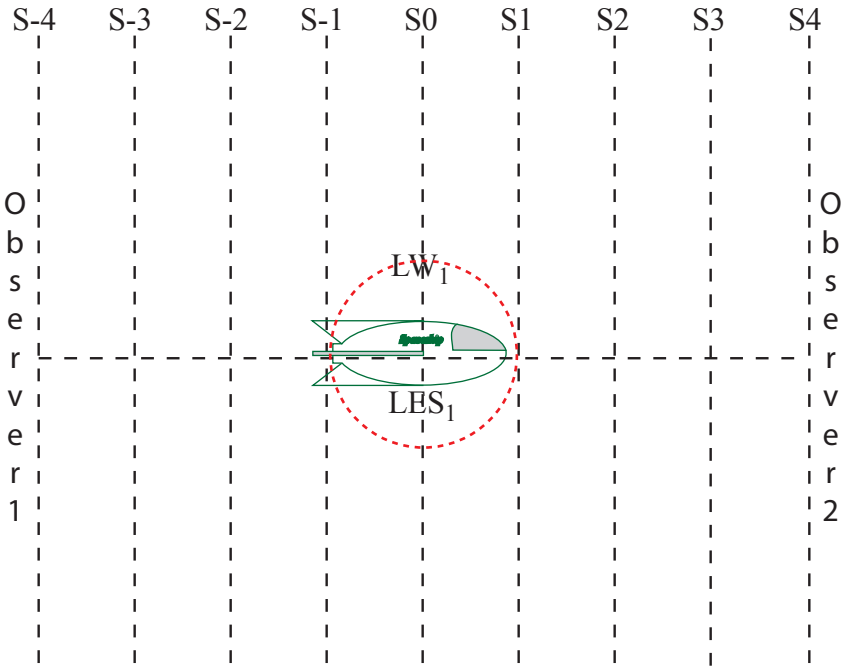
The Michelson-Morley Experiment and Light Motion

Whereas the Doppler Effect has been observed and is therefore accepted to be a physical fact there is a problem inre its conflict with the results of the Michelson-Morley Interferometer Experiment (MMIX) wherein one of the results is the observation of the fact that regardless of the direction in which the MMIX apparatus is directed and regardless of the time of year/position of the MMIX inre the orbit of the Earth about the Sun the motion of light is the traveling of lightwaves (LWs) or lightrays (LRs) past observers always at 186,000 mps which has been described by Bertrand Russell as the phenomenon wherein an LW or LR emitted from an LS aboard a moving entity will always travel outward from the LS at 186,000 mps and therefore the LS shall always remain in the center of an LW and equidistant from LRs traveling in opposite directions from the LS as shown in the following series of illustrations.

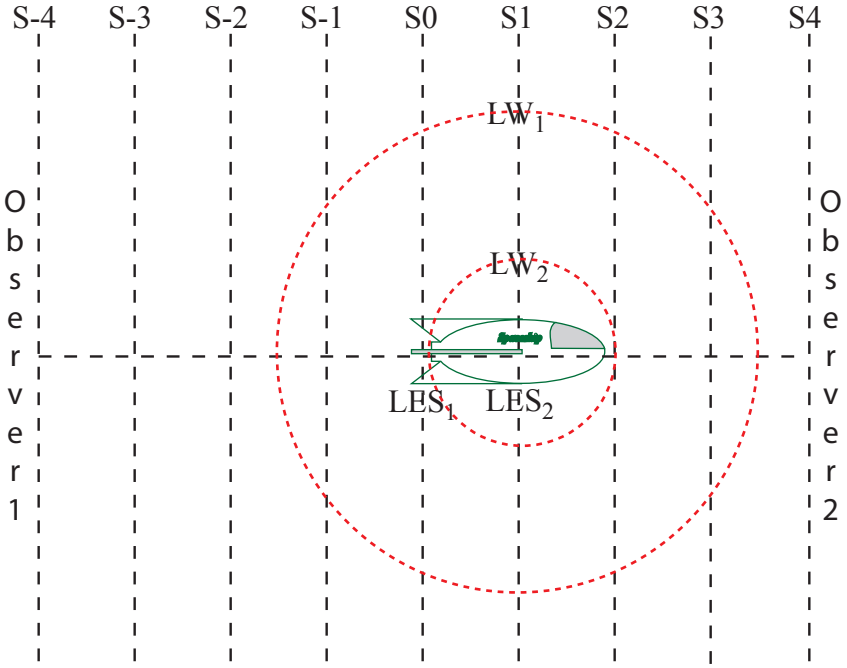
Here is a Spaceship in-motion at AV_1 at Spaceline 0 (S0).



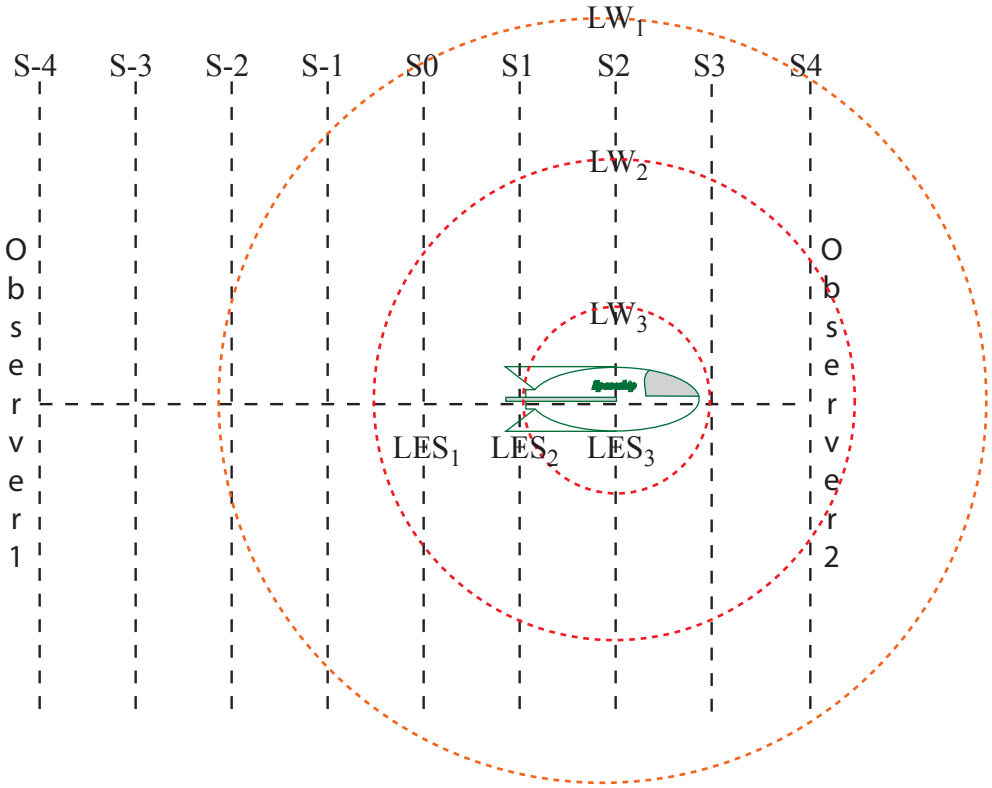
Here is the Spaceship in-motion at AV_1 at Spaceline 0 (S0) when a Light Source (LS) aboard the Spaceship emits Lightwave 1 (LW_1) at Light Emission Spacepoint 1 (LES_1) also located upon Spaceline 0.



Here is Spaceship in-motion at AV_1 at Spaceline 1 (S1) when Lightwave 2 (LW_2) is emitted at Light Emission Spacepoint 2 (LES_2).

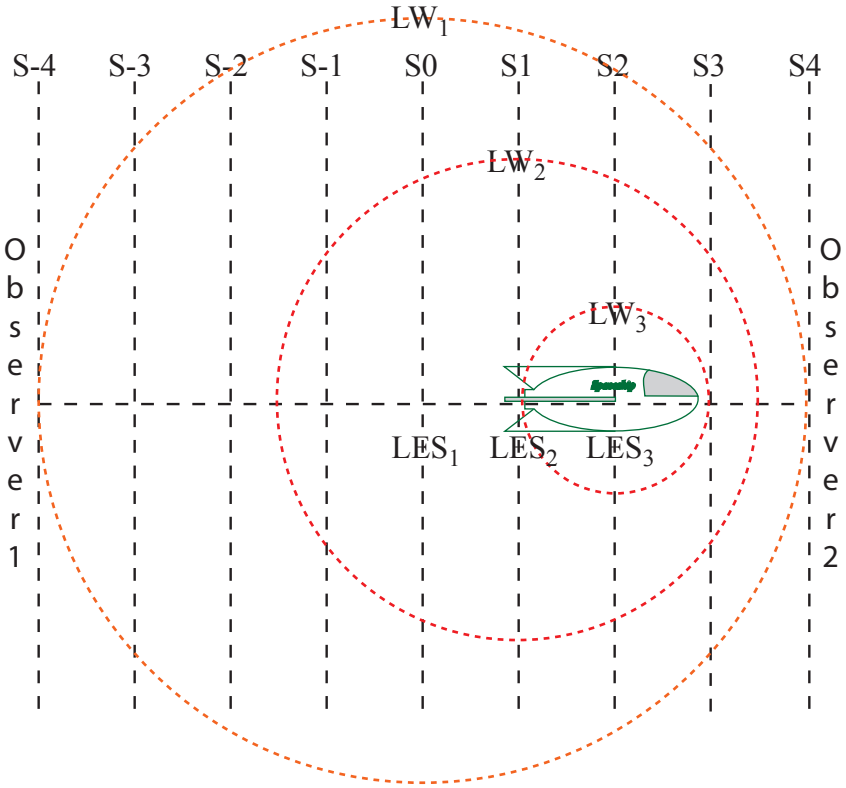


Here is Spaceship in-motion at AV_1 at Spaceline 2 (S2) when Lightwave 3 (LW_3) is emitted at Light Emission Spacepoint 3 (LES_3).

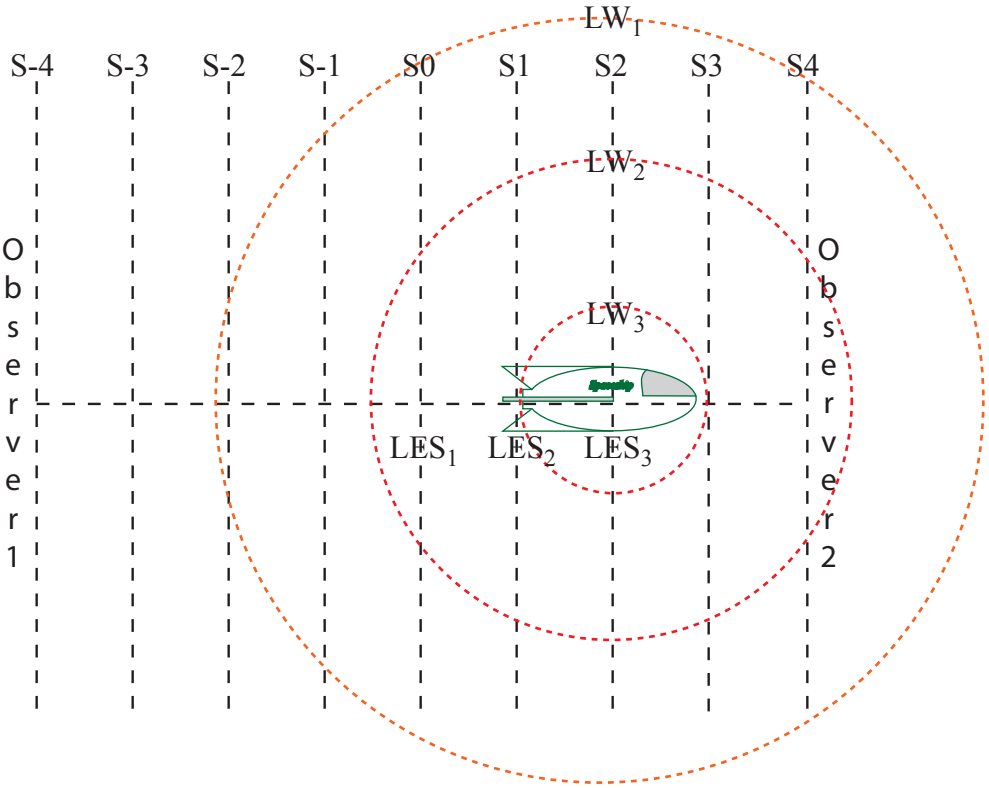


Again there is the Spaceship traveling at $AV_1 < 186{,}000$ mps and $RV_1 > 0.00$ mps away from Observer 1 and $RV_2 > 0.00$ mps towards Observer 2, both of whom are at-rest at AR at $AV_0 = 0.00$ mps, and an LS aboard Spaceship emits LWs at LES_1, LES_2 and LES_3 but in this case wherein according to the Michelson-Morley Interferometer experiment the LWs must expand at RV = 186,000 mps from the LS and thereby the Spaceship must remain in the center of the expanding LWs the fact is that the LWs are not observed to be shifted wherein Observer 1 does not observe a red-shift and Observer 2 does not observe a blue-shift.

Thus, at LES_3, either the LWs are traveling in the Doppler mode ...



... or in the Michelson-Morley Interferometer Experiment mode ...

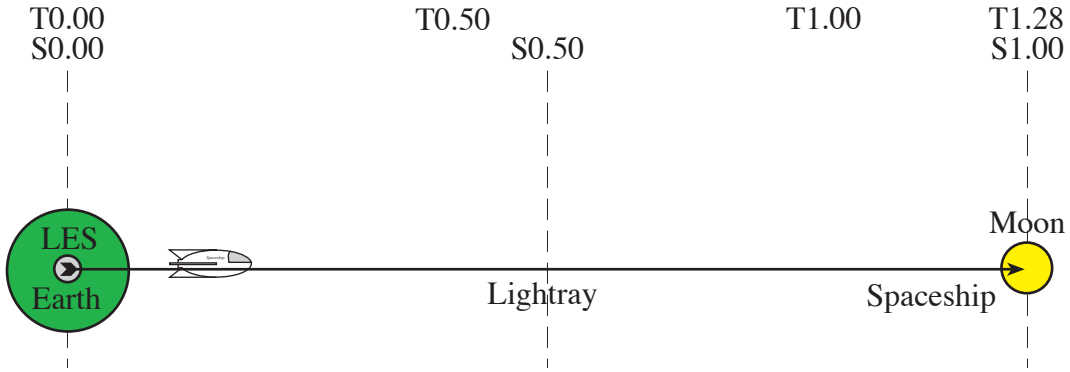


Under the assumption that a light source (LS) emits a lightwave, lightray or photon at a specific spacepoint, the light emission spacepoint (LES) which has no motion and is therefore at-rest at AR = AV_0 = 0.00 mps, and, as shown by their spacepoint positions inre the spacegrid lines, the LESs do not move and therefore the LWs, LRs or photons are in-motion at ***c*** or RV = 186,000 mps relative to their LESs, the logical choice is that light travels in the Doppler mode.

Light Motion Inre the Earth and the Moon

Light travels from the Earth to the Moon in 1.28 seconds.

If a spacecraft (Spaceship) were positioned between the Earth and the Moon with an AV_2 and a DoM away from the Earth towards the Moon and if a Lightray (LR) was fired from a light source which had a light emission spacepoint (LES) upon the Earth to the Moon with an AV_1 = 186k mps parallel to the Spaceship's DoM and thereby the LR's and Spaceship's DoMs = SDoMs, ...



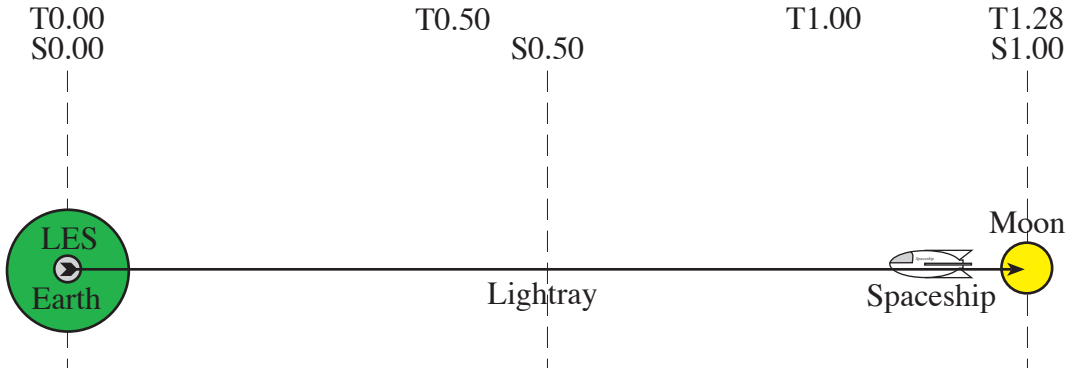
... then, by the formula for relative velocity, ...

$$RV = AV_1 \pm AV_2,$$

... the LR would travel past the Spaceship's center-of-mass (CoM) at ...

$$RV = AV_1 - AV_2.$$

If the Spaceship were to return to the Earth from the Moon at AV_2 and if an LR was fired from the Earth to the Moon at AV_1 parallel to the Spaceship's DoM so the Spaceship's and the LR's DoMs = ODoM, ...



... then, by the formula for relative velocity, ...

$$RV = AV_1 \pm AV_2,$$

... the LR would travel past the Spaceship's CoM at ...

$$RV = AV_1 + AV_2.$$

No person or object or event escapes the reality that there is a physical relationship inre in-motion objects whose DoMs are parallel, either SDoM or ODoM, that is expressed by the RV formula, ...

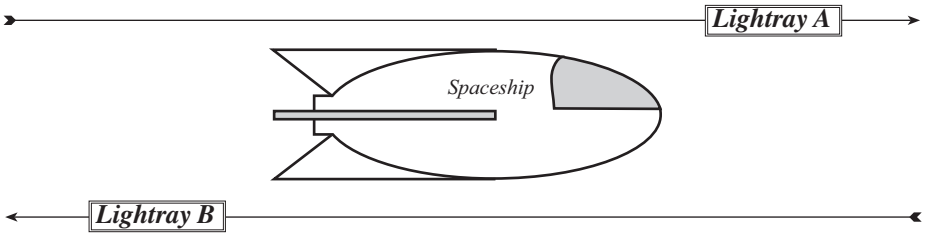
$$RV = AV_1 \pm AV_2.$$

Therefore, light cannot travel at 186k mps past the CoM of an in-motion object which has an AV > 0.00 mps.

The transmission of a light signal from the Earth to the Moon or to a spacecraft positioned between the Earth and the Moon does not occur instantaneously, therefore there is a time-delay, a time-interval, between the firing of a lightray from its Earthbound LS and LES and the reception of that light signal by LD's aboard the spacecraft. If there should be a time-delay inre the motion of a light signal from the Earth to the spacecraft but the light signal was detected on the Moon at a timepoint that was 1.28 seconds after the light signal was fired from its Earthbound LS, then the arrival timepoint would prove that the light signal traveled past the spacecraft's CoM at $RV = AV_1 \pm AV_2$ depending on the DoM of the spacecraft.

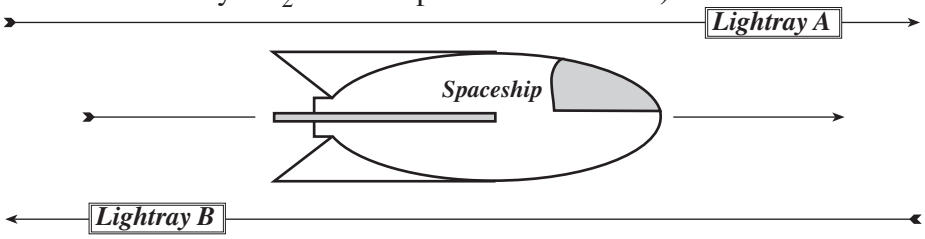
If a light signal truly traveled past a spacecraft's CoM at 186k mps regardless of the light signal's DoM, as relativistas claim, then, at least in theory, and depending on its DoM, the LR fired from its LS and from its LES inre the Earth would either be accelerated or decelerated while within the spacecraft and its arrival timepoint inre the Moon would be shortened or lengthen but would not be T1.28 seconds.

In the Spaceship 1 Diagram, the only condition in which Lighrays A and B could travel past Spaceship's CoM at ***c*** would be if and when Spaceship is absolute rest (AR) at the absolute velocity (AV) of AV = 0.00 mps in the absolute rest reference frame (ARRF) which is also the light emission spacepoint reference frame (LESRF) as shown in Spaceship 1.



Spaceship 1

In the Spaceship 2 Diagram, Spaceship has an AV > 0.00 mps and is therefore not at AR in the ARRF/LESREF but instead is in-motion moving left-to-right and therefore Lightrays A and B cannot possibly logically or physically travel past Spaceship's CoM at ***c*** but instead must travel past Spaceship's CoM at $RV_L = AV_1 \pm AV_2$ when AV_1 is a Lightray's AV = 186k or ***c*** and AV_2 is Spaceship's AV > 0.00 mps (the exact value of Spaceship's AV_2 is irrelevant to the fact that at any $AV_2 > 0.00$ mps will be relevant).



Spaceship 2

Lightray A will travel past Spaceship's CoM at $RV_L = AV_1 - AV_2$ which will be a value less than 186k mps or ***c*** but will not be less than 0.00 mps; Lightray B will travel past Spaceship's CoM at $RV_L = AV_1 + AV_2$ which will be a value larger than 186k or ***c*** but will be less than 2***c*** or 372k mps.

The Einstein Railroad Diagrams

Albert Einstein created a diagram which can be called the Einstein Railroad Diagram to illustrate his concept and relevant principles inre (*inre = in regards*, *in regards to*, *in relation to*, *relative to*, or *about*) the motion of light and simultaneity.

Einstein intended to prove that simultaneity is relative, that a simultaneity – the occurrences of two or more events at the same timepoint – to one observer in one reference frame, *K*, is not a simultaneity to another observer in another reference frame, *K'*.

One of the requirements for Einstein's concept of simultaneity – that simultaneity is relative – as illustrated in the Einstein Railroad Diagram requires light to have an absolute velocity (AV) that is independent of all reference frames and bodies with the exception of a reference frame that is not supposed to exist, the absolute rest reference frame (ARRF), but which must exist for the Einstein Railroad Diagram to describe simultaneity accurately and that requirement violates one of the axioms/postulates of relativity – that the speed of light is the same for all observers in all reference frames, which means that a light photon travels past an observer at the speed of light, ***c***, in any reference frame.

Another of the requirements for Einstein's concept of simultaneity as illustrated in the Einstein Railroad Diagram is that there must be a reference frame that is at absolute rest (AR) – the absolute rest reference frame (ARRF). The ARRF is the reference frame in which exist the spacepoints at which light is emitted from light-sources when the emission of light is assumed to occur at spacepoints that do not move, are not in-motion and are therefore at-rest, at AR in the ARRF.

The assumption that light emission spacepoints (LESs) are not in-motion and therefore at at-rest at AR in the ARRF is based upon the results of the Orbiting Stars Diagrams that the velocity of light in not affected by the motion of light-sources.

Einstein's Railroad Diagram

Einstein's Railroad Diagram for proving the non-simultaneity of events for observers in different reference frames ...

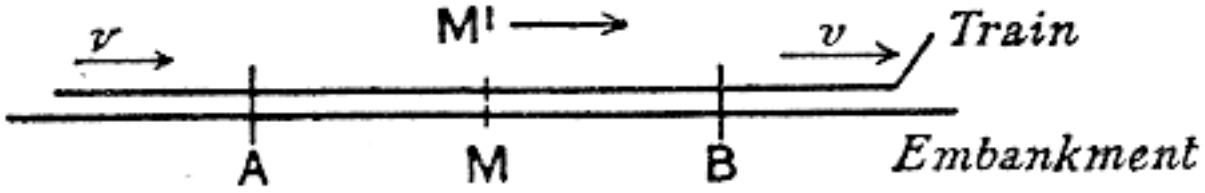


FIG. 1.

... presents ...

1. An observer, *M*, on an *Embankment* that is at-rest (both M and the Embankment are at-rest);
2. An observer, *M'*, on a *Train* that is in-motion moving left-to-right at *v* inre M and the Embankment (both M' and the Train are in-motion at *v* inre M and the Embankment;
3. Two *Lightning Strikes A & B* (hereinafter to be called either *Lightning Strikes A & B* or *Events A & B*) occurring at the same timepoint and equidistant from M and M';
4. M and M' are opposite each other at the timepoint (timemark, mark upon a timeline, or history, or record of timepoints/timemarks and the matter-energy [m/e] configuration inre people, objects and events during or at a timepoint) at which the Lightning Strikes occurred;
5. The Embankment is one reference frame (*K*) while the Train is another reference frame (*K'*) because the Train is already in motion at *v* in the diagram inre the Embankment and the Lightning Strikes A & B;

6A. The requirement that light must travel at *c - v* past any object moving at *v* parallel and in the same direction of motion (SDoM);

6B. The requirement that light must travel at *c + v* past any object moving at *v* parallel but in the opposite direction of motion (ODoM).

According to the one of the results of the Michelson-Morley experiments (and replications thereof) and one of the postulates of the Theory of Special Relativity, the motion of light is always *c* inre any observer, any object, any reference body, and any reference frame.

As determined by observations of stars orbiting about a massive object or moons orbiting planets, the speed of light *in vacuo* (in a subvolume of space that is devoid of matter-energy, or m/e, including gravity) independent of the velocity or motion of a light source and is always *c*.

There exists an incompatibility inre the motion of light inre an observer always being *c* and the motion of light *in vacuo* always being *c*.

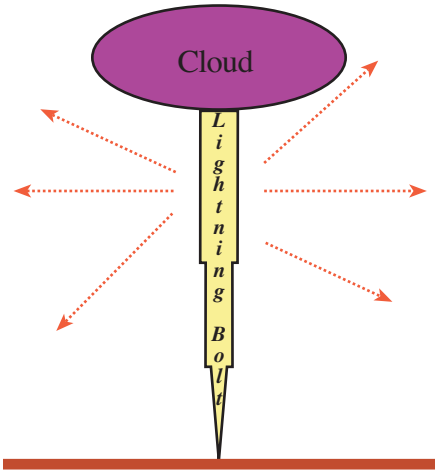
The Reference Frames in the Einstein Railroad Drawing

Einstein specified that in the FIG 1. diagram the Embankment was one reference frame, ***K***, and the Train was another reference frame, ***K'***.

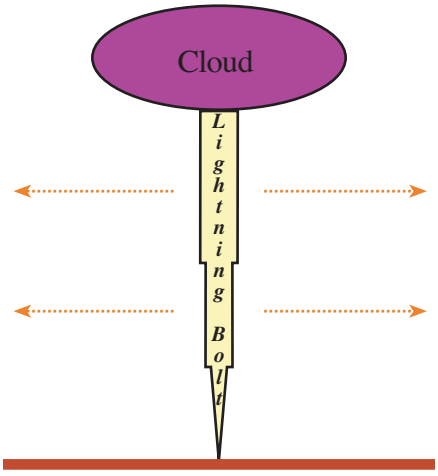
Einstein did not specify from which reference frame observations/measurements inre the Lightning Strikes, the motions of the LRs, the motions of M/the Embankment and M'/the Train, etc., are to be made, therefore the relationships – the observations/measurements – symbolized in the Einstein FIG. 1. diagram are assumed to be observed by another observer, M'', who is in another reference frame, ***K''***, as if M'' is taking a photograph at a 90º right angle inre ***K***/Embankment and ***K'***/Train starting at the timepoint when M is opposite M'.

The Lightning Bolt

When a lightning bolt strikes, its flash is actually a light source from which light is emitted in many directions at the speed of light, *c*, or 186,000 mps.



Among the lightrays emitted from the lightning bolts illustrated in the Einstein Railroad Diagram are lightrays emitted parallel to the Embankment and the motion of the Train.



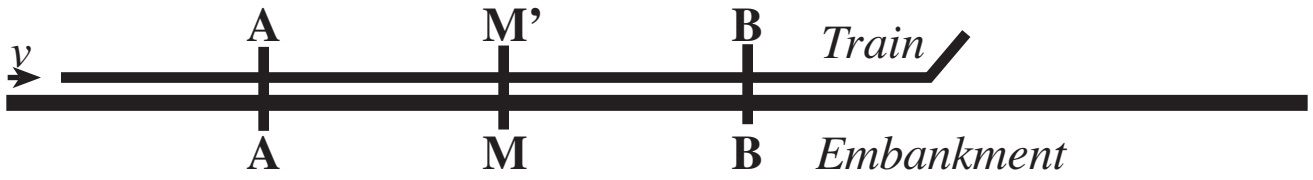
The lightrays emitted from the event of the lightning bolt strike that are in-motion parallel to the Embankment

and the motion of the Train are to be the Lightrays (LRs) used for the determination of the simultaneity or non-simultaneity of the occurrences of the lightning strikes by observers M and M'.

Converting the Einstein Railroad Diagram

The Einstein Railroad Diagram (FIG.1.) can be converted into an Adobe FreeHand 11 diagram, and a series of diagrams labeled Einstein RR 1.x at Tx (Einstein Railroad Diagram 1.x at Timepoint Tx) can be created to show the motions of Lightrays from Lightning Strikes/Events A & B inre the Embankment and the Train and observers M and M' and the distances A-M, B-M, A-M', and B-M' occurring over time.

Inre the Einstein RR Diagrams, the velocity of the Train, *v*, is unspecified: we do not need to know what is the velocity, *v*, of the Train and therefore the observer *M'* and the reference frame *K'*; we only need to know that there is a velocity difference between M' and the Train and *K'* inre M and the Embankment and *K*.

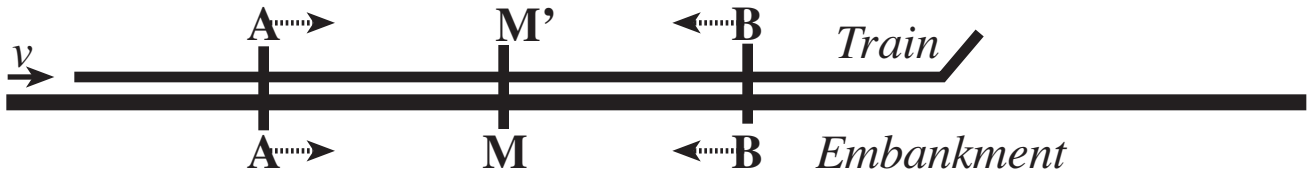


Einstein RR 1.0 at T0

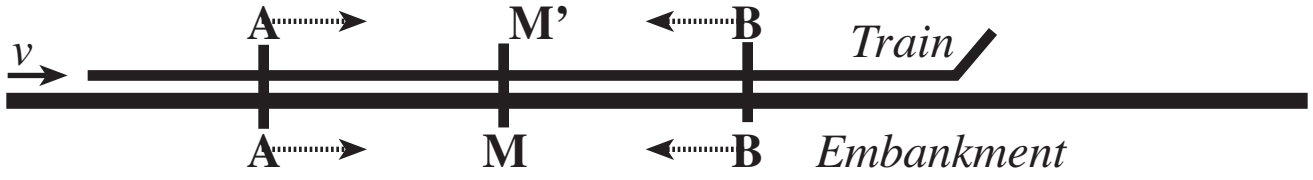
At T0, lightning bolts have struck at A and B.

The Einstein Railroad 1.x Diagrams

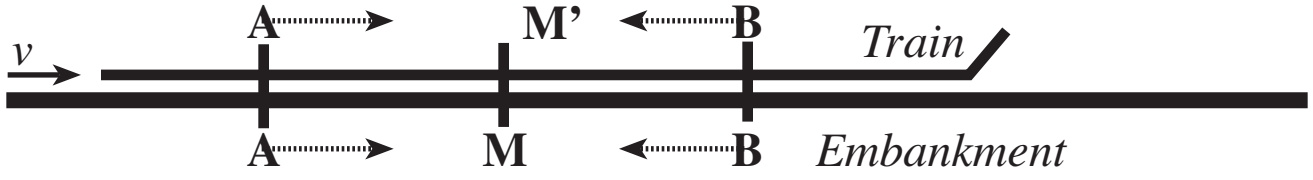
According to the Einstein FIG 1 diagram, the motions of the Lightrays A-M, B-M, A-M', and B-M' are thus ...



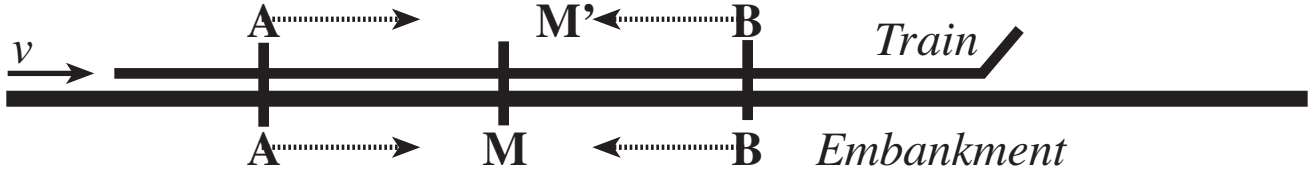
Einstein RR 1.1 at T1



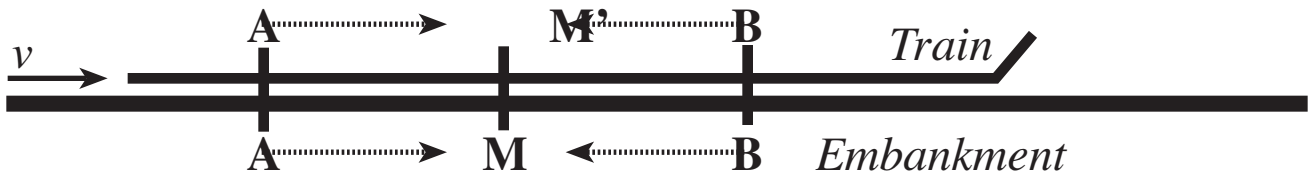
Einstein RR 1.2 at T2



Einstein RR 1.3 at T3

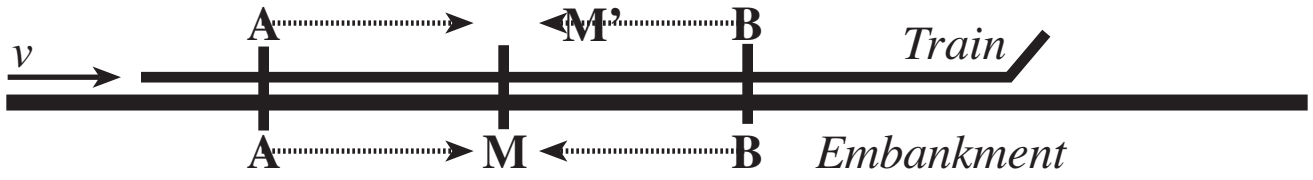


Einstein RR 1.4 at T4

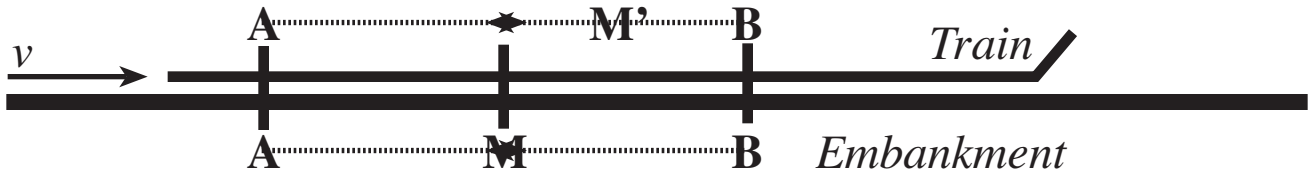


Einstein RR 1.5 at T5

At T5, M' reports Event B has occurred.

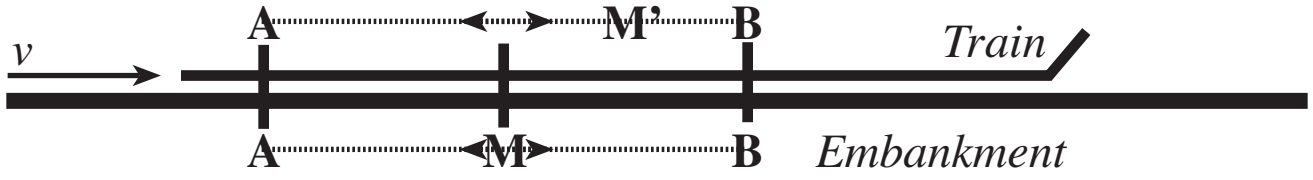


Einstein RR 1.6 at T6

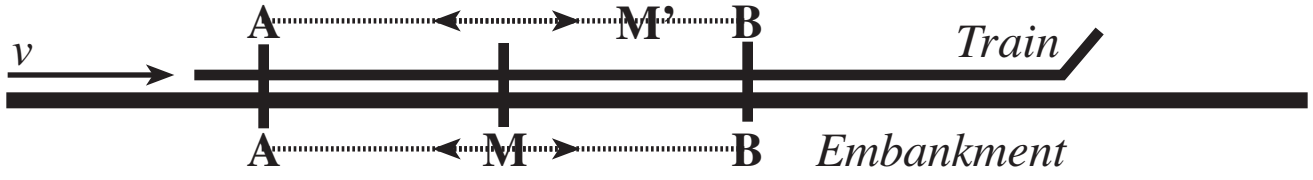


Einstein RR 1.7 at T7

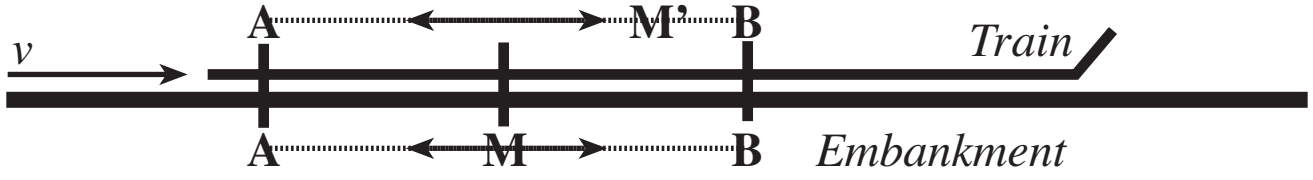
At T7, M Reports Events A and B have occurred simultaneously.



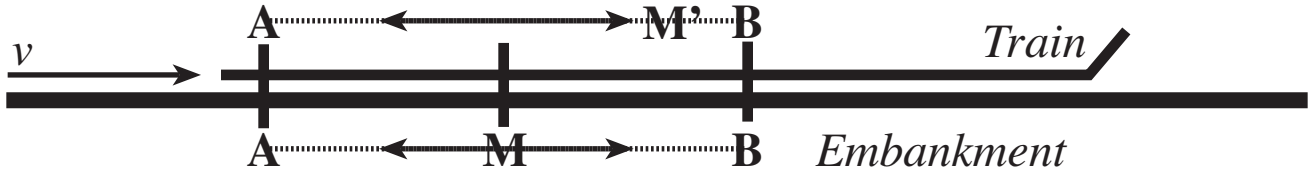
Einstein RR 1.8 at T8



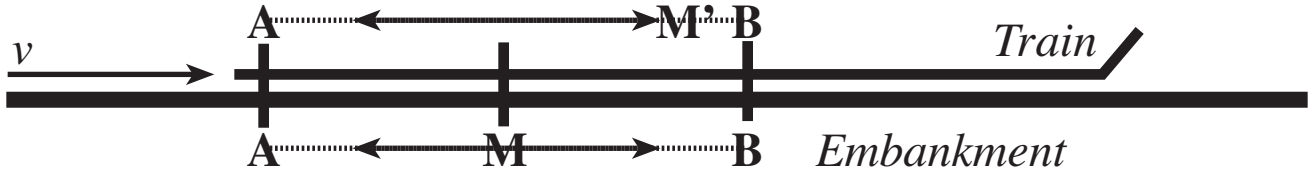
Einstein RR 1.9 at T9



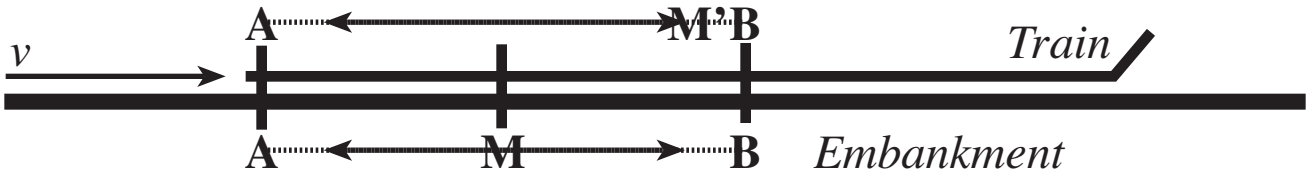
Einstein RR 1.10 at T10



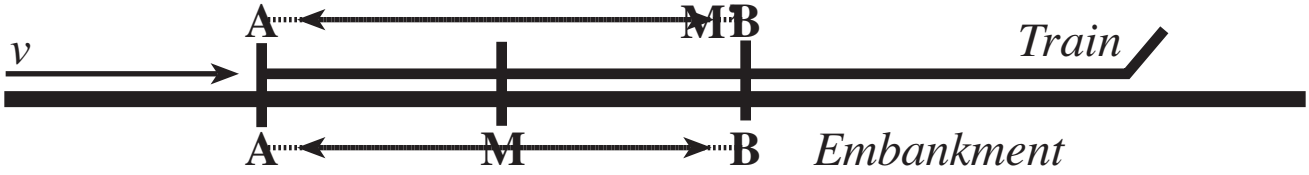
Einstein RR 1.11 at T11



Einstein RR 1.12 at T12

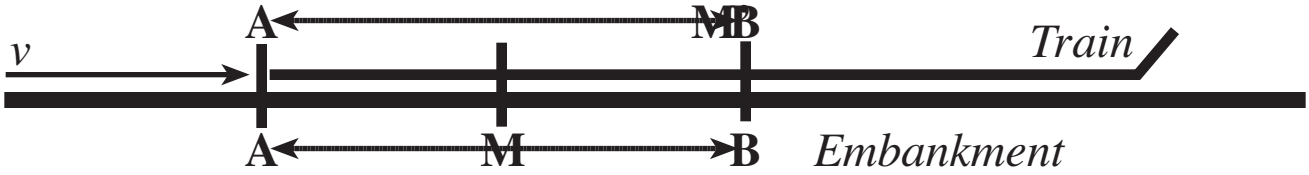


Einstein RR 1.13 at T13



Einstein RR 1.14 at T14

At T14, M' reports Event A has occurred and therefore Events A and B occurred non-simultaneously.



Einstein RR 1.15 at T15

INRE Einstein RR Diagrams 1.0-1.15, …

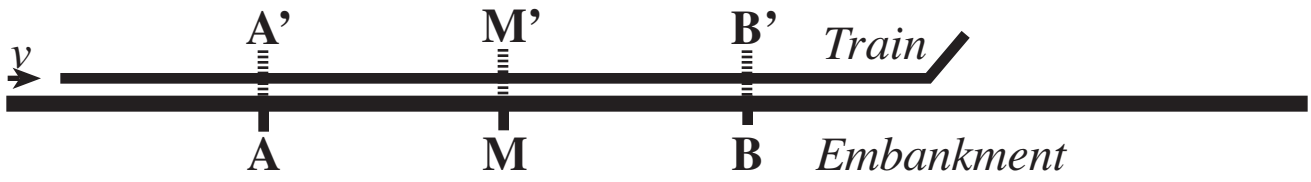
If …
… (P1) Lightrays from Lightning Strikes/Light Sources A and B travel at *c* inre the Embankment …
… and …
… (P2) when traveling at *v* on the Train M' observes Event B occurring prior to Event A (Event A is non-simultaneous inre Event B), …
… then …
… (Q1) Lightrays from A have to travel at an RV = *c* inre M/Embankment and at an RV = *c* - *v* past M'/Train while (Q2) Lightrays from B have to travel at an RV = *c* inre M/Embankment and at an RV = *c* + *v* inre M'/Train.

The Einstein Railroad 1.xc Diagrams

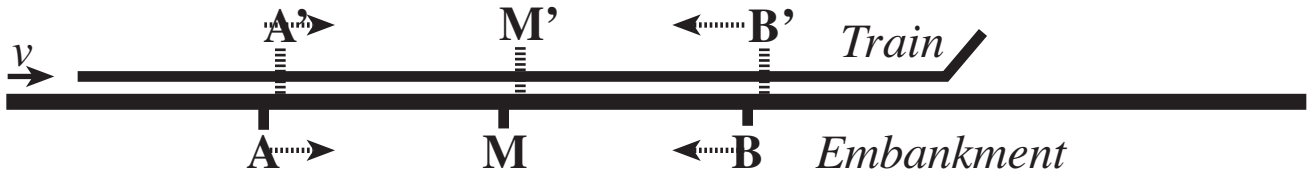
Another set of Einstein RR diagrams can be created to present A' as the letter designating the light from Event A/Lightning Strike A inre M'/The Train/*K'* and B' as the letter designating the light from Event B/Lightning Strike B inre M'/The Train/*K'* and vertical line markers linked to the symbols A' and B' indicating the positions on the Train at which the Lightning Strikes occurred.

Of critical importance is the fact that the Lightning Strikes are Light Sources of Lightrays (or Lightwaves or Photons) which travel in the diagrams parallel to the Embankment and the Train. Each Lightning Strike is a Light Source (LS) of Lightrays (LRs). The motions of Light Sources (LSs) do not change the velocities (speeds and directions) of Lightrays (LRs) emitted by the Light Sources. This fact means the velocities and therefore the motions of Lightrays from A and A' are identical inre the Embankment and the Train and the velocities and therefore the motions of Lightrays from B and B' are identical inre the Embankment and the Train. The fact that Lightrays will travel at *c* inre the Lightning Strikes means these Lightray velocities/motions are absolute velocities (AVs) and absolute motions (AMs).

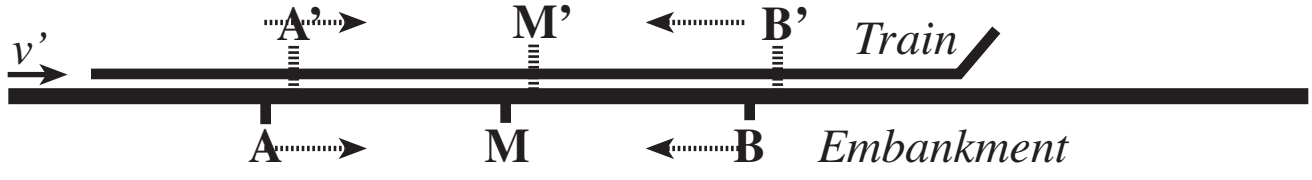
Of critical importance is the fact that inre the diagrams the Train has already been in motion inre the Embankment and therefore the length of the Train has already been shortened according to the FitzGerald-Lorentz transformation equations and as a result throughout the diagrams the lengths A-M, B-M, A'-M', and B'-M' are identical, i.e. A-M = B-M = A'-M' = B'-M', and the lengths A-B and A'-B' are also identical, i.e. A-B = A'-B'; the fact that the Train's length has already contracted means the F-L transformation equations do NOT describe any causal relationships that could change the durations of the light motions of Lightrays (or Photons) from the Lightning Strikes over the lengths A-M, B-M, A'-M', B'-M', A-B, and A'-B'.



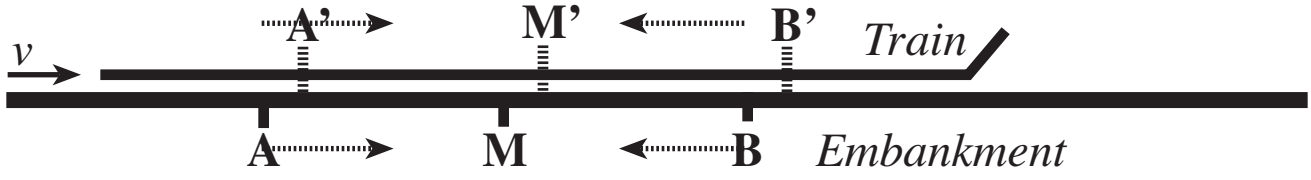
Einstein RR 1.0c T0



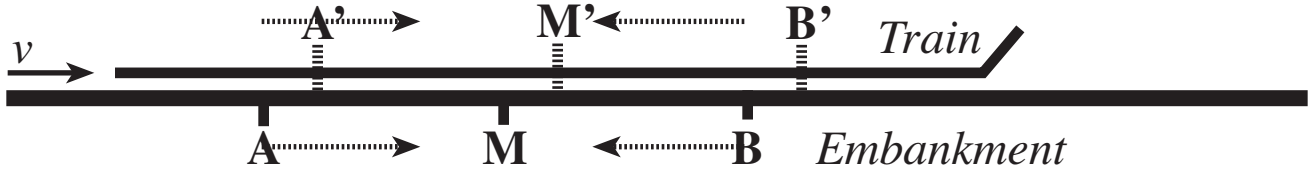
Einstein RR 1.1c T1



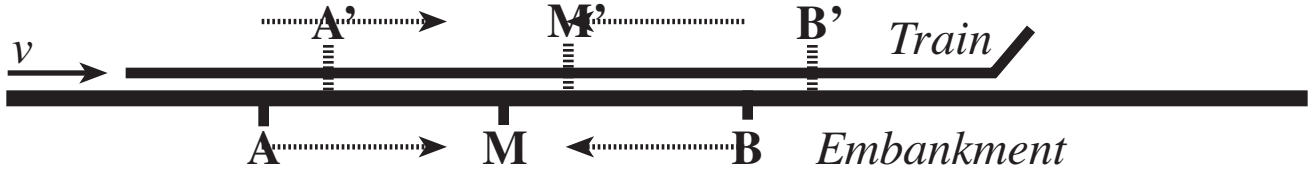
Einstein RR 1.2c T2



Einstein RR 1.3c T3

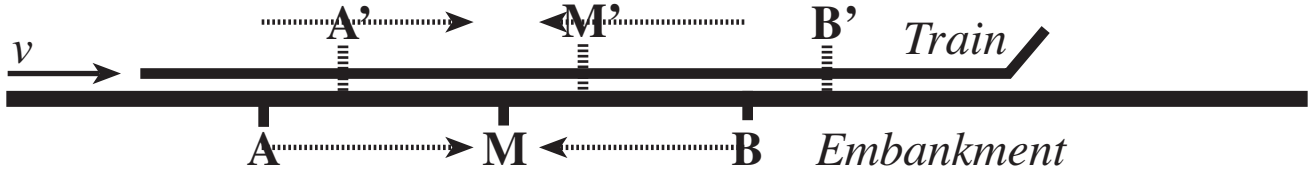


Einstein RR 1.4c T4

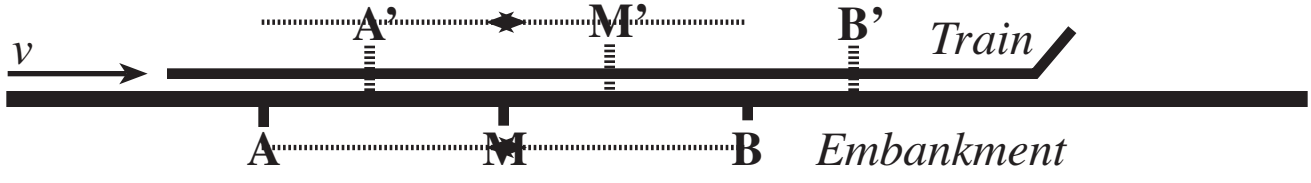


Einstein RR 1.5c T5

At T5, M' reports Event B has occurred.

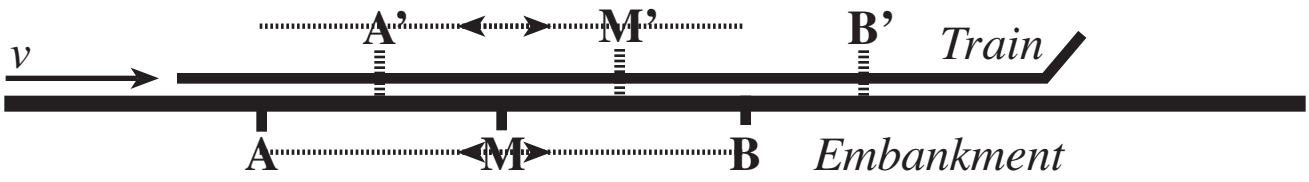


Einstein RR 1.6c T6

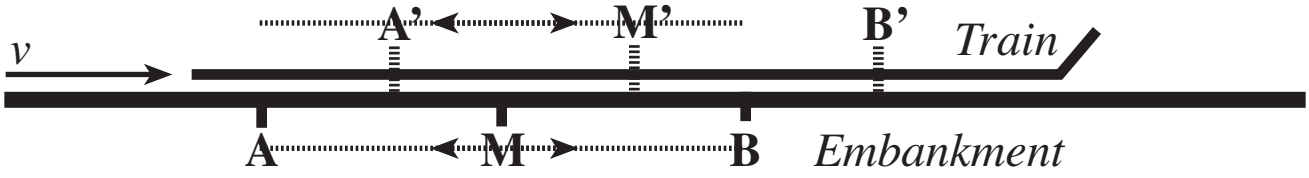


Einstein RR 1.7c T7

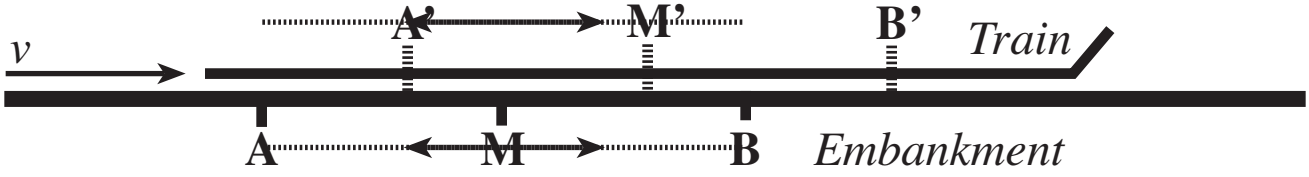
At T7, M Reports Events A and B have occurred simultaneously.



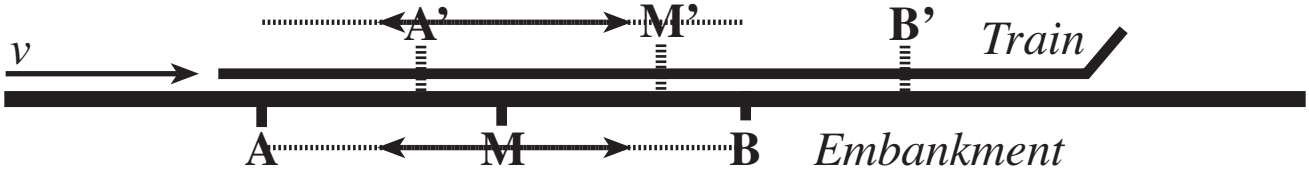
Einstein RR 1.8c T8



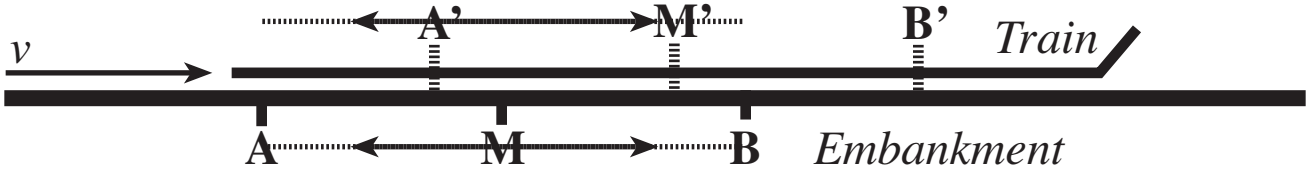
Einstein RR 1.9c T9



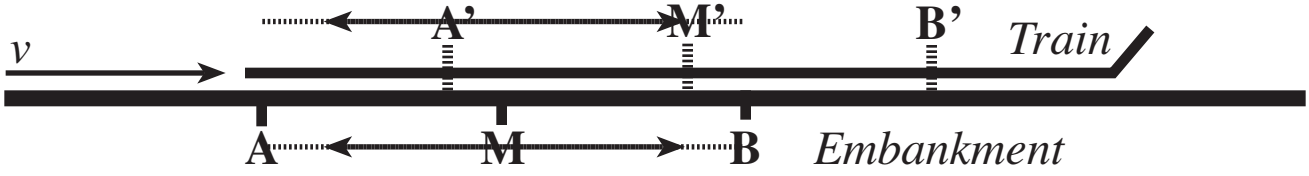
Einstein RR 1.10c T10



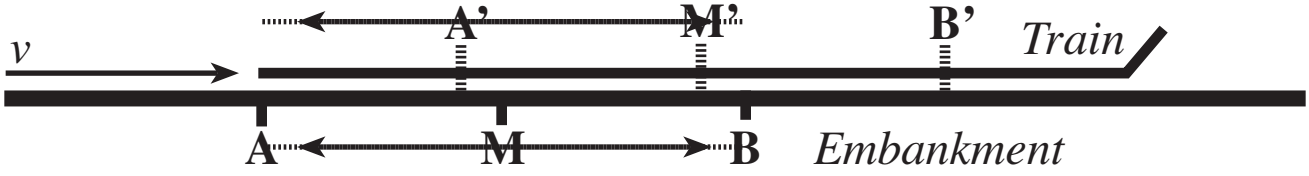
Einstein RR 1.11c T11



Einstein RR 1.12c T12

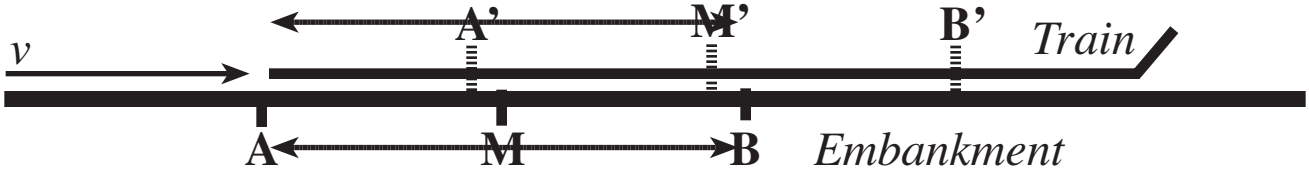


Einstein RR 1.13c T13



Einstein RR 1.14c at T14

At T14, M' reports Event A has occurred and therefore Events A and B occurred non-simultaneously.



Einstein RR 1.15c at T15

INRE Einstein RR Diagrams 1.0c-1.15c, …

If …
… (P1) Lightrays from Lightning Strikes/Light Sources A/A' and B/B' travel at *c* inre the Embankment …
… and …
… (P2) when traveling at *v* M' observes Event B occurring prior to Event A (Event A is non-simultaneous inre Event B), …
… then …
… (Q1) Lightrays from A/A' have to travel at an RV = *c* inre M/Embankment/*K* and at an RV = *c* - *v* past M'/Train/*K'* while (Q2) Lightrays from B/B' have to travel at an RV = *c* inre M/Embankment/*K* and at an RV = *c* + *v* inre M'/Train/*K'*.

Einstein's own FIG 1. and the Einstein RR 1.0 - 1.15 diagrams require that the Embankment has an absolute velocity (AV) that is the AV_1 of 0 mps.

If, …
… (P1) according to the relationships of the motions of the Lightrays and the observers M and M' and the Embankment and the Train are represented by Einstein's FIG 1., as described in the Einstein RR 1.0 - 1.15 diagrams, …
… and …
… (P2) the Embankment has ANY motion wherein its absolute velocity is greater than 0 mps, i.e. $AV_1 > 0$ mps parallel to the Train in the same direction of motion (the Embankment would be in motion left-to-right) …
… then …
… (Q) *both* M and M' would observe and report Event B occurring before Event A and therefore Events A and B occurred non-simultaneously.

NOTE: A description and illustrations of what would occur inre the reports from observers M and M' of the simultaneities and non-simultaneities of the Lightning Strikes if the Embankment of the Einstein Railroad were to be in-motion relative to an absolute rest reference frame (ARRF) in the section entitled **What If The Einstein Railroad Embankment Were To Be In-Motion?** on pages 115-116.

What If The Einstein Railroad Embankment Were To Be In-Motion?

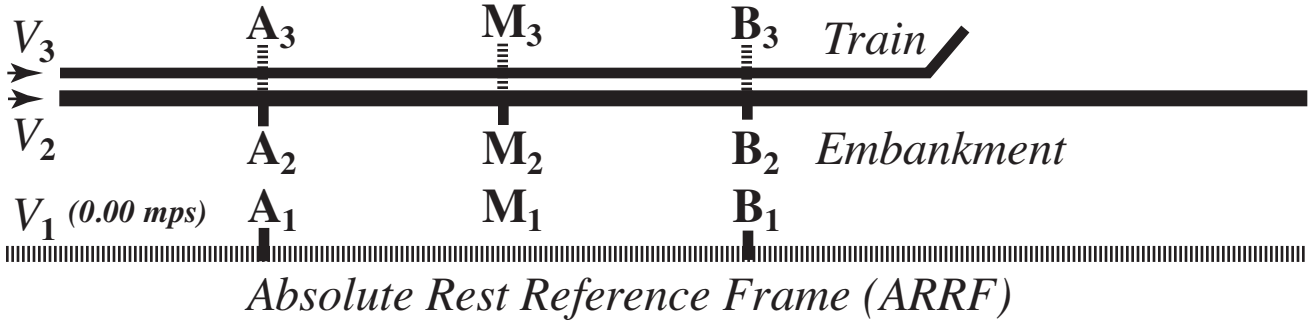
The Einstein 1X, 1XX, 1XXX, and 1XXXX Diagrams

If Einstein's Railway Platform (the Embankment) were to be in-motion at an AV > 0.00 mps, then both Observer M_1 on the Platform and Observer M_2 on the Train would report that the Lightning Strikes A & B occurred non-simultaneously but Observer M_3 on the Absolute Rest Reference Frame (ARRF) would report that the Lightning Strikes A & B occurred simultaneously.

In the following diagrams, there is an assumption that the motion of a light source imparts neither an acceleration nor a deceleration to a lightray or a lightwave and another assumption that there exists an absolute rest reference frame (ARRF) which has an $AV_{ARRF} = 0.00$ mps or an $AV_0 = 0.00$ mps or a $V_1 = 0.00$ mps.

The Embankment is assumed to be located upon the Earth which is in-motion inre the ARRF at V_2; the Train is in-motion inre the Embankment at V_3 and inre the ARRF at $V_2 + V_3$.

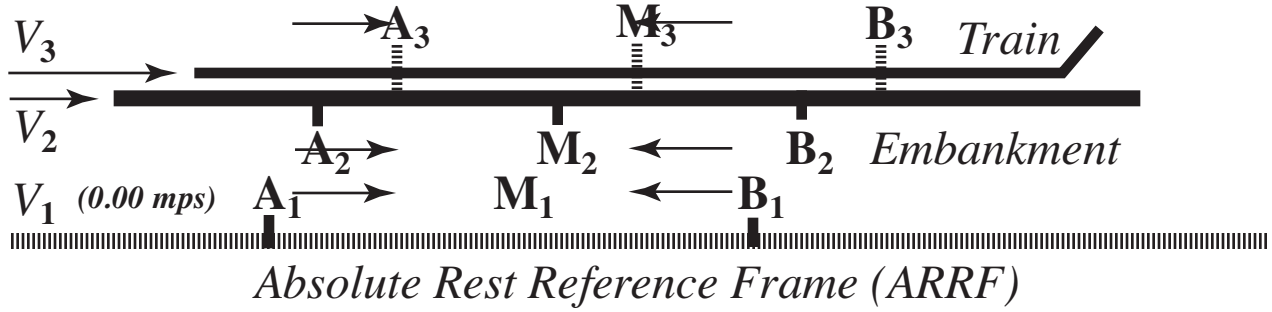
The Embankment velocity is a relative velocity (RV) inre the ARRF and can be designated ***v***; the Train velocity inre the ARRF is also an RV and can be designated ***v'***.



Einstein Railroad 1X

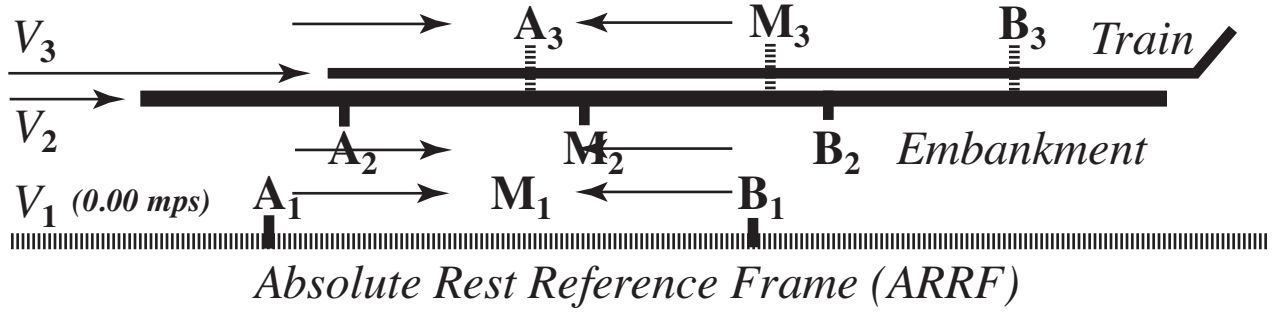
As the Embankment and the Train move forwards (left-to-right), ...

(1) Observer M_3, on the Train, would report observing LRB_3 before observing LRA_3 and eventually report that Events A_3 & B_3 did not occur simultaneously,



Einstein Railroad 1XX

(2) Observer M_2 on the Embankment would report observing LRB_2 before observing LRA_2 and eventually report that Events A_2 & B_2 did not occur simultaneously,

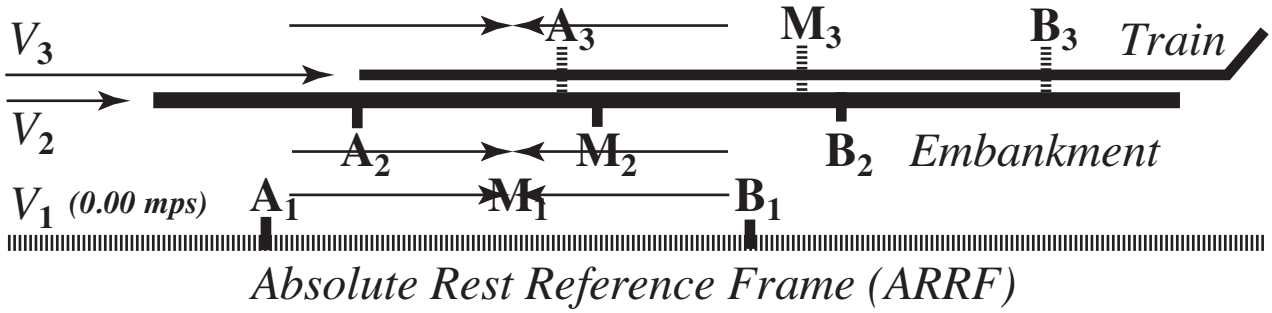


Einstein Railroad 1XXX

... and ...

(3) Observer M_1 on the ARRF would report observing LRA_1 and LRB_1 simultaneously and therefore Events A_1

& B_1 occurred simultaneously.

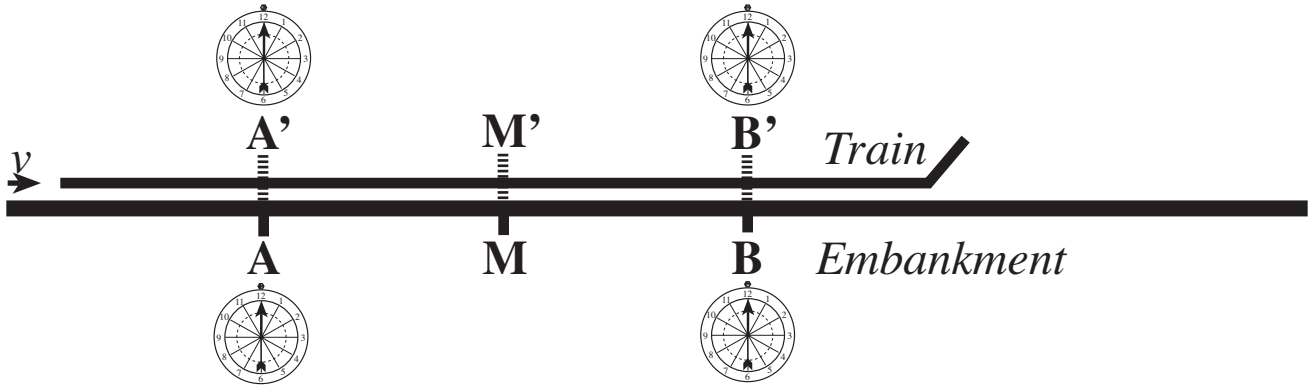


Einstein Railroad 1XXXX

The result herein is the requirement for the Embankment to be at-rest at AR at AV = 0.00 mps in the ARRF in the Einstein Railroad Diagrams for Einstein's concept and relevant principles of simultaneity to be accurately illustrated and the requirement that the velocities of the lightrays must be AV = 186,000 mps *in vacuo* and the requirement that the velocities of the lightrays must be relative velocities (RVs) inre the ARRF & M_1, the Embankment & M_2 and the Train & M_3.

The Solution to the Einstein Simultaneity Problem

Inre the Einstein Railroad, if ITICs, absolute time clocks (ATCs), non-distortable clocks, adjustable clocks, were placed in locations close to the Lightning Strikes, then, because the definition of *simultaneity* is the occurrence of two or more events at the same timepoint, because the Lightning Strikes A & B would occur at the same timepoint, then, regardless of the observations of M or M', or any other observers, the Lightning Strikes would be determined to be simultaneous.



If the adjustable clocks were co-located and paired with cameras capable of time-stamping photographs, then the time-stamped photos inre the occurrences of Lightning Strikes A & B would serve as physical evidence that would serve as conclusive proof of when the Lightning Strikes occurred and if/not the Lightning Strikes occurred simultaneously. Regardless of who studied the time-stamped photographs, or where the time-stamped photographs were studied, meaning regardless of the reference frame within which, or the reference body upon which, the time-stamped photographs were studied, observers who studied these photographs would have to agree that they serve as physical evidence and therefore as conclusive proof of when the Lightning Strikes occurred and if/not the Lightning Strikes occurred simultaneously.

By the definition of simultaneity as two or more events occurring at the same timepoint and the specification that adjustable clocks/timepieces using identical time-intervals are to be used for temporal measurement and by being adjustable and adjusted are independent of the state of motion of their bodies of reference, when identical adjustable clocks using iddentical time-intervals are co-located and paired with time-stamping cameras are used to record the occurrences of events, then the resulting time-stamped photographs (or videos) will reveal the timepoints at which the events occurred and those events occurring at the same identical timepoints will be determined to have occurred simultaneously.

NOTE: Adjustable/non-distortable clocks actually exist as (1) radio clocks – slave clocks whose timerates and timecounts are controlled by master clocks linked to the standard clocks in the USNO (United States Naval Observatory), the US NIST (United States National Institute of Standards and Technology), the BIPM (French Bureau Internationale des Poids et Méasures) and (2) inertial clocks which are designed to employ accelerometers to detect inertial changes caused by changes of motion – changes of velocity, changes of speed or/and direction – and computers to regulate the clocks' timerates and timecounts. Radio clocks are found in the US GPS navigation system; inertial clocks are found in the INS (Inertial Navigation System) found in US aircraft, ships, submarines, tanks, and trucks.

NOTE: Time is defined as the use by people or machines of a chosen duration (cycle, recurring motion) that is a time-interval (TI) used for a unit of temporal measurement (1) for the measurement of the durations between the occurrences of events, the durations of single events, and the durations (ages) of people and objects, (2) for the generation in timepieces (clocks, watches, etc.) of their timerates (rates of ticking, etc.), timepoints (timemarkson a timeline/continuum of time), timelines (continuums of time), and their timecounts (accumulations of timepoints on timelines, always by addition, from the past through the present into the future), and (3) for the determination of the sequences of events, the simultaneities or non-simultaneities of events, the causalities and coincidentialities of events, and the changerates of events (the changes in the rates at which events occur) inre scalar levels, reference frames and reference bodies. Timepieces are distortable – varying with accelerations and decelerations – or adjustable/non-distortable – adjusted to compensate for accelerations and decelerations.

Is The Speed of Light The Same For All Observers?

Einstein claimed that the speed of light is *c* inre any and all reference frames and any and all observers: The speed of light is the same for all observers. [Source]

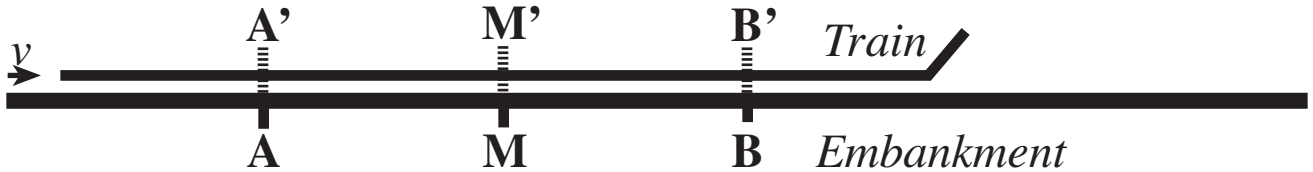
Is the speed of light the same for all observers because by the use of distortable rulers and clocks all observers measure the speed of light to be ***c*** in their reference frames while a lightray travels past an observer's CoM at $RV = AV_1 \pm AV_2$ or because a lightray travels past an observer's CoM at RV = ***c***?

In the following Einstein Railroad Diagrams, Einstein's claim that the speed of light is the same for all observers is symbolized by the relationships of Lightrays from A' and B' traveling the distances A'-M' and B'-M' in the same time or duration as Lightrays from A and B traveling the distances A-M and B-M.

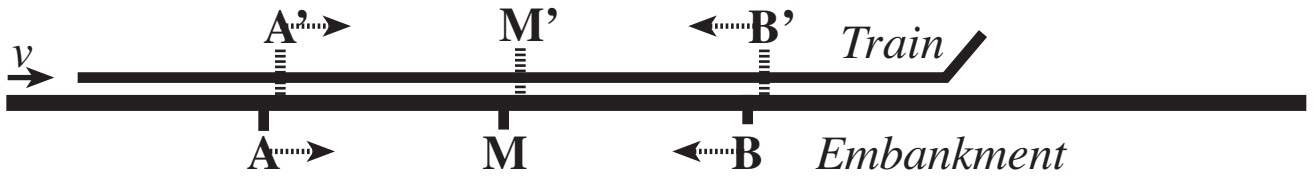
In theory, if (P) the speed of light is the same, *c*, for all observers and therefore all reference frames, because a lightray travels past an observer's CoM at RV = ***c***, then (Q) Lightrays from A' and B' should travel the distances A'-M' and B'-M' in the same time duration and strike M' at the same timepoint and prompt M' to declare that Events A & B occurred at the same timepoint and therefore Events A & B occurred simultaneously.

The Einstein Railroad 2.xc Diagrams

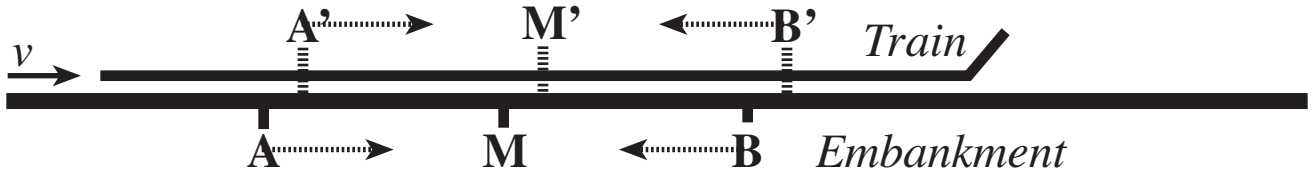
If the speed of light is the same for all observers, ***c***, then the Lightrays A'-M' and B'-M' would travel the same distance/space over the same duration/time as the Lightrays A-M and B-M with the result that M' and M both would report that the lightning strikes occurred simultaneously.



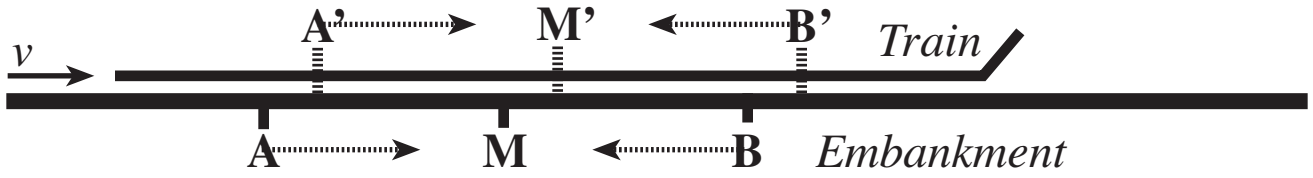
Einstein RR 2.0c at T0



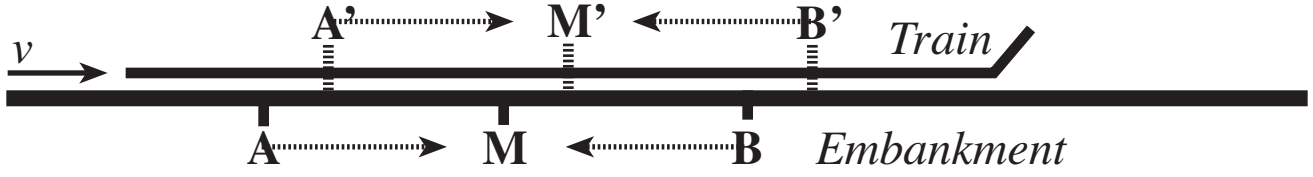
Einstein RR 2.1c at T1



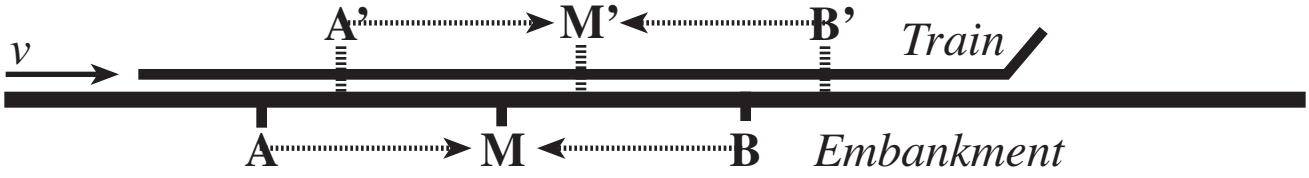
Einstein RR 2.3c at T3



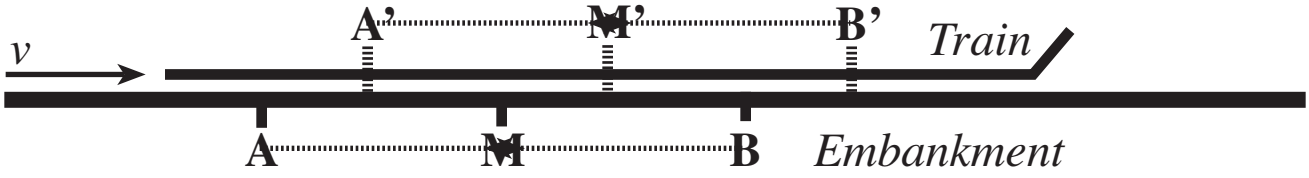
Einstein RR 2.4c at T4



Einstein RR 2.5c at T5



Einstein RR 2.6c at T6



Einstein RR 2.7c at T7

At T7, M and M' report Events A and B have occurred simultaneously.INRE the Einstein RR 2.0c-2.07c Diagrams, …

If …
… (P) Lightrays from A' and B' travel at RV = *c* inre M'/Train/K' as Einstein claimed (Einstein: The speed of light is *c* for all observers/the speed of light is *c* in all reference frames), …
… then …
… (Q) M' would observe Events A and B to have occurred simultaneously.

RESTATED …

If …
… (P) Lightrays from Lightning Strikes/Light Sources A/A' and B/B' travel at *c* inre *both* the Embankment/K and the Train/K' …
… then …
… (Q1) Lightrays from A/A' andB/B' have to strike and thereby be observed by *both* M/Embankment/K and M'/Train/K' at the same timepoint T7 …
…and, thereby, …
… (Q2) *both* M and M' would observe/report Events A and B to have occurred simultaneously.

Therefore, because (P) the Einstein Railroad Diagram FIG. 1. reveals that light travels $c \pm v$ inre entities including observers who/which are in-motion parallel to and either in the same or the opposite direction of motion, then (Q1) light does NOT travel at *c* inre all observers in all reference frames and therefore (Q2) the speed of light is not the same for all observers and reference frames.

If the motions of light sources were to affect the motions of lightwaves, lightrays or photons emitted from the light sources, then the affects of the motions of light sources on photons would be illustrated by the Einstein RR 2.xc Diagrams shown above wherein lightrays travel the space/distances A'-M' and B'-M' in the same time/duration as lightrays travel the space/distances A-B and A'-B'.

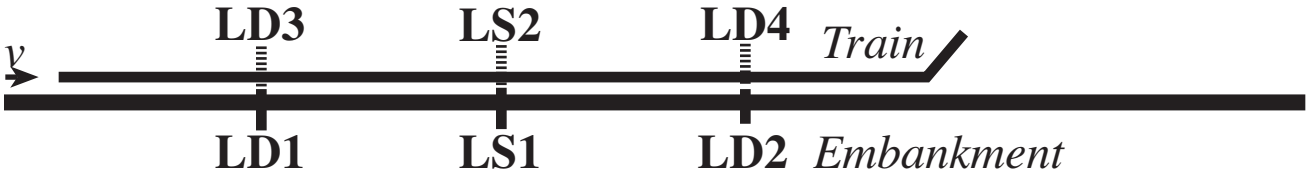
Another set of diagrams can be used to present another claim inre the motion of light that is not true.

Einstein, and others, have claimed that the speed of light is the same for all observers. Bertrand Russell and Lincoln Barnett have claimed that if an observer were to be located at the center of an emission of lightwaves, then, regardless of his motion, the lightwaves would depart from him at *c* in any direction. This means that from a light source, lightwaves would travel at *c* from the light source regardless of its motion.

This light motion can be illustrated by the Einstein RR 4.x Diagrams.

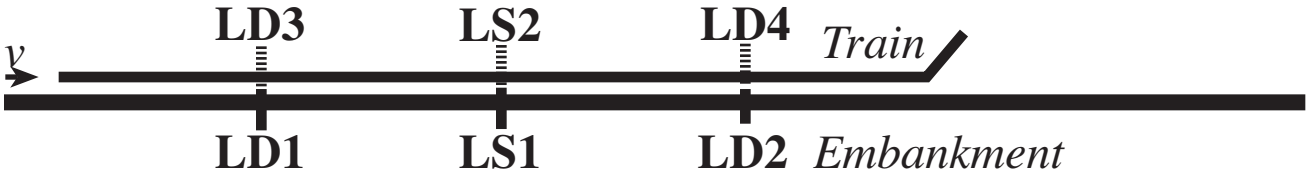
The Einstein Railroad 4.x Diagrams

The Einstein Railway Diagram can to be modified to remove the Lightning Strikes/Light Sources A & B – the Events A & B, Observers M and M', and to insert Light Detectors LD1 and LD2 on the Embankment and LD3, and LD4 on the Train, and Light Source LS1 on the Embankment and Light Source LS2 on the Train.

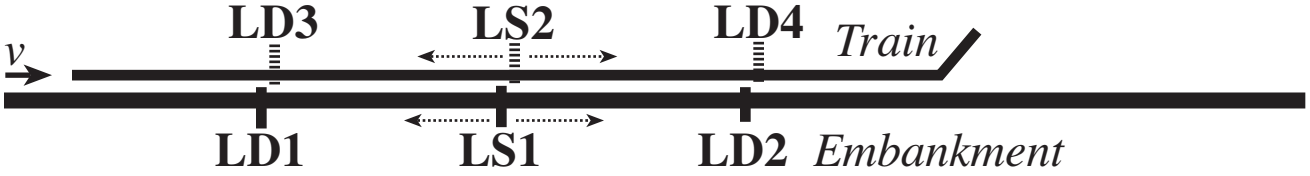


Einstein RR 4.0

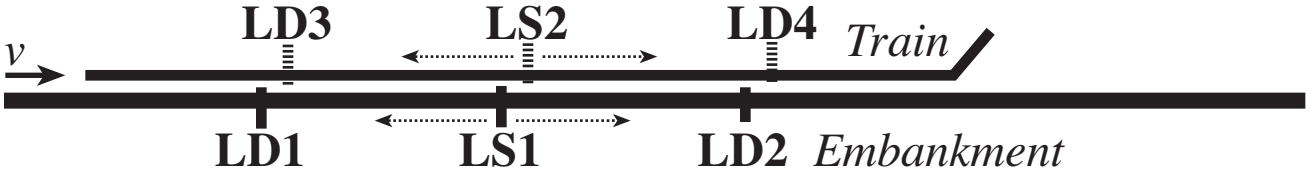
In the next series of Einstein RR Diagrams, the Light Sources LS1 and LS2 emit Lightrays (photons) that travel parallel to the Embankment and the Train.



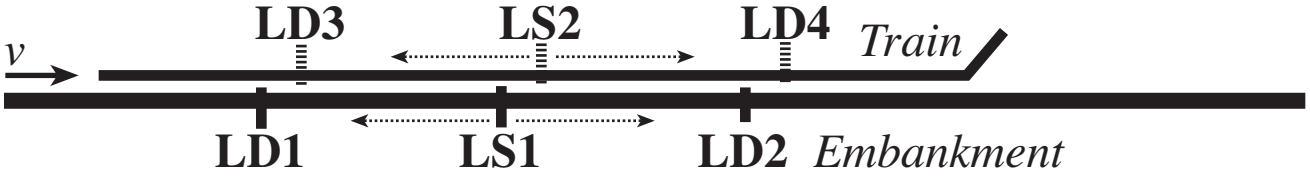
Einstein RR 4.0 at T0



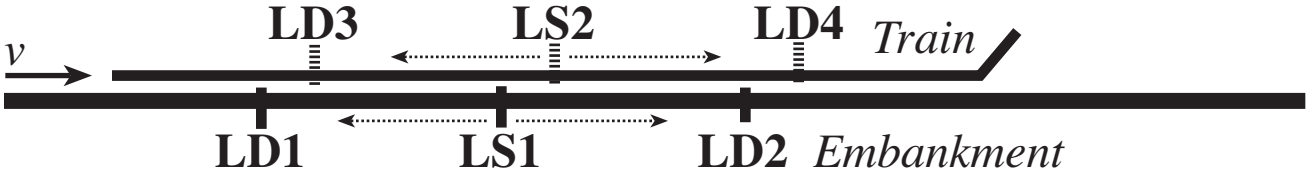
Einstein RR 4.1 at T1



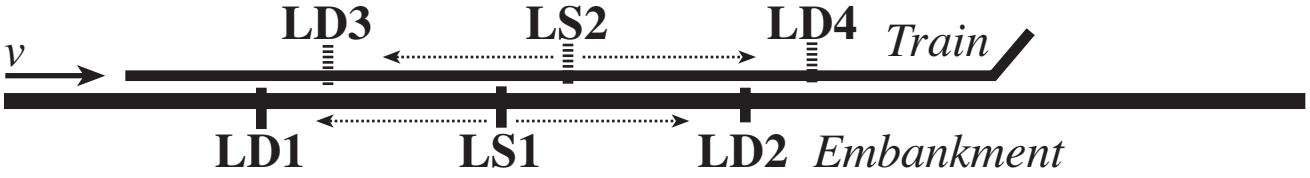
Einstein RR 4.2 at T2



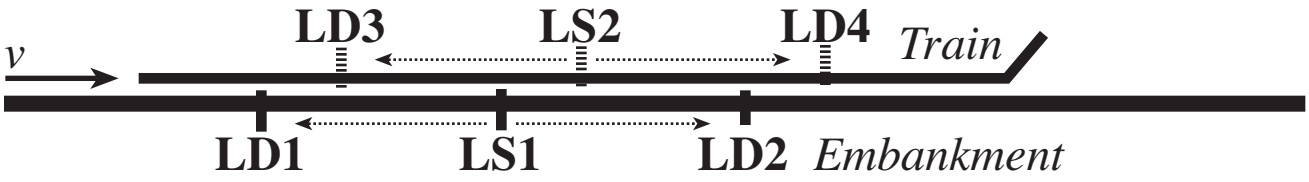
Einstein RR 4.3 at T3



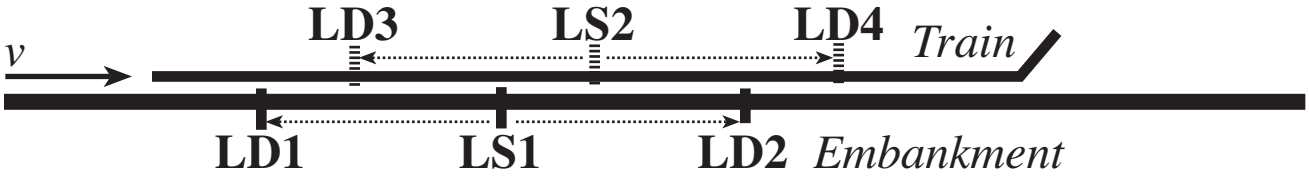
Einstein RR 4.4 at T4



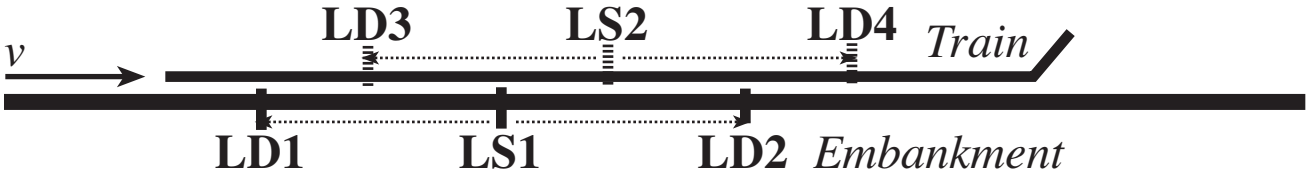
Einstein RR 4.5 at T5



Einstein RR 4.6 at T6



Einstein RR 4.7 at T7



Einstein RR 4.8 at T8

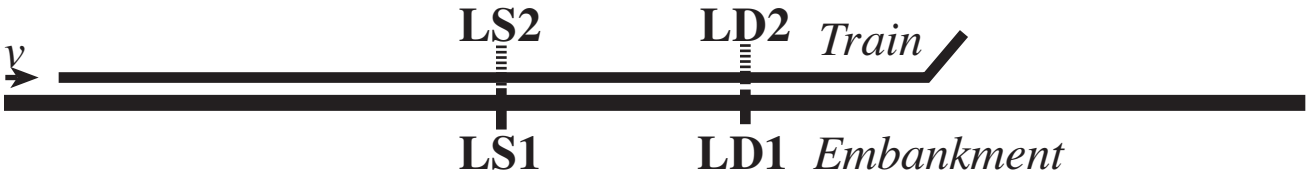
Inre the light motions in the Einstein RR 4.x Diagrams, when Lightrays travel from LS1 and LS2 at *c* over identical distances (spaces) LS1 - LD1, LS1 - LD2, LS2 - LD3, and LS2 - LD4, they cover those identical distances (spaces) in identical durations (times) and strike their relevant LDs simultaneously. If the LDs were adjustable synchronized clocks – clocks which are adjusted to maintain identical timerates, timepoints, timelines, and timecounts, then the timepoints at which the Lightrays were detected would be identical.

This result clearly indicates that the Lightray from LS2 - LD3 traveled behind and therefore slower than the Lightray from LS1 - LD1 and the Lightray from LS2 - LD4 traveled ahead of and therefore faster than the Lightray from LS1 - LD2.

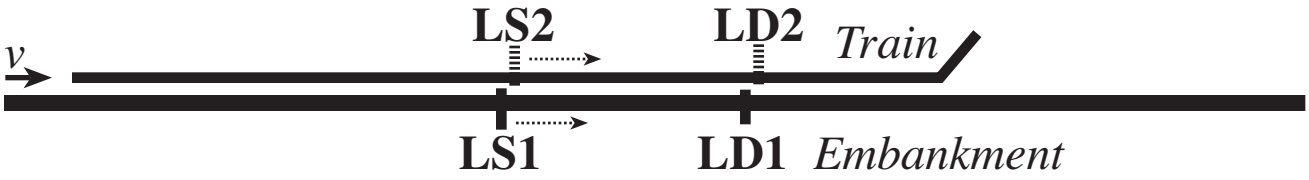
These results, however, are false, because of the fact that for the Einstein RR 1.x Diagrams to describe accurately the light motions of Lightrays from Events A & B and the non-simultaneity of Events A & B for observer M' the Lightrays would have to travel independently of the *K* and *K'* reference frames and thereby travel independently of the observer M and the Embankment and the observer M' and the Train as they would if they were traveling *in vacuo* at *c* and the motions of light sources do not affect the velocities of lightrays.

The Einstein Railroad 5.xb Diagrams

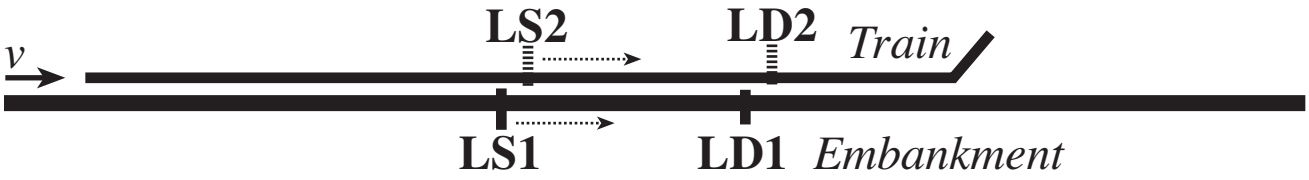
In the next series of Einstein RR 5.x Diagrams, for clarity, LD3 and LD4 have been removed and LD1 and LD2 have been relocated.



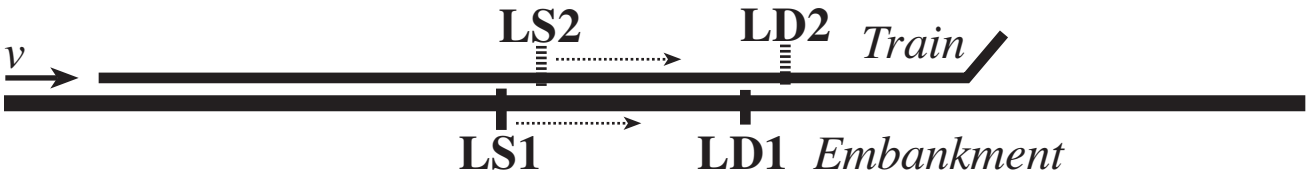
Einstein RR 5.0b at T0



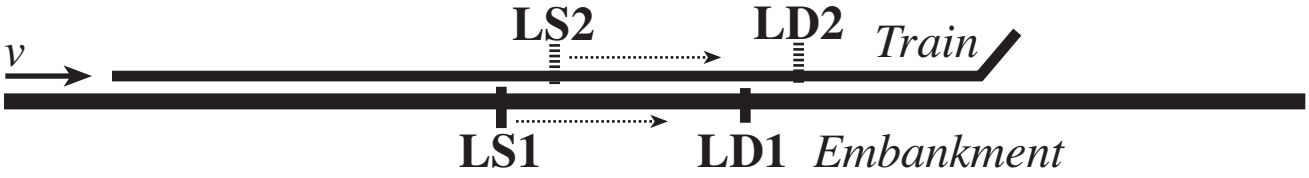
Einstein RR 5.1b at T1



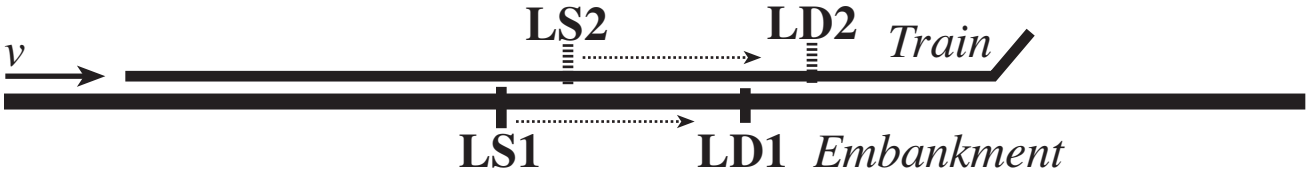
Einstein RR 5.2b at T2



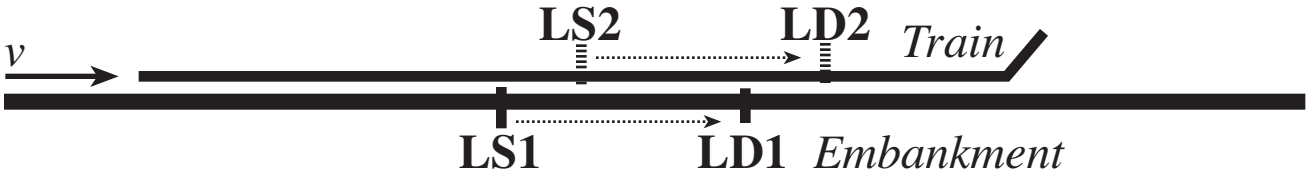
Einstein RR 5.3b at T3



Einstein RR 5.4b at T4



Einstein RR 5.5b at T5



Einstein RR 5.6b at T6

Einstein RR 5.7b at T7

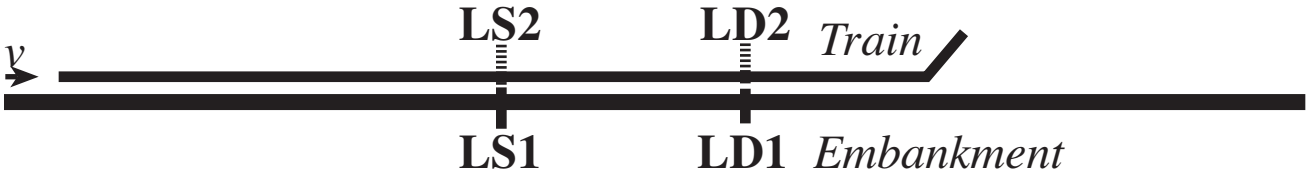
Inre the light motions in the Einstein RR 5.xb Diagrams, when Lightrays travel from LS1 and LS2 at *c* over identical distances (spaces) LS1 - LD1 and LS2 - LD2, they cover those identical distances (spaces) in identical durations (times) and strike their relevant LDs simultaneously. If the LDs were adjustable synchronized clocks – clocks which are adjusted to maintain identical time-intervals, timerates, timepoints, timelines, and timecounts, then the timepoints at which the Lightrays were detected would be identical.

This result clearly indicates that the Lightray from LS2 - LD2 traveled ahead of and therefore faster than the Lightray from LS1 - LD1.

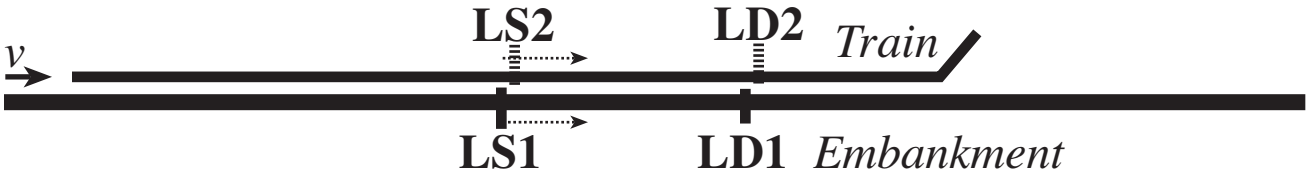
These results, however, are false, because of the fact that for the Einstein RR 1.x Diagrams to describe accurately the light motions of Lightrays from Events A & B and the non-simultaneity of Events A & B for observer M' the Lightrays would have to travel independently of the *K* and *K'* reference frames and thereby travel independently of the observer M and the Embankment and the observer M' and the Train as they would if they were traveling *in vacuo* at *c* and the motions of light sources do not affect the velocities of lightrays.

The Einstein Railroad 6.xb Diagrams

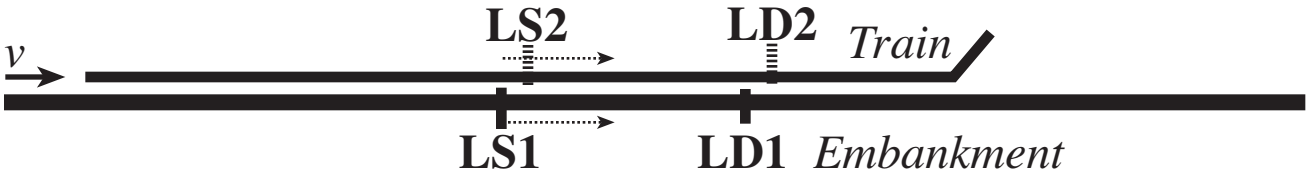
The Einstein Railroad 6.x Diagrams show the motions of Lightrays from LS1 and LS2 traveling over the same distance/space and in the same duration/time in accord with the experimental results (De Sitter) that show that the motion of a light source does not affect the motion of light emitted from that source and that the light thereby emitted travels at ***c*** *in vacuo* (in a subvolume of space devoid of m/e) regardless of the AV of the light source.



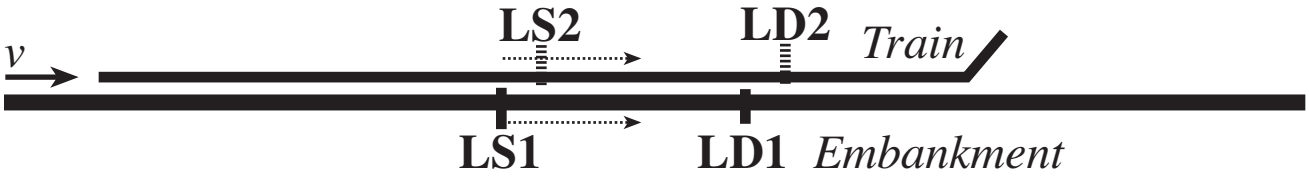
Einstein RR 6.0b at T0



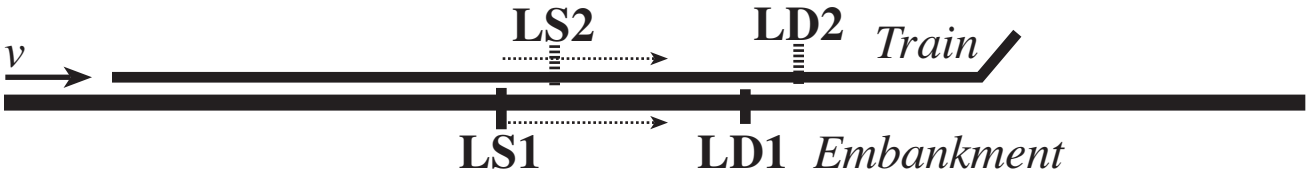
Einstein RR 6.1b at T1



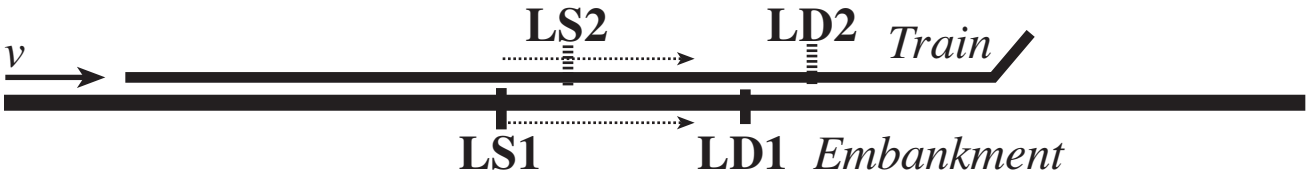
Einstein RR 6.2b at T2



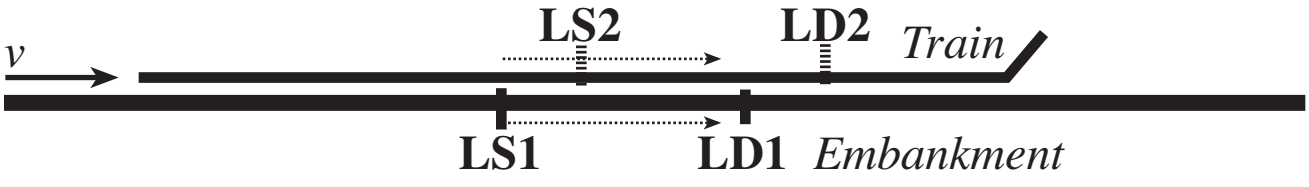
Einstein RR 6.3b at T3



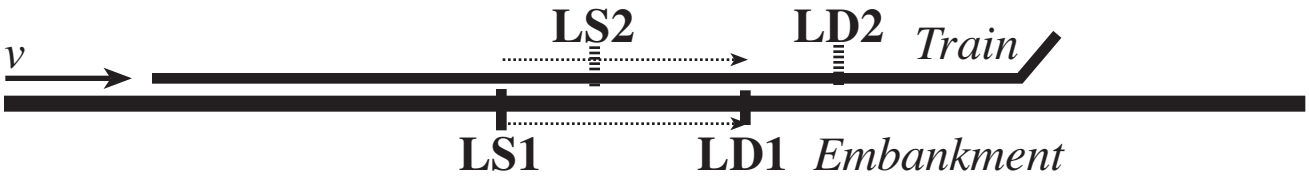
Einstein RR 6.4 bat T4



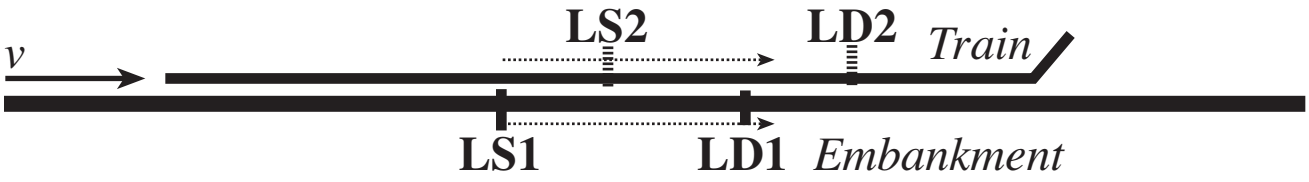
Einstein RR 6.5b at T5



Einstein RR 6.6b at T6

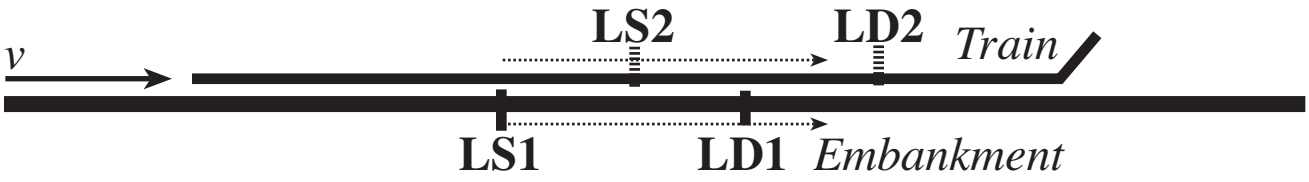


Einstein RR 6.7b at T7

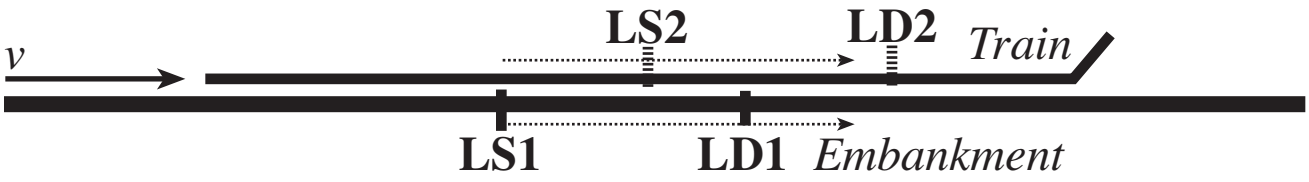


Einstein RR 6.8b at T8

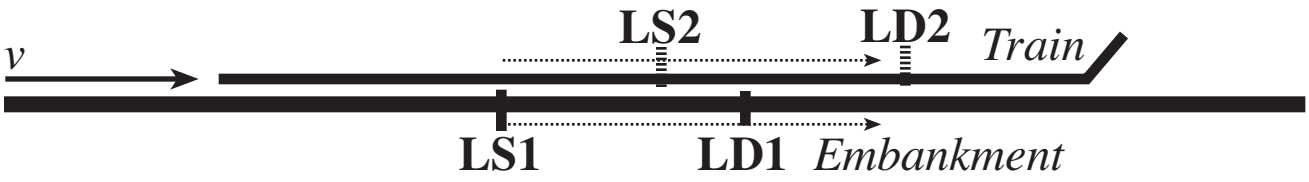
Einstein RR 6.9b at T9



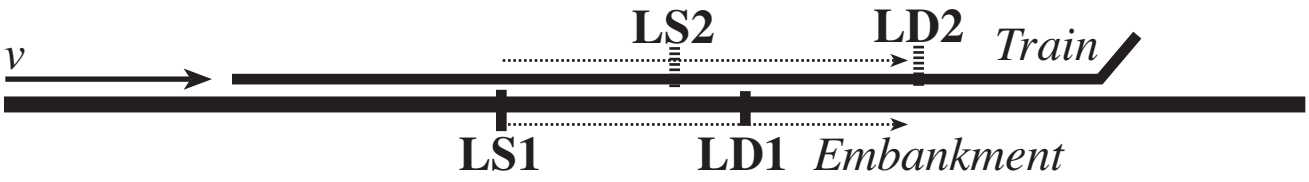
Einstein RR 6.10b at T10



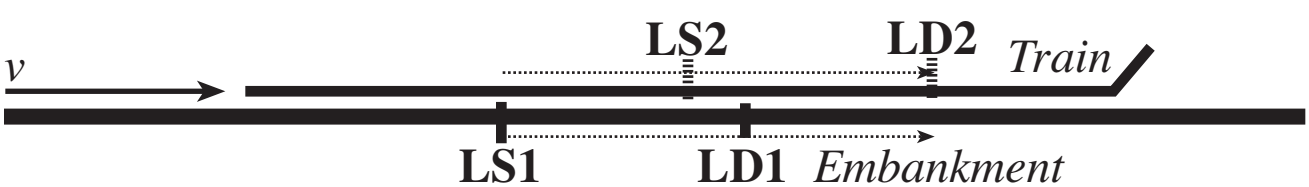
Einstein RR 6.11b at T11



Einstein RR 6.12b at T12



Einstein RR 6.13b at T13



Einstein RR 6.14b at T14

Inre the Einstein RR 6.xb Diagrams, the motions of LS1 and LS2 do not affect the velocities of the Lightray from LS1 - LD1 or the Lightray from LS2 - LD2. The Lightrays travel the same distances (spaces) in the

same durations (time), but they depart simultaneously and parallel from their Light Sources and advance together so one Lightray (LS2-LD2) does not outpace and thereby travel faster than the other (LS1-LD1).

If the Light Detectors LD1 and LD2 were adjustable synchronized clocks and thereby have identical time-intervals, timerates, timepoints, timelines, and timecounts, then the clock at LD1 would record the detection of the Lightray from LS1 at an earlier timepoint and the clock at LD2 would record the detection of the Lightray from LS2 at a later and therefore different timepoint. This result would prove that the Lightray from LS2 traveled independently of the Train's reference frame *K'*.

This result is similar to the results of the Einstein RR 1.x Diagrams and illustrates the true motions of the Lightrays as they travel independently of their Light Sources and observers and reference frames.

This result contradicts the Michelson-Morley results and Einstein's claim that the speed of light is the same for all observers – that a lightray or lightwave travels past the CoM of an observer or an object at ***c***.

This result proves that the distances inre space and durations inre time are independent of the measurements by observers and that result proves that space/distance and time/duration are absolute.

The Theory of Quantum Mechanics and the Quantization of M/E

According to the theory of quantum mechanics, all forms of m/e are quantizable – all m/e can be considered to occur/be/exist in packets called quantum (singular) or quanta (plural) which have a finite volume (f-volume) and therefore a surface/boundary and therefore a shape. A single quantum, however, is not everywhere-at-once, but, instead, is in one place/location/position or within one subvolume within space. If this were not the reality, the true fact inre quanta, then Einstein's photoelectric effect would not be a reality, and photons, which are quanta of the m/e forms which are light forms, would not be realities. Because it has a finite volume/surface/shape, it is possible for a quantum to contact and thereby be contiguous with another quantum inre a percentage of its surface (% contiguity) if not its entire surface (100% contiguity). If a quantum is not 100% contiguous with another quantum, or with several other quanta, then, because the volume/surface/boundary of the quantum is finite (the volume of a quantum is an f-volume) and therefore is physically separated from other quanta and therefore from other forms of m/e, the result is a volume, a volume of finite size, and therefore has finite shape, an f-volume, that forms between non-contiguous quanta, that volume is devoid of m/e, and, because that volume is devoid of m/e, that volume is a pure vacuum, and, therefore, that pure vacuum f-volume is raw space, a subvolume of the entirety of the infinite void which is space. If anyone objects to the claim that between non-contiguous quanta exists volumes which are pure vacuums, then he/she/it must prove that m/e is not quantizable, that m/e does not exist in quanta, in finite volumes, or that, somehow, m/e exists everywhere in the form of quanta which are 100% contiguous with other quanta and therefore there cannot be and therefore is not any space between quanta, and, therefore, space as a pure vacuum cannot and does not exist.

Light Travels at c Inre Entities at AV = 0 MPS

If (P) light travels at *c* inre another entity comprised of m/e, then (Q) that entity must have an AV = 0 mps. If (P) light emitted from a light source at a spacepoint travels at *c* inre that spacepoint, then (Q) that spacepoint must have and therefore does have an AV = 0 mps, and must be and therefore is at absolute rest (AR) in the one-and-only absolute rest reference frame (ARRF). Similarly, for a lightray/lightwave/photon to travel past the center-of-mass (CoM) of an entity at *c*, then that entity must have and does have an AV = 0 mps.

The Cosmic Speedometer

The Cosmic Speedometer … Range: AV = 0 mps - AV = *c* or 186,000 mps. If (P) the maximum speed (speed minus direction of motion) of an entity comprised of m/e (there are no other entities not comprised of m/e) is AV = *c* or 186,000 mps, the speed of light, the (Q) there ought to be/must be and therefore is a minimum speed of AV = 0 mps, which is the AV of a spacepoint from which light is emitted from a light source.

The Cosmic Speedometer	
AV = 0 mps	AV = 186,000 mps
AR/ARRF	AM/AMRF

The Absolute Rest Reference Frame (ARRF)

The sum total of all spacepoints at which light was emitted from light sources is a reference frame within which the spacepoints all have RVs = 0 mps inre each other. This reference frame is the ARRF.

The Relative Velocities of Entities in Reference Frames

NOTE: Within a reference frame, all entities comprised of m/e have AVs = 0 mps and therefore have RVs = 0 mps inre each other. Those entities not only are not moving inre each other but they are not moving inre the universe – the space/spatial component of the universe.

The Physics of Finite and Infinite

Within physics, …

Finite = Having spatial, temporal or/and physical limitations (limitations inre mass).
Infinite = Having no spatial, temporal or/and physical limitations (no limitations inre mass).

The Independence of the Motion of Light and the Motions of M and M'

The motion of light is independent of the motion of M'/the Train/*K'* and M/the Embankment/*K*. If this fact were not true/the reality, then, somehow, the motion of light would be dependent on the motion of its light source, which is a violation of one of the laws of physics (that the motion of a light source does NOT affect the motion of light emitted from the light source, i.e. velocity of a light source does not cause the velocity of light emitted from that light source to vary from *c*).

The Independence of Space & Time inre Spatial & Temporal Measurement

Regardless of who/what is measuring them, or from which reference frame/body the measurements of them are made, the space/distances and time/durations being measured are, at least in theory, unaffected by the measurement processes, i.e. the spatial and temporal measurement processes are coincidental and therefore non-causal inre the distances and durations measured; the distance and duration of the motion of a photon from the Sun to the Earth is not affected/caused to change by the measurement processes and thereby and therefore remain unchanged throughout and after the measurement processes. The spatial measurement process is not causal inre changing the distances measured and the temporal measurement process is not causal inre changing the durations measured.

A Force Can Only Act Upon an Entity Comprised of M/E

A force can only act upon an entity comprised of m/e, an entity which has a structure comprised of m/e, a person, an object, or an event; a force cannot act upon a vacuum because the vacuum, being devoid of m/e, has no structure, i.e. no 'thing' or 'stuff' which can be changed by a force, therefore a force cannot act upon space, because space is an i-volume (an infinite volume), an infinite void, an infinite vacuum; a force cannot act upon the principle of time because the temporal principle has no structure.

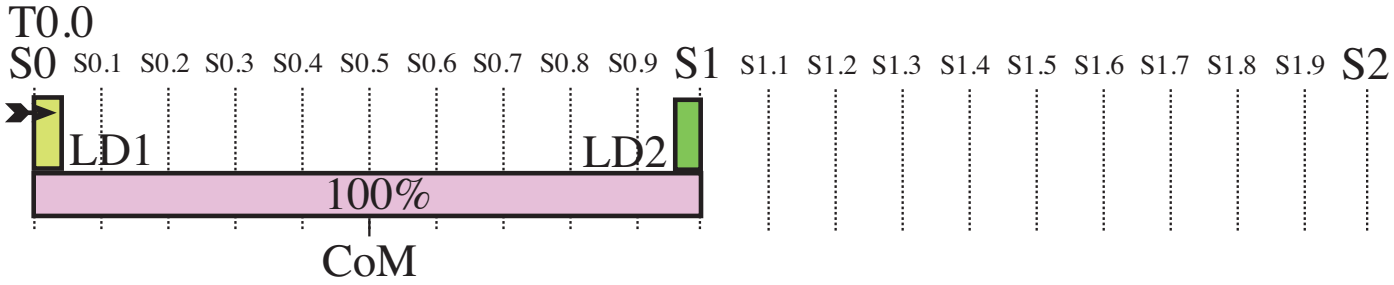
Inre the process of time – the temporal process, a force can act upon a distortable clock, as has been proven by numerous experiments, including the Hafele-Keating experiment (*see* The Hafele-Keating Experiment on page 133).

The fact that a force cannot act upon the temporal principle but can act upon the temporal process by causing distortions of the timerates and timecounts of distortable clocks is the reason why when a clock, which is a physical manifestation of the temporal principle resulting from the temporal process, is destroyed the temporal principle is not destroyed and therefore time, the essence of time, is not destroyed, and therefore and thereby the temporal process can be re-implemented by designing, fabricating and deploying a new clock to again measure time.

Light Detectors (LDs) and the Measurement of the Speed of Light

To determine the time/duration of the motion of light over a distance there must be at least two light detectors, LD1 at one end of the distance and LD2 at the other end of the distance.

In the following Light Motion Diagrams, …



(1) the horizontal lavender-colored rectangle represents the Entity;
(2) the percentage number written inside the Entity rectangle (Ex: 100%) represents the percentage of the Entity's original length;
(3) the left-side yellow vertical rectangle represents a Light Detector #1 or LD1;
(4) the right-side green vertical rectangle represents a Light Detector #2 or LD2;
(5) the Entity's center-of-mass is represented by the acronym CoM;
(6) there is a grid representing space/distance units S0 to S1 and S1 to S2, with S0-S1 = S1-S2, with space/distance sub-units (Ex: S0.1, S0.2, S0.3, etc.), time/duration units T0.0 to T1.0 and T1.0 to T2.0, with T0.0-T1.0 = T1.0-T2.0, and time/duration subunits (Ex: T0.1, T0.2, T0.3, etc.);
… and …
(7) a light packet/quantum/photon which could be designated a lightray, lightwave, or photon is designated herein to be a Lightray (LR) which is represented by an arrow whose arrowhead represents the LR's forward edge/position-in-space (spacepoint) and whose feathers represent the LR's rearward edge/the spacepoint at which the LR was emitted from its Light Source (LS).

The Linear Change of an Entity's Length with Acceleration

When (P) an Entity is at-rest as 0.0c, then (Q) its length is at its maximum. The Entity's length can be regarded as one space-unit and designated SU, or S; additional space subunits can be designated SSU. The traversal time or transit time or travel time of a photon over the length of an Entity at-rest at 0.0c can be regarded as one time-unit and designated TU or T; additional time subunits can be designated TTU.

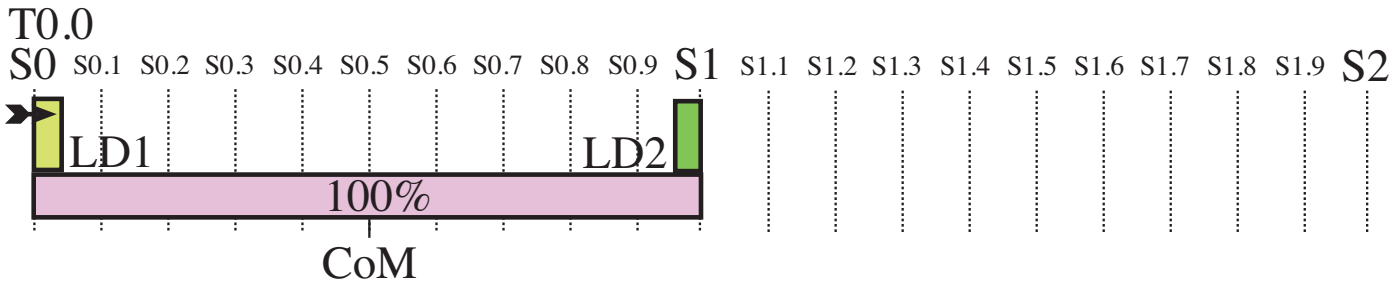
If (P) an Entity is accelerated and if the Entity's length were to change linearly with the increase in its velocity, then (Q) for every percentage change of the Entity's velocity there would be a corresponding percentage change of the Entity's length.

Examples of linear changes of an Entity's length with accelerations and the subsequent light traversal times over the Entity's shortened length will be presented in a series of Light Motion Diagrams.

In each set of two Diagrams in a Series the first Diagram will present an Entity at S0 at T0 and in the second Diagram the Entity will be presented at S1 at T1.

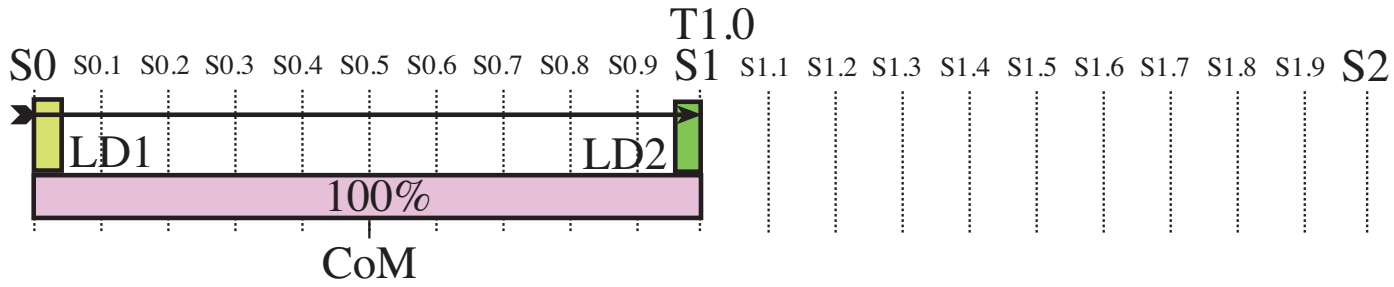
For all sets of Diagrams, at S0 at T0 the Entity will be at-rest at 0.0***c*** or in-motion at a percentage of ***c*** with a designation on the body of the entity of the shortening of the Entity's length caused by accelerations and at S1 at T1 the Entity will either be at-rest at 0.0***c*** or in-motion at a percentage of 0.0***c*** and a light photon at will have traveled from S0 to S1 during the duration from T0 to T1 and will be present at S1.

An example of a two Diagram set is presented thus ...



Light Motion: Entity At-Rest at 0.00*c* with 100% Length at S0 at Timepoint T0.0 with Photon at S0.

At T0 the Entity is at-rest at 0.00***c*** at S0 with its length unchanged at 100% and the Photon is in-motion at 1.00***c*** at S0.

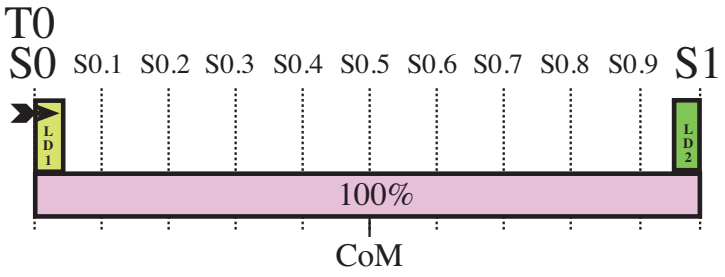


Light Motion: Entity At-Rest at 0.00*c* with 100% Length at S0 at Timepoint T1.0 with Photon at S1.

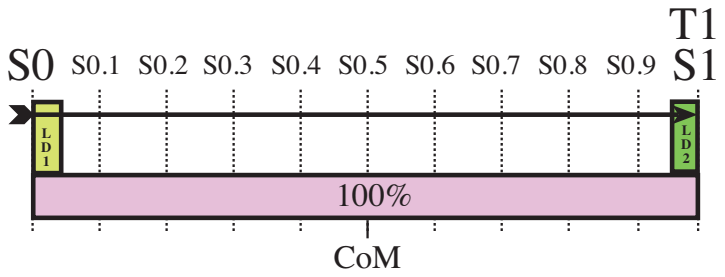
At T1 the Entity is at-rest at 0.00***c*** at S0 with its length unchanged at 100% but the Photon is in-motion at 1.00***c*** at S1.

The Measurement of Light When an Entity Is At-Rest at 0.00*c*

If (P) an Entity were to be at-rest with a velocity of 0 mps, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0).



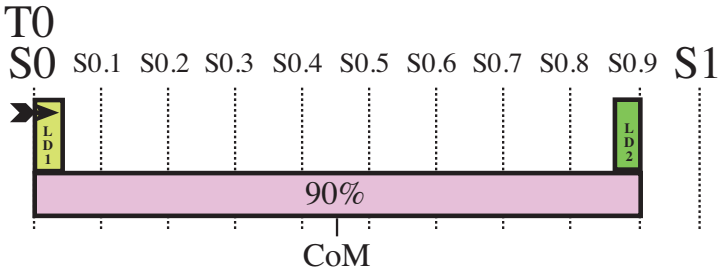
Light Motion 0.0***c*** @ S0 @ T0



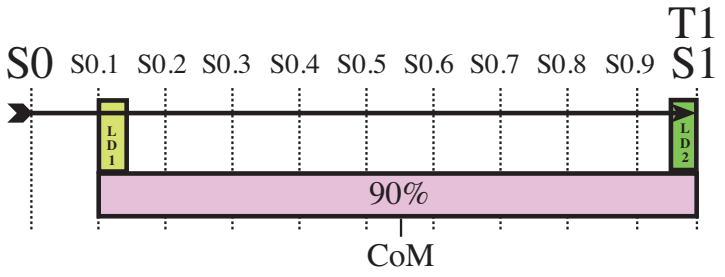
Light Motion 0.0***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.10*c*

If (P) an Entity were to be in-motion with a velocity of 0.10*c* or 18,600 mps and its length contracted to 90% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 18,600 mps = 167,400 mps.



Light Motion 0.1***c*** @ S0 @ T0

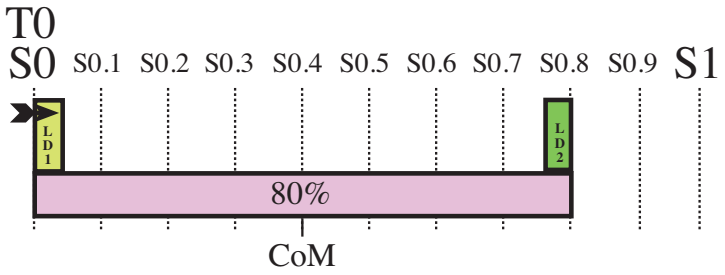


Light Motion 0.1***c*** @ S1 @ T1

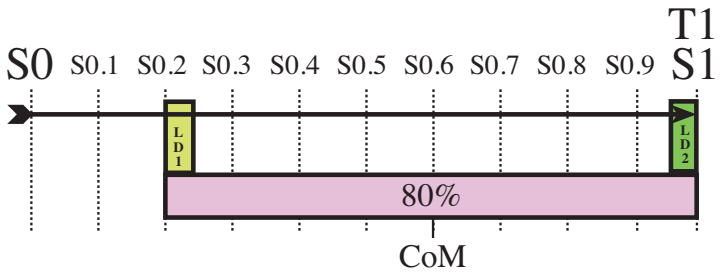
The Measurement of Light When an Entity Is In-Motion at 0.20*c*

If (P) an Entity were to be in-motion with a velocity of 0.20*c* or 37,200 mps and its length contracted to 80% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's

forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 37,200 mps = 148,800 mps.



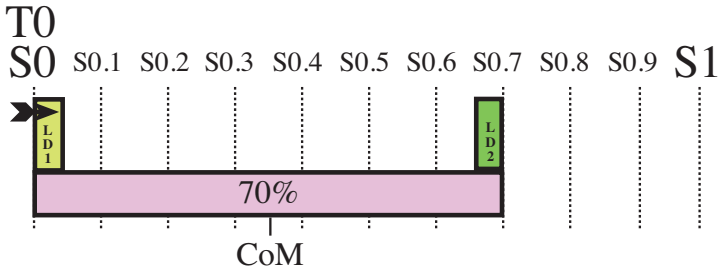
Light Motion 0.2***c*** @ S0 @ T0



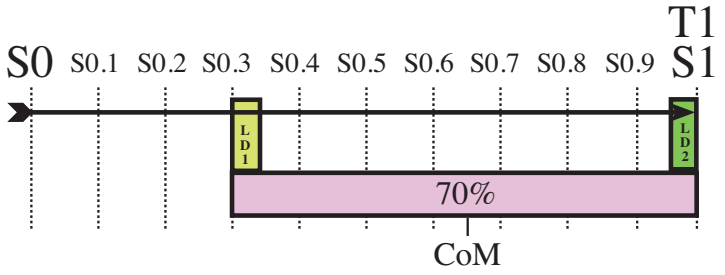
Light Motion 0.2***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.30*c*

If (P) an Entity were to be in-motion with a velocity of 0.30*c* or 55,800 mps and its length contracted to 70% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 55,800 mps = 130,200 mps.



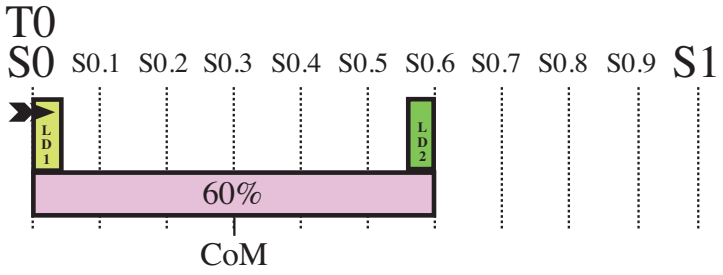
Light Motion 0.3***c*** @ S0 @ T0



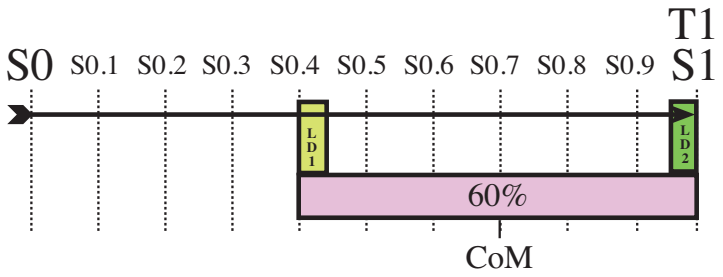
Light Motion 0.3***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.40*c*

If (P) an Entity were to be in-motion with a velocity of 0.40*c* or 74,400 mps and its length contracted to 60% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 74,400 mps = 111,600 mps.



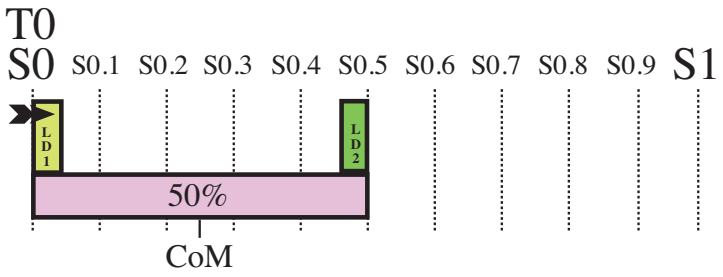
Light Motion 0.4***c*** @ S0 @ T0



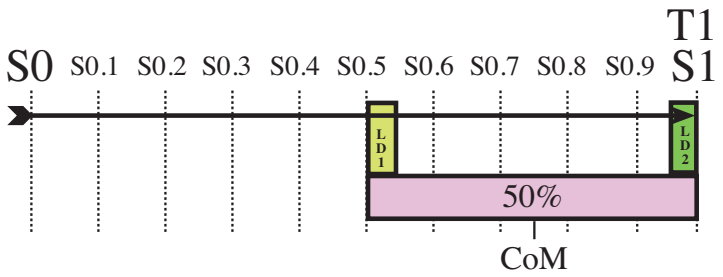
Light Motion 0.4***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.50*c*

If (P) an Entity were to be in-motion with a velocity of 0.50*c* or 93,000 mps and its length contracted to 50% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 93,000 mps = 93,000 mps.



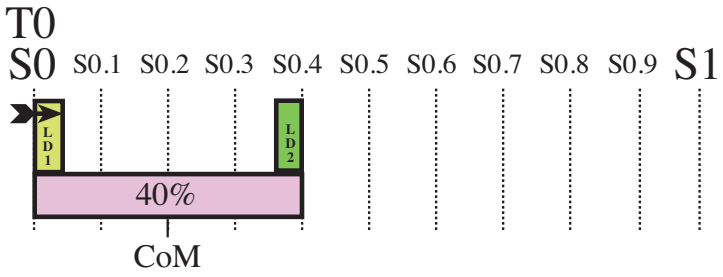
Light Motion 0.5***c*** @ S0 @ T0



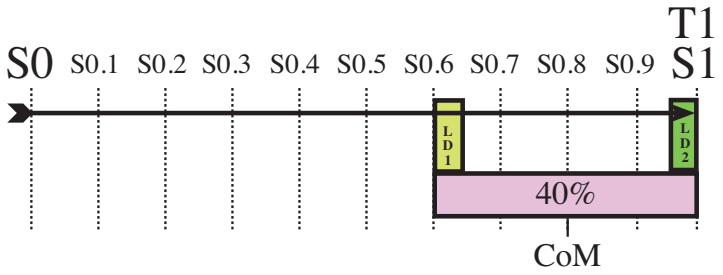
Light Motion 0.5***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.60*c*

If (P) an Entity were to be in-motion with a velocity of 0.60*c* or 111,600 mps and its length contracted to 40% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 111,600 mps = 74,400 mps.



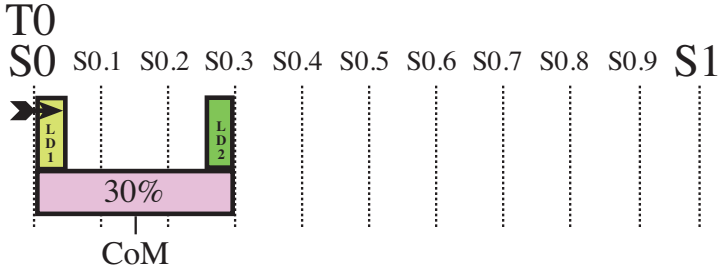
Light Motion 0.6***c*** @ S0 @ T0



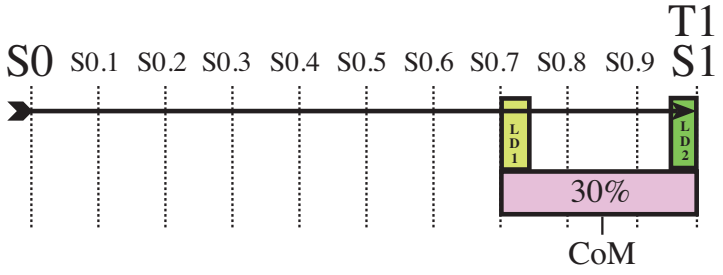
Light Motion 0.6***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.70*c*

If (P) an Entity were to be in-motion with a velocity of 0.70*c* or 130,200 mps and its length contracted to 30% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 130,200 mps = 55,800 mps.



Light Motion 0.7***c*** @ S0 @ T0

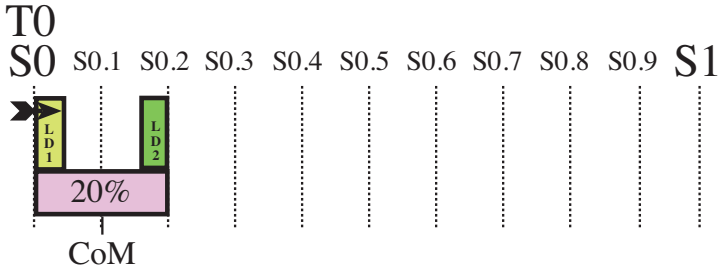


Light Motion 0.7***c*** @ S1 @ T1

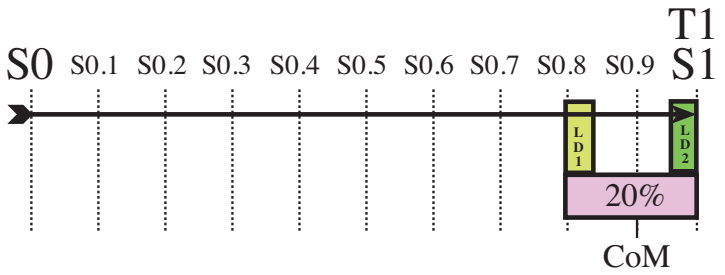
The Measurement of Light When an Entity Is In-Motion at 0.80*c*

If (P) an Entity were to be in-motion with a velocity of 0.80*c* or 148,800 mps and its length contracted to 20% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's

forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 148,800 mps = 37,200 mps.



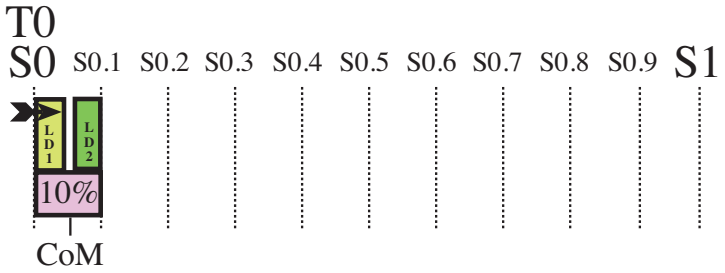
Light Motion 0.8***c*** @ S0 @ T0



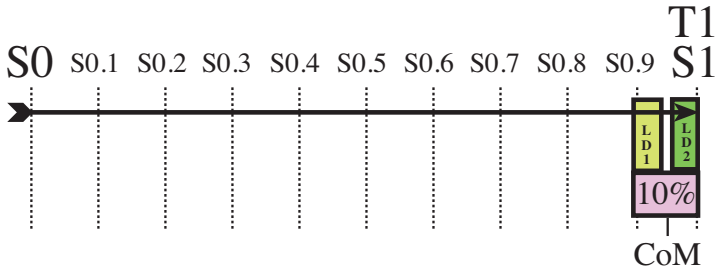
Light Motion 0.8***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 0.90*c*

If (P) an Entity were to be in-motion with a velocity of 0.90*c* or 167,400 mps and its length contracted to 10% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 167,400 mps = 18,600 mps.



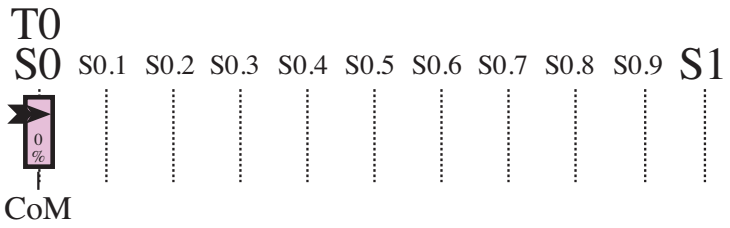
Light Motion 0.9***c*** @ S0 @ T0



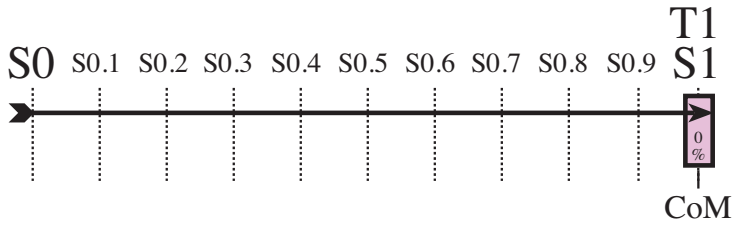
Light Motion 0.9***c*** @ S1 @ T1

The Measurement of Light When an Entity Is In-Motion at 1.00*c*

If (P) an Entity were to be in-motion with a velocity of 1.0*c* or 186,000 mps and its length contracted to 0% of its original at-rest length, then (Q) an LR (represented by an arrow whose arrowhead represents the LR's forward edge) would NOT traverse the length of the Entity from LD1 to LD2 in one time-unit (T0.0-T1.0) and the RV (relative velocity) inre the LR and the Entity would be RV = *c* - *v* = 186,000 mps - 186,000 mps = 0.00 mps.



Light Motion 1.0***c*** @ S0 @ T0



Light Motion 1.0***c*** @ S1 @ T1

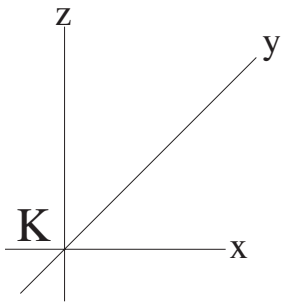
If (P) the Entity were to be in-motion with a velocity of *c* or 186,000 mps (the speed of light), during which the Entity's length would be 0% and the Light Detectors would disappear from view but, nevertheless, the Entity would have a center-of-mass and its CoM which would be a reference point, then (Q) an LR would never travel past the Entity from T0.0 - T1.0).

The Curvilinear Change of an Entity's Length with Acceleration

The Newton-Galilei transformation equations (N-G transforms) and the Fitzgerald-Lorentz (F-L) transformation equations (F-L transforms) describe howitiz that the measurements of space/distance and time/duration change when entities or reference frames or reference bodies are accelerated or decelerated.

A reference frame is a coordinate system from which observations and measurements can be made.

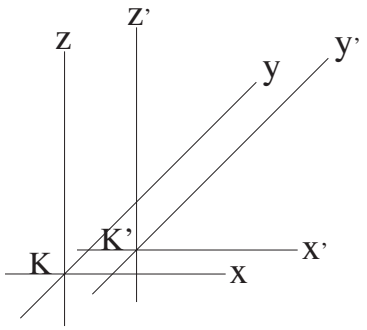
Coordinate systems are often drawn using three straight lines, x, y and z, from a common origin, K, as shown in this drawing.



A Coordinate System K

The x-line is called the x-axis, the y-line is called the y-axis, and the z-line is called the z-axis.

Two reference frames moving in uniform translation (non-rotating motion) in the same direction of motion parallel to each other but with different velocities (different AVs) resulting in a relative velocity (RV) are designated K with x, y, and z axes and K' with x', y', and z' axes.



Two Coordinate Systems K and K'

The Newton-Galilei transformation equations are these ...

$$x' = x - vt$$
$$y' = y$$
$$z' = z$$
$$t' = t$$

The Newton-Galiei transformation equations describe a linear ratio change of an entity's x-axis length with uniform accelerations and as shown in the previous illustrations an Entity comprised of a specified at-rest x-axis length and two light detectors, LD1 and LD2, located at the ends of the Entity's x-axis will detect a lightray (LR) in LD1 at T0 and in LD2 at T1 at any velocity from AV = 0.00 mps or 0.00*c* to AV = 186,000 mps or 1.00*c*.

The FitzGerald-Lorentz transformation equations are these ...

$$x' = \frac{x - vt}{\sqrt{1 - \frac{v^2}{c^2}}}$$

$$y' = y$$

$$z' = z$$

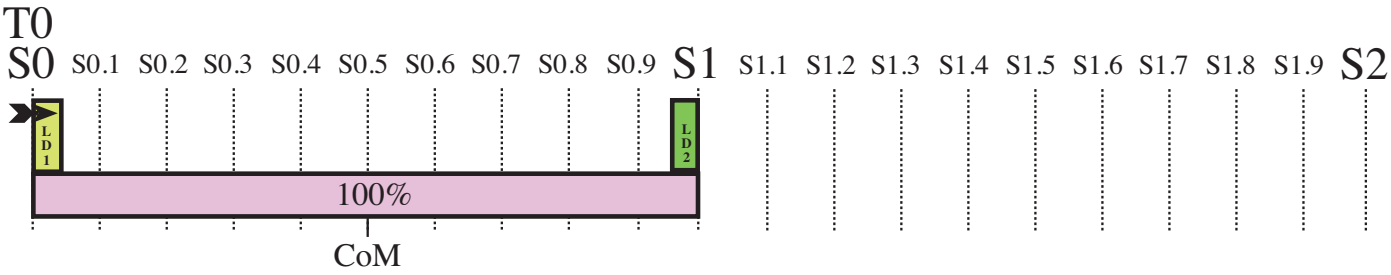
$$t' = \frac{t - \frac{v}{c^2}.x}{\sqrt{1 - \frac{v^2}{c^2}}}$$

The FitzGerald-Lorentz transformation equations describe a curvilinear ratio change of an entity's x-axis length with uniform accelerations and as shown in the following illustrations an Entity comprised of a specified at-rest x-axis length and two light detectors, LD1 and LD2, located at the ends of the Entity's x-axis will detect a lightray (LR) in LD1 at T0 and in LD2 at T1 only when the Entity is at-rest at AV = 0.00 mps or 0.00*c* but will not detect the LR in LD2 at T1 at any velocity from AV > 0.00 mps or 0.00*c* to AV = 186,000 mps or 1.00*c*.

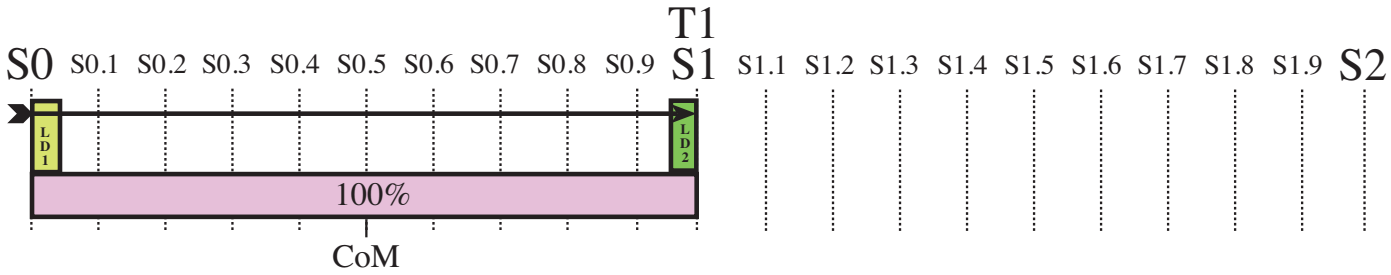
The Measurement of Light When an Entity Is At-Rest at 0.00*c*

When an Entity comprised of a specified at-rest x-axis length and a light detector 1 (LD1) located at one end of the x-axis and a light detector 2 (LD2) located at the other end of the x-axis is accelerated to velocities greater than AV = 0.00 mps (AV > 0.00 mps or AV > 0.00*c*) and its length contracts in a curvilinear ratio of velocity-to-x-axis length in accord with the FitzGerald-Lorentz transformation equations, the intuited experimental results should show no condition inre which a Photon detected by LD1 at T0 is detected by LD2 at T1.

When an Entity is at-rest/not in-motion at 0.00*c* or 0.00 mps at T0, the Entity's length is 100% and a Photon traveling at 1.0*c* traverses the Entity's length in one time-unit (TU) from T0 to T1.



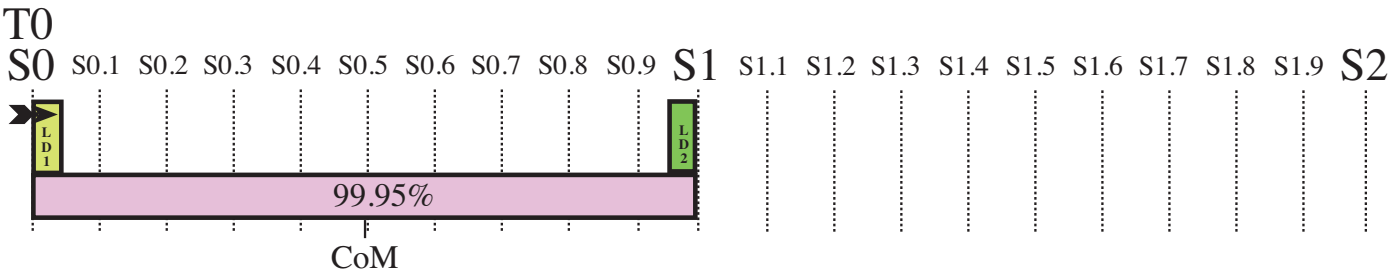
Light Motion 0.0***c*** @ S0 @ T0



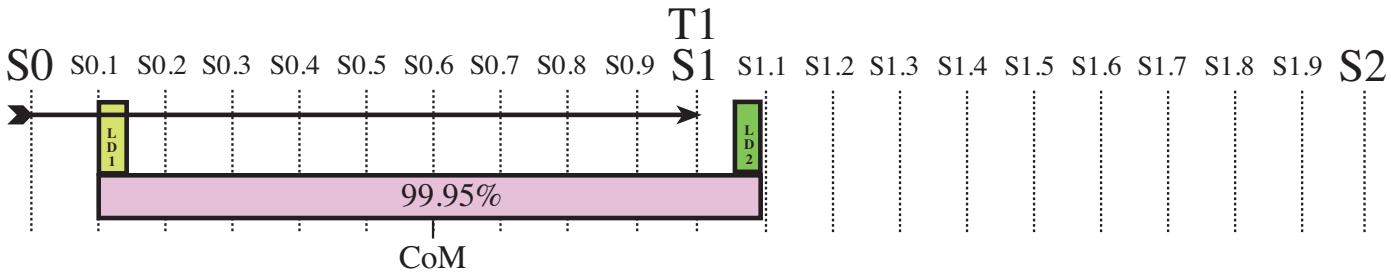
Light Motion 0.0***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is at-rest/not-in-motion at 0.00*c* or 0.00 mps at T0 and the Entity's length is 100%, the Photon is detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.10*c*



Light Motion 0.10***c*** @ S0 @ T0

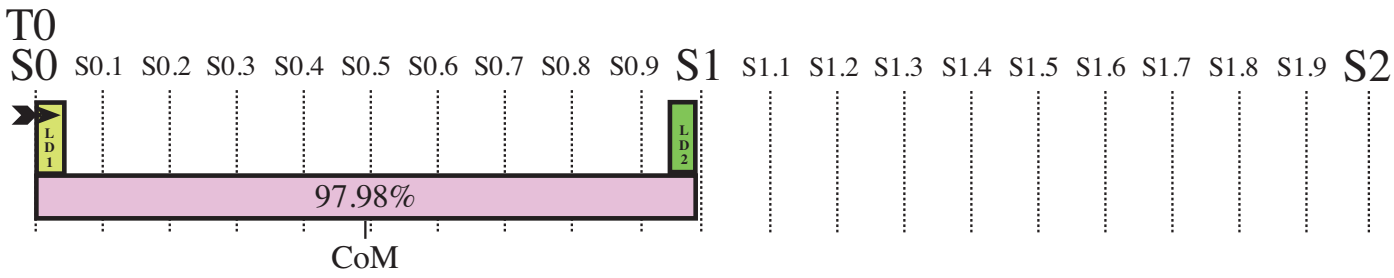


Light Motion 0.10***c*** @ S1 @ T1

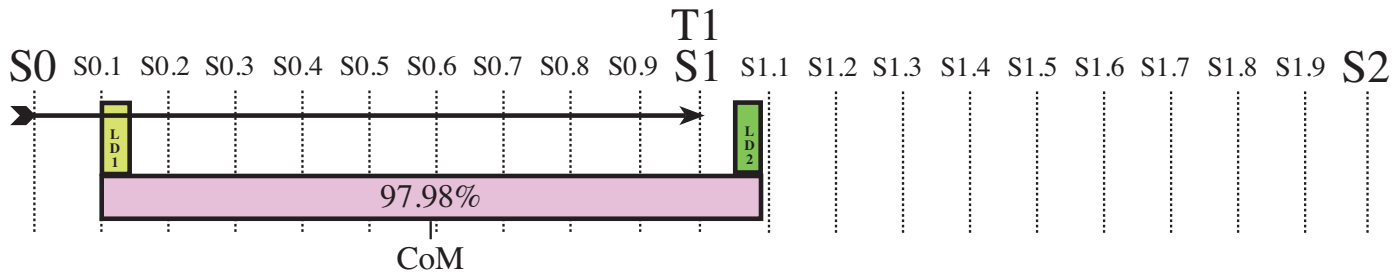
Result: Under the conditions wherein the Entity is in-motion at 0.10*c* at T0 and the Entity's length is 99.95%,

the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.20*c*



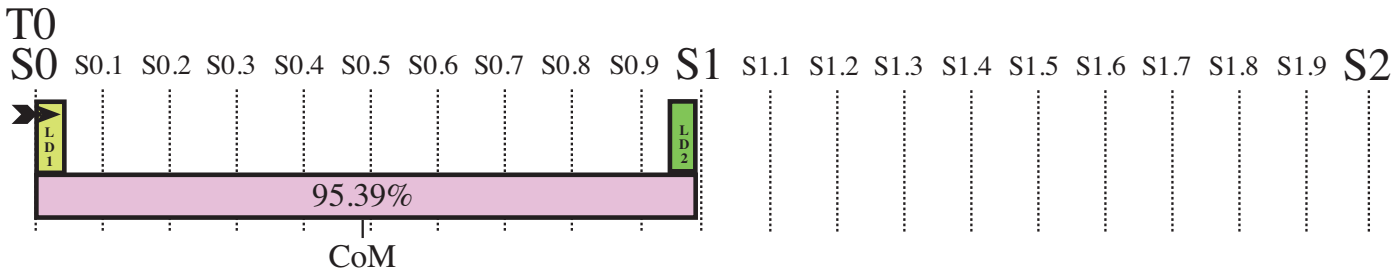
Light Motion 0.20***c*** @ S0 @ T0



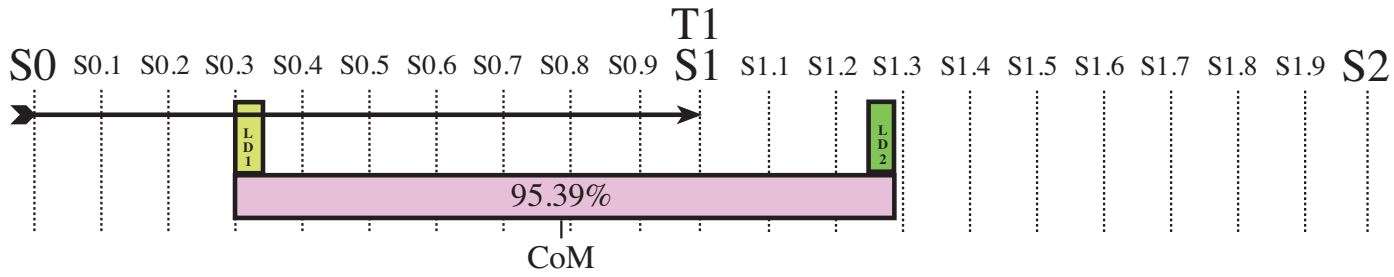
Light Motion 0.20***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.20*c* at T0 and the Entity's length is 97.98%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.30*c*



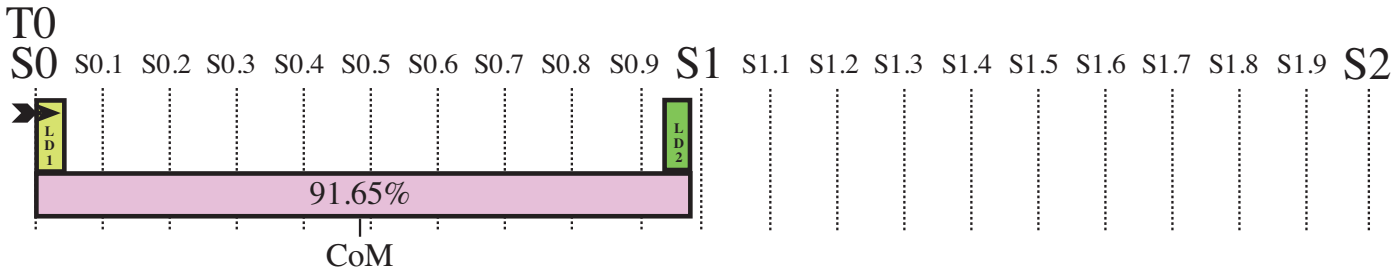
Light Motion 0.30***c*** @ S0 @ T0



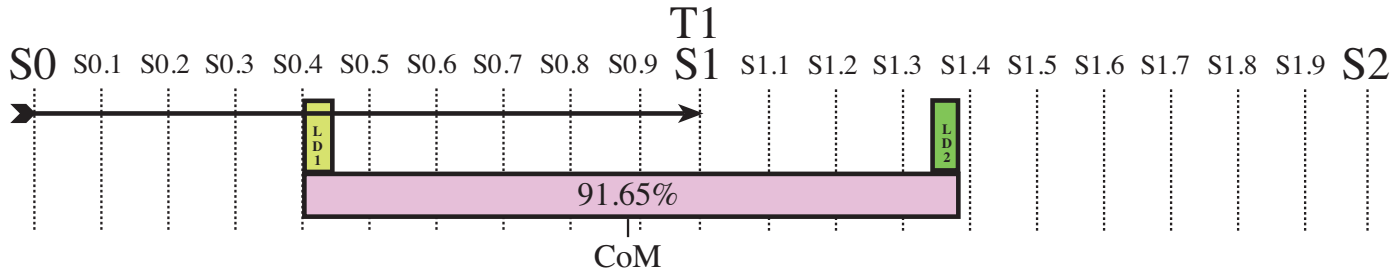
Light Motion 0.30***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.30*c* at T0 and the Entity's length is 95.39%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.40*c*



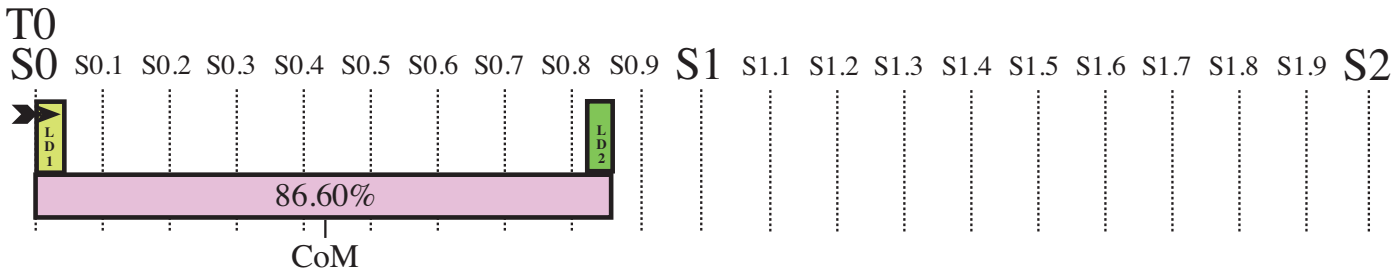
Light Motion 0.40***c*** @ S0 @ T0



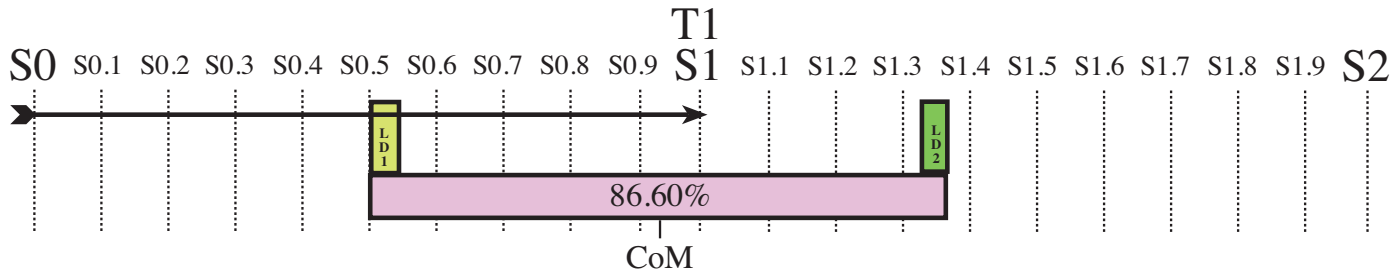
Light Motion 0.40***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.40*c* at T0 and the Entity's length is 91.65%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.50*c*



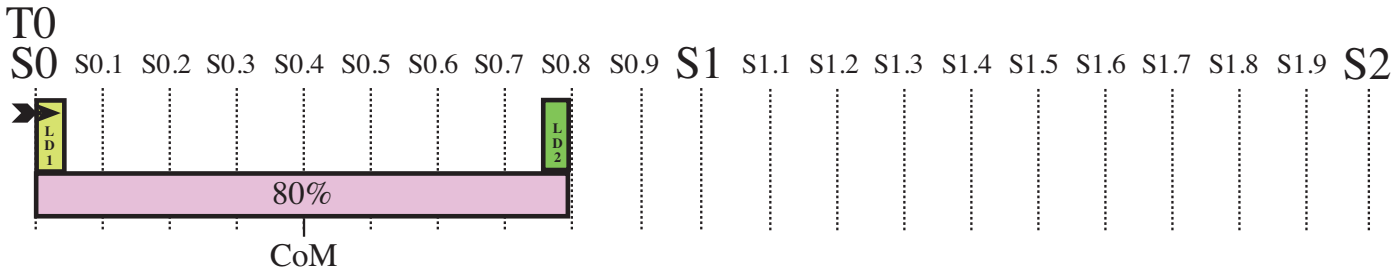
Light Motion 0.50***c*** @ S0 @ T0



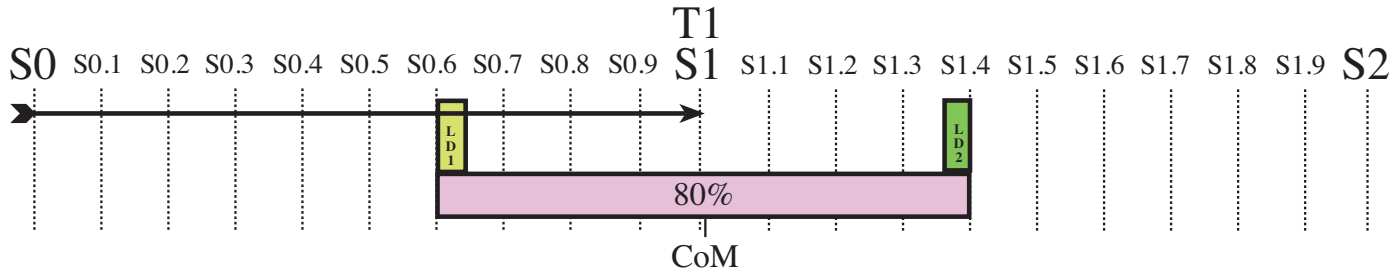
Light Motion 0.50***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.50*c* at T0 and the Entity's length is 86.60%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.60*c*



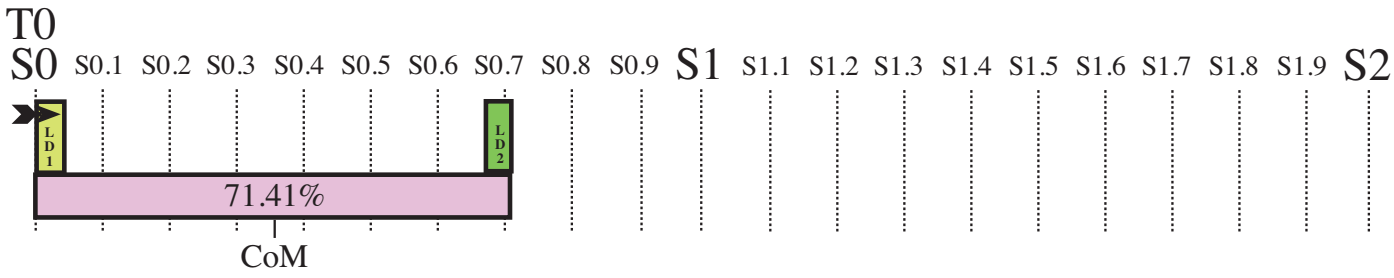
Light Motion 0.60***c*** @ S0 @ T0



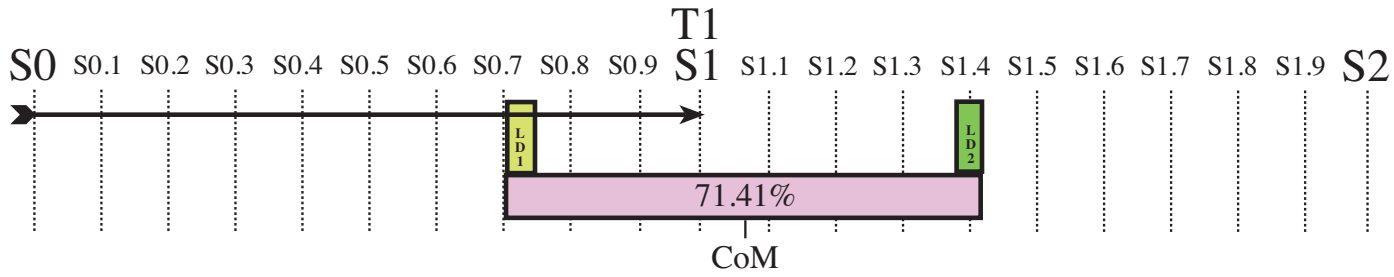
Light Motion 0.60***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.60*c* at T0 and the Entity's length is 80%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.70*c*



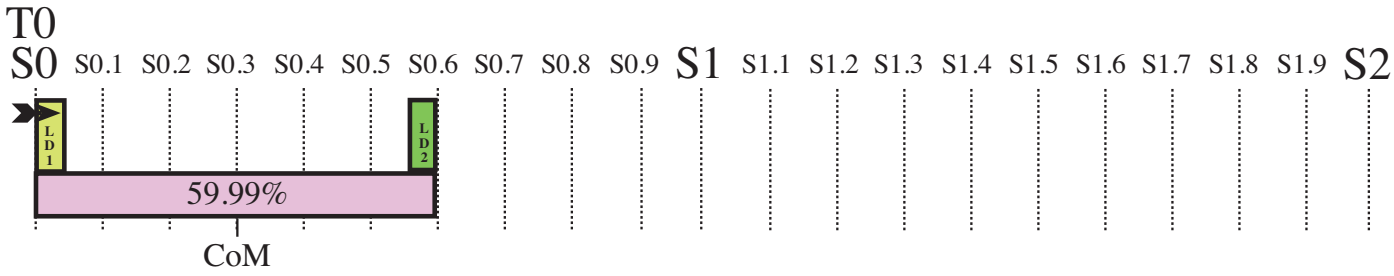
Light Motion 0.70***c*** @ S0 @ T0



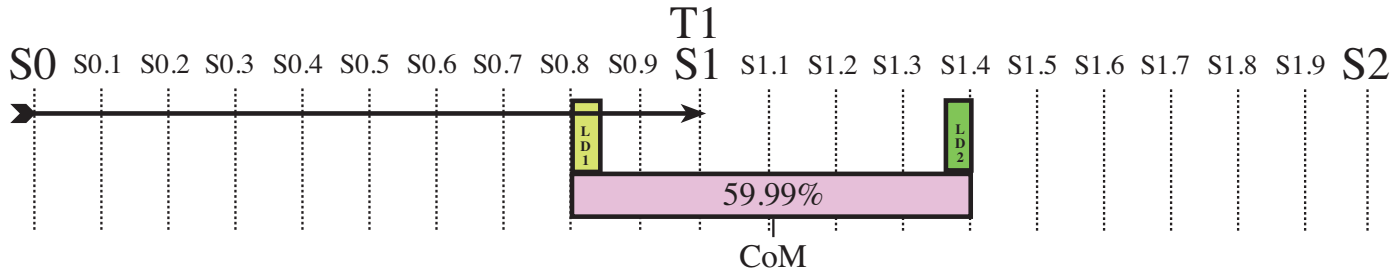
Light Motion 0.70***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.70*c* at T0 and the Entity's length is 71.41%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.80*c*



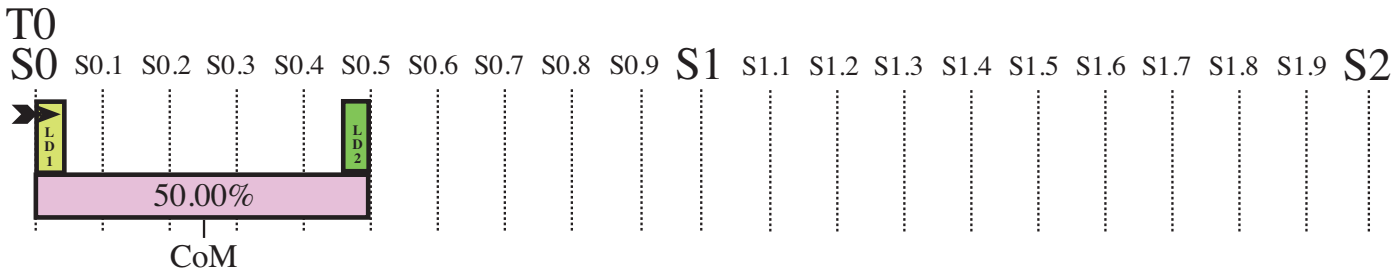
Light Motion 0.80***c*** @ S0 @ T0



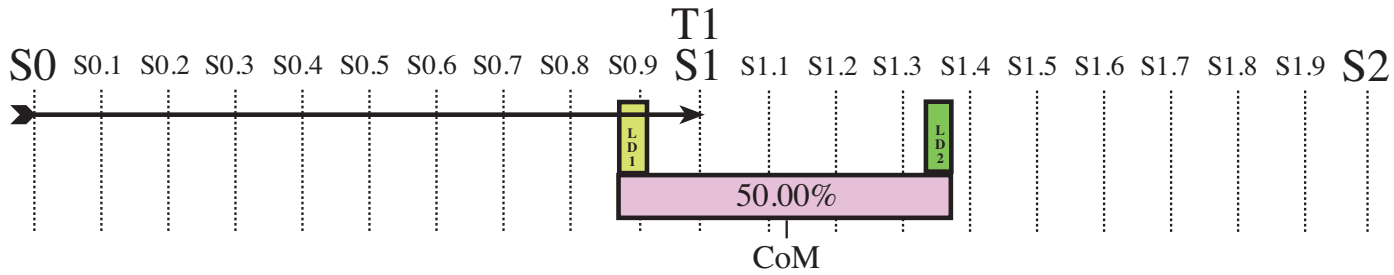
Light Motion 0.80***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.80*c* at T0 and the Entity's length is 59.99%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.86*c*



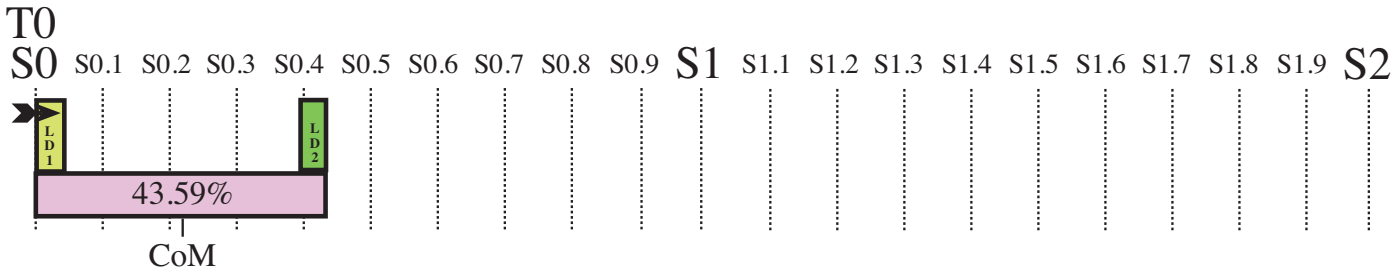
Light Motion 0.86***c*** @ S0 @ T0



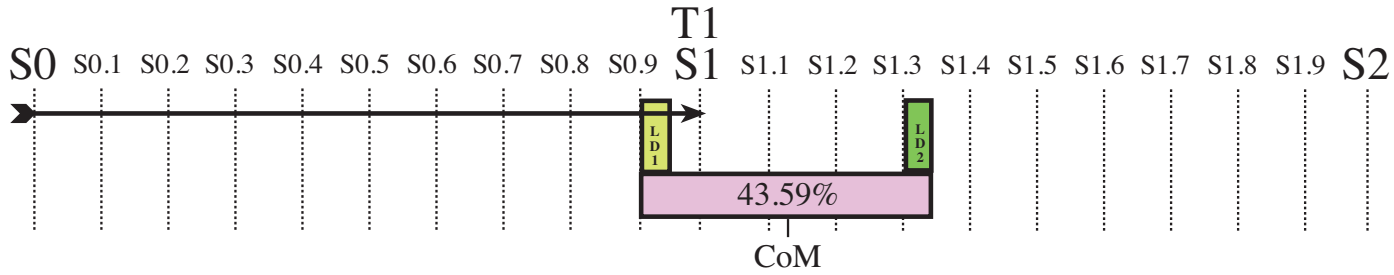
Light Motion 0.86***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.86*c* at T0 and the Entity's length is 50%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.90*c*



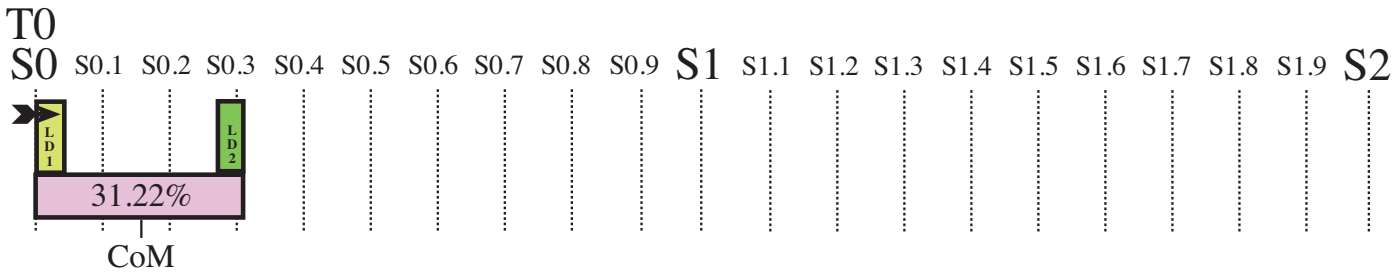
Light Motion 0.90***c*** @ S0 @ T0



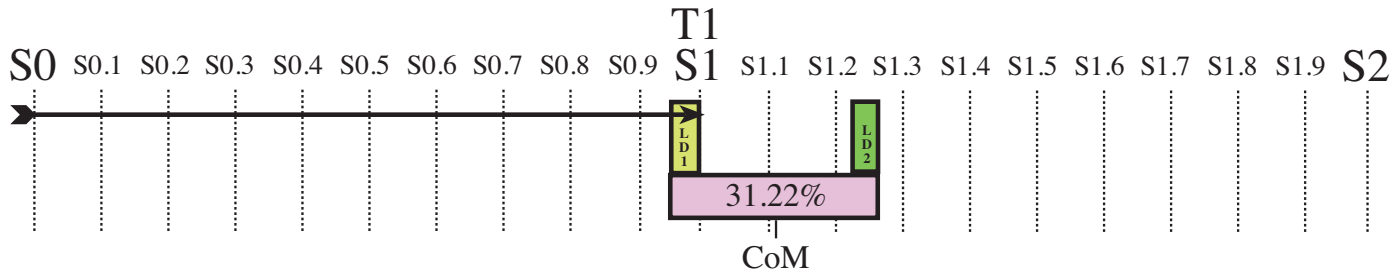
Light Motion 0.90***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.90*c* at T0 and the Entity's length is 43.59%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.95*c*



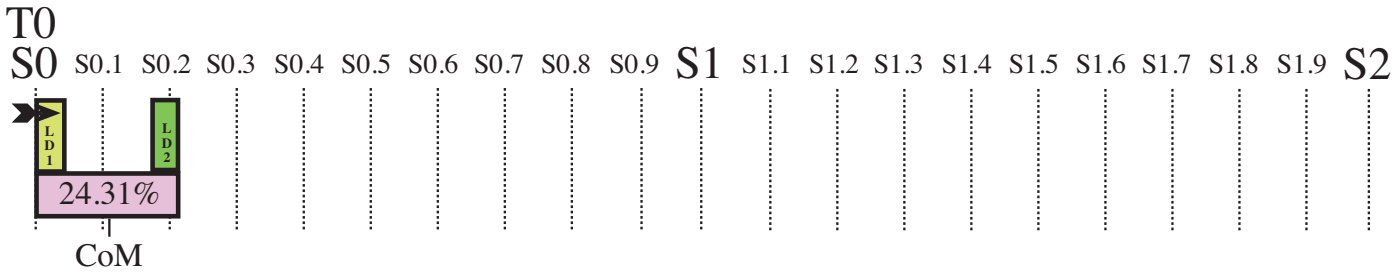
Light Motion 0.95***c*** @ S0 @ T0



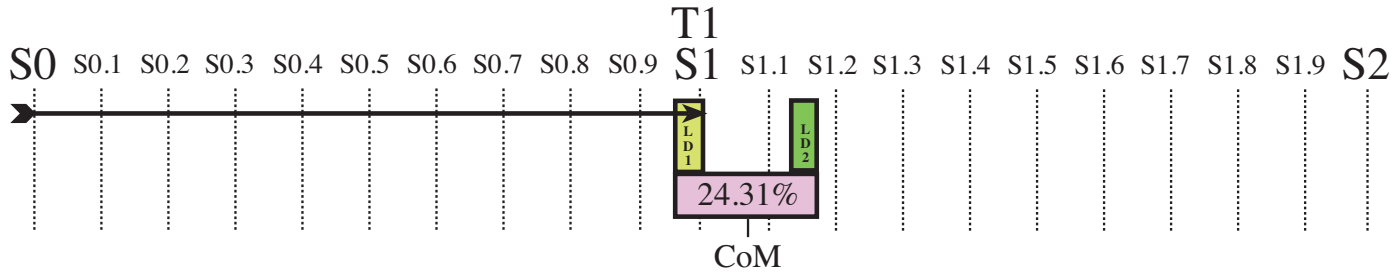
Light Motion 0.95***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.95*c* at T0 and the Entity's length is 31.22%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.97*c*



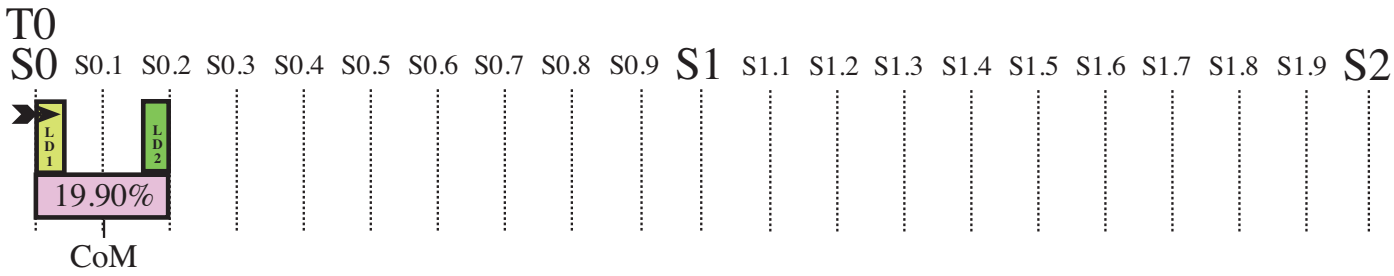
Light Motion 0.97***c*** @ S0 @ T0



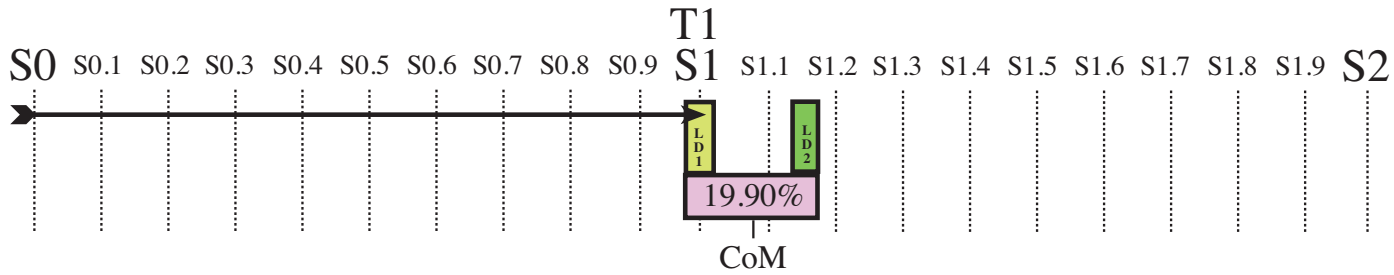
Light Motion 0.97***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.97*c* at T0 and the Entity's length is 24.31%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.98*c*



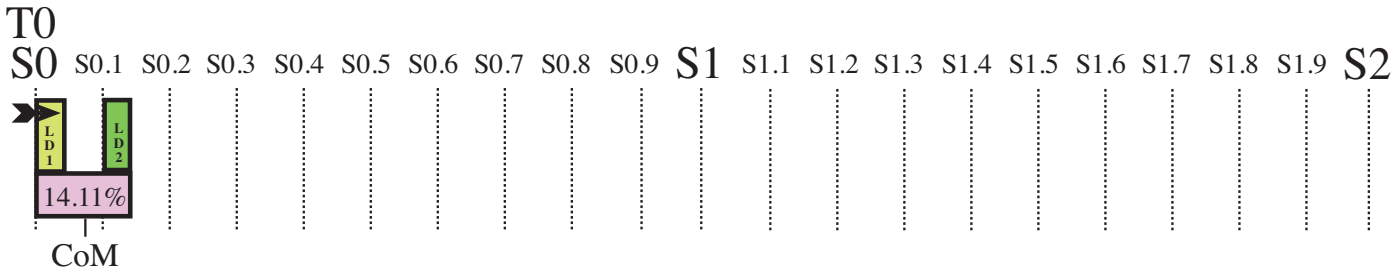
Light Motion 0.98***c*** @ S0 @ T0



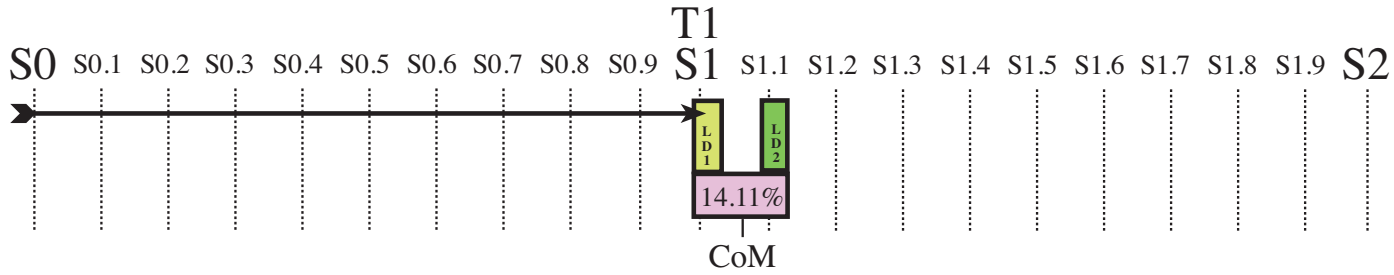
Light Motion 0.98***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.98*c* at T0 and the Entity's length is 19.90%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 0.99*c*



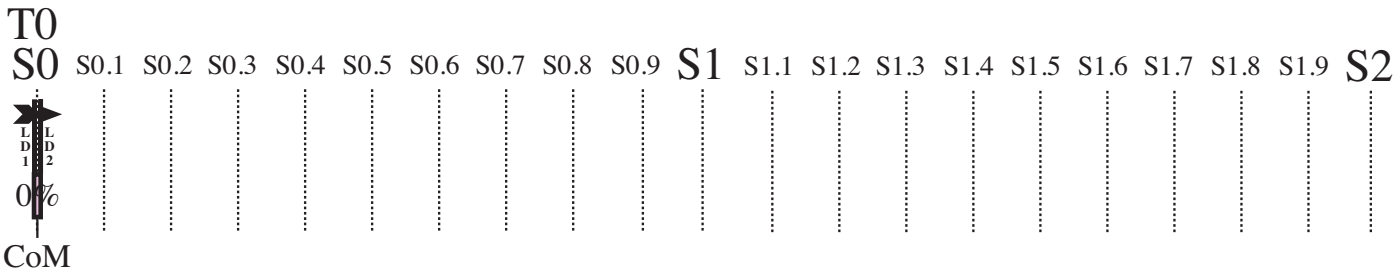
Light Motion 0.99***c*** @ S0 @ T0



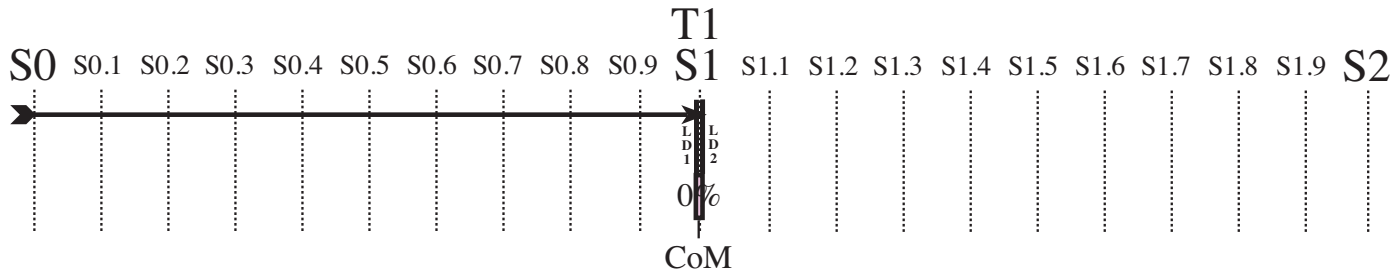
Light Motion 0.99***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 0.99*c* at T0 and the Entity's length is 14.11%, the Photon is not detected at T1.

The Measurement of Light When an Entity Is In-Motion at 1.00*c*



Light Motion 1.00***c*** @ S0 @ T0



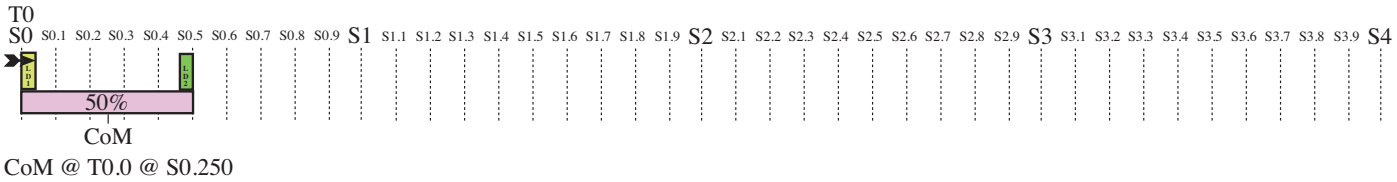
Light Motion 1.00***c*** @ S1 @ T1

Result: Under the conditions wherein the Entity is in-motion at 1.00*c* at T0 and the Entity's length is 0.00%, the Photon is not detected at T1.

When (P1) an Entity is in-motion at an AV > 0.00 mps and (P2) a Photon is not detected at T1, then that result justifies the conclusion (Q) that

The Light Motion 1 Tx.x Diagrams

Proposition: An Entity is in-motion traveling at a velocity of 0.86*c* and a Photon (designated by an arrow) is in-motion traveling at a velocity of *c* or 1.00*c* parallel to and in the same direction of motion as the motion of the Entity (left-to-right) independently of the motion of the Entity.



On the ends of the Entity are Light Detectors LD1 and LD2. When a Photon is traveling past the Entity at a greater velocity (speed + direction) parallel to and in the same direction of motion as the Entity, the Photon will first be detected by LD1 and then LD2.

The center-of-mass of the Entity is designated CoM and is assumed to be located at approximately the center of the length of the Entity if/when the Entity's mass is evenly distributed throughout the Entity's length.

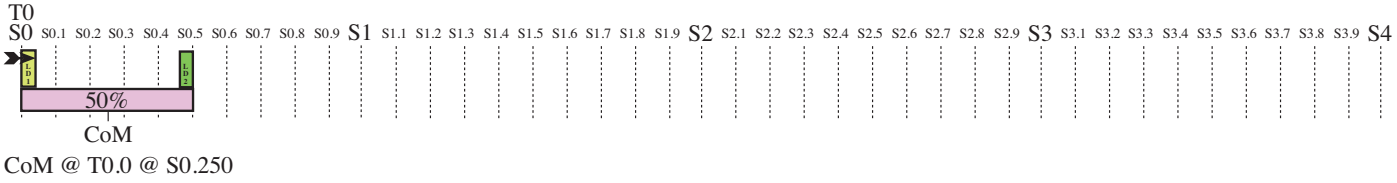
The position/location of the CoM inre an actual entity may be different from the entity's center-of-length, but if when once the entity has been accelerated to a specific velocity the CoM's position/location inre the entity does NOT vary during the entity's motion at that specific velocity, then the CoM can be used as a non-distortable reference point inre the space-units (SUs) traversed by the entity during measured time-units (TUs).

The Photon is moving at the velocity of *c* and travels the space distance S0.10 during each time duration T0.10. The Photon is traveling at *c*; the Entity is traveling at 0.86*c*.

The Entity traveling at 0.86*c* has shortened to 50% of its original length. This phenomenon is described by the FitzGerald-Lorentz transformation equations.

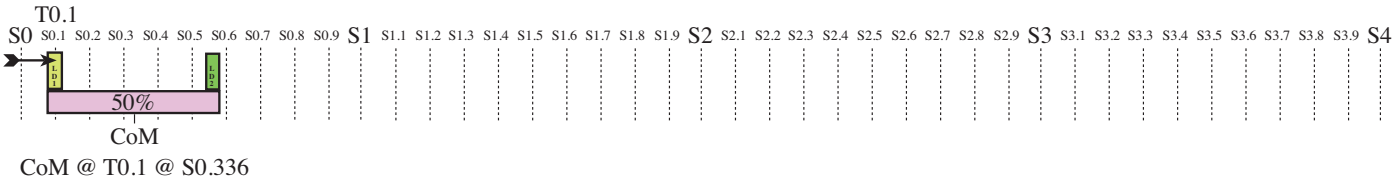
For every space distance S0.10 traveled by the Photon there is a space distance S0.086 traveled by the Entity; when the Photon has traveled the space distance from S0.00 to S1.00 during the time duration T0.0 to T1.00, the Entity has traveled 86% of the space distance S0.00 to S1.00 or from S0.00 to S0.86.

The Light Motion Entity/CoM Diagrams begin at T0.0, Timepoint 0.0, when the Entity/CoM is located at S0.25 and the Photon (Photon Arrow) is located at S0.0 and has been detected by LD1.

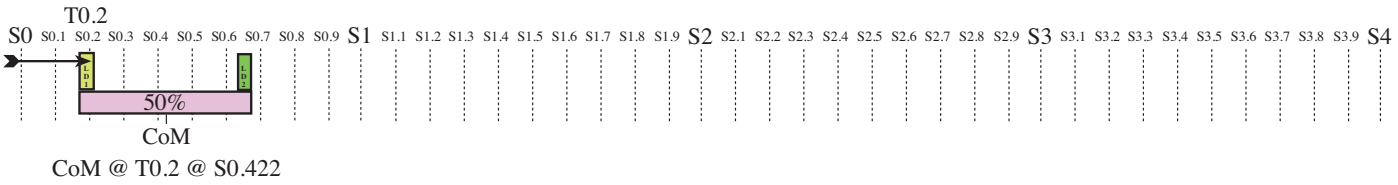


Light Motion T0.0 CoM at S0.25

At T0.1, the Entity/CoM would have moved a distance of S0.086 to S0.336 [S0.25 + S0.086 = S0.336]

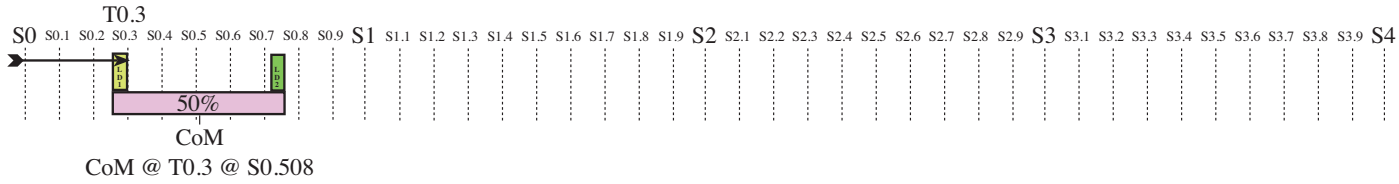


Light Motion T0.1 CoM at S0.336



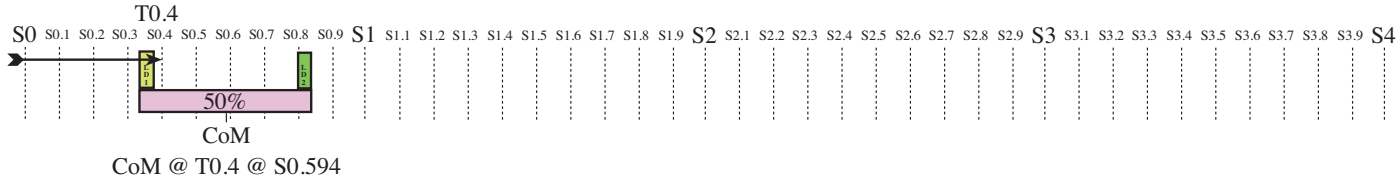
Light Motion T0.2 CoM at S0.422

At T0.2, the Entity/CoM would have moved a distance of S0.086 to S0.422 [S0.336 + S0.086 = S0.422]



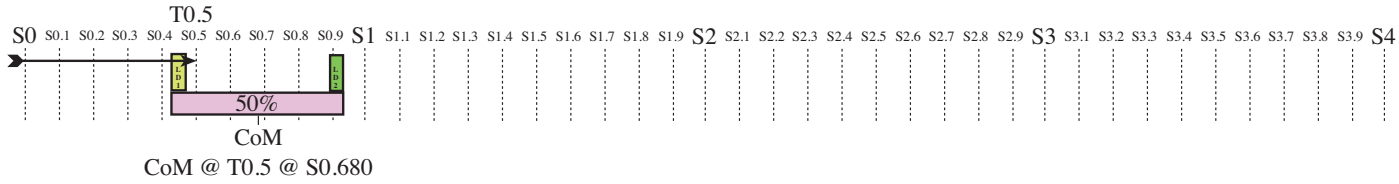
Light Motion T0.3 CoM at S0.508

At T0.3, the Entity/CoM would have moved a distance of S0.086 to S0.508 [S0.422 + S0.086 = S0.508]



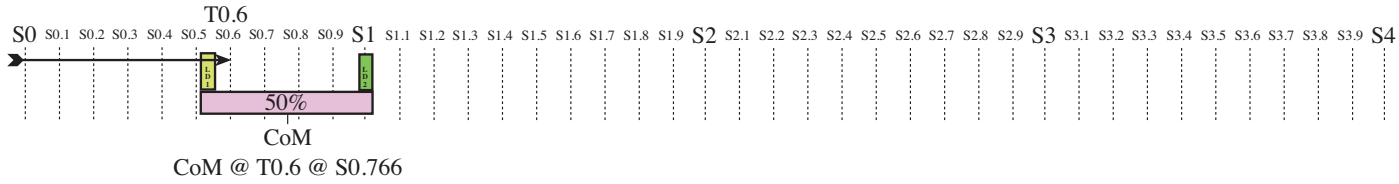
Light Motion T0.4 CoM at S0.594

At T0.4, the Entity/CoM would have moved a distance of S0.086 to S0.594 [S0.508 + S0.086 = S0.594]



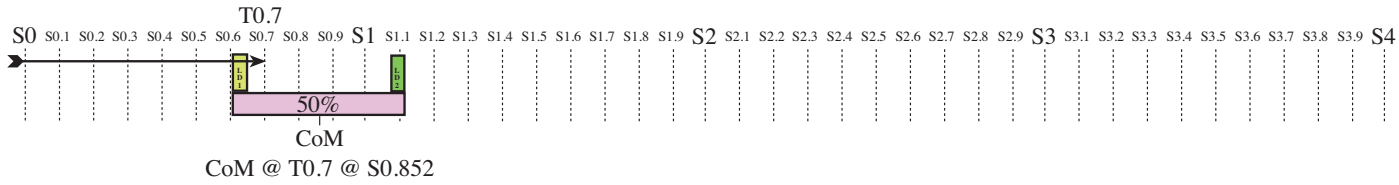
Light Motion T0.5 CoM at S0.680

At T0.5, the Entity/CoM would have moved a distance of S0.086 to S0.680 [S0.594 + S0.086 = S0.680]



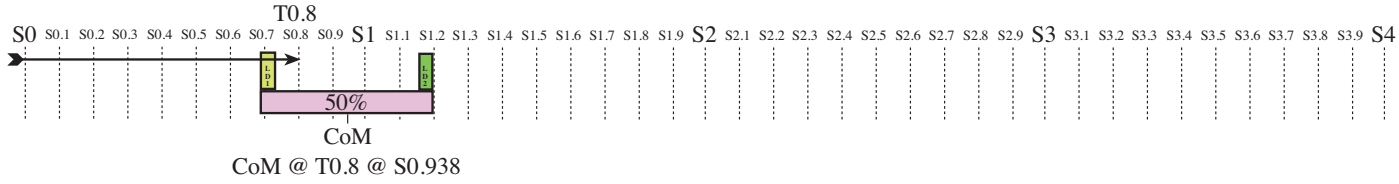
Light Motion T0.6 CoM at S0.766

At T0.6, the Entity/CoM would have moved a distance of S0.086 to S0.766 [S0.680 + S0.086 = S0.766]



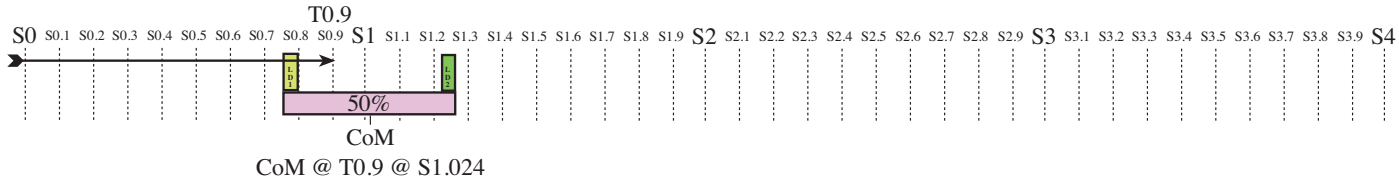
Light Motion T0.7 CoM at S0.852

At T0.7, the Entity/CoM would have moved a distance of S0.086 to S0.852 [S0.766 + S0.086 = S0.852]



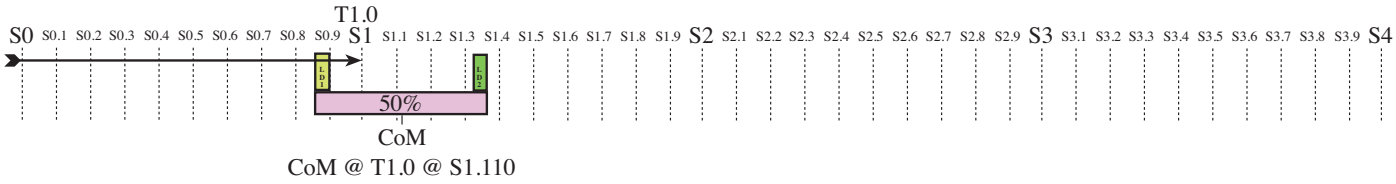
Light Motion T0.8 CoM at S0.938

At T0.8, the Entity/CoM would have moved a distance of S0.086 to S0.938 [S0.852 + S0.086 = S0.938]



Light Motion T0.9 CoM at S1.024

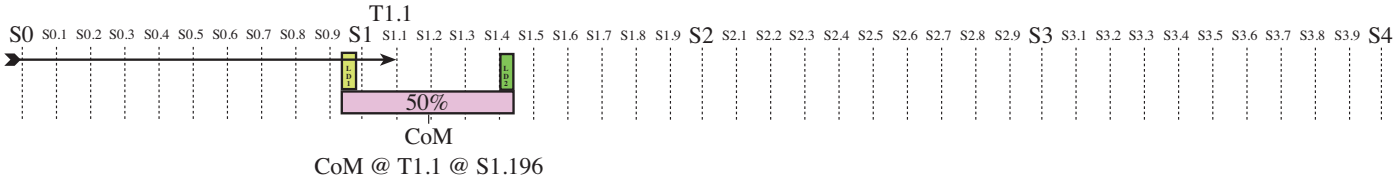
At T0.9, the Entity/CoM would have moved a distance of S0.086 to S0.938 [S0.938 + S0.086 = S1.024]



CoM @ T1.0 @ S1.110

Light Motion T1.0 CoM at S1.110

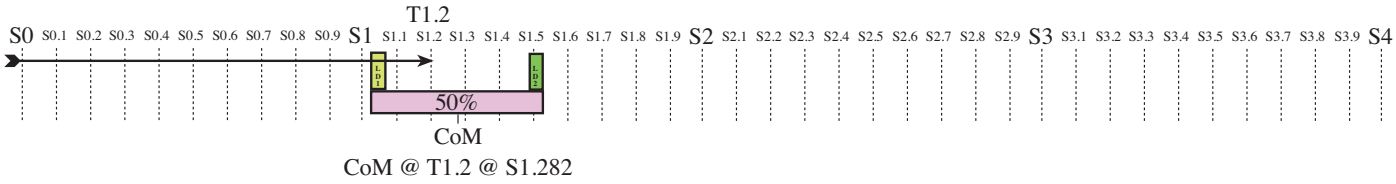
At T1.0, the Entity/CoM would have moved a distance of S0.086 to S1.110 [S1.024 + S0.086 = S1.110]



CoM @ T1.1 @ S1.196

Light Motion T1.1 CoM at S1.196

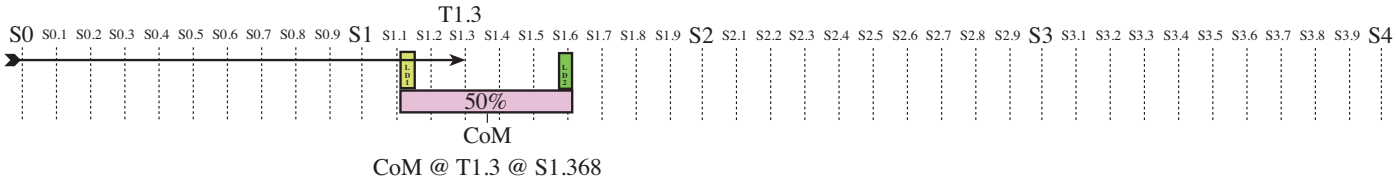
At T1.1, the Entity/CoM would have moved a distance of S0.086 to S1.196 [S1.110 + S0.086 = S1.196]



CoM @ T1.2 @ S1.282

Light Motion T1.2 CoM at S1.282

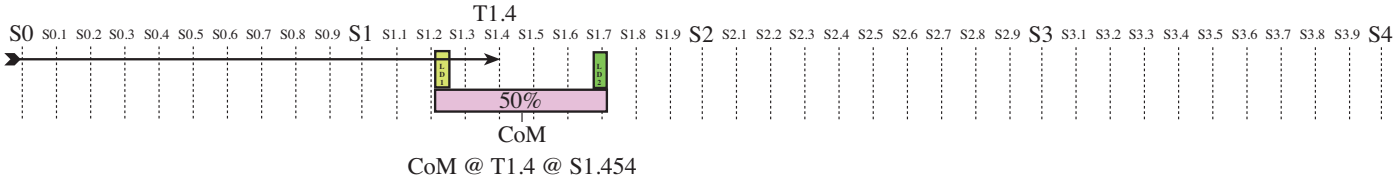
At T1.2, the Entity/CoM would have moved a distance of S0.086 to S1.282 [S1.196 + S0.086 = S1.282]



CoM @ T1.3 @ S1.368

Light Motion T1.3 CoM at S1.368

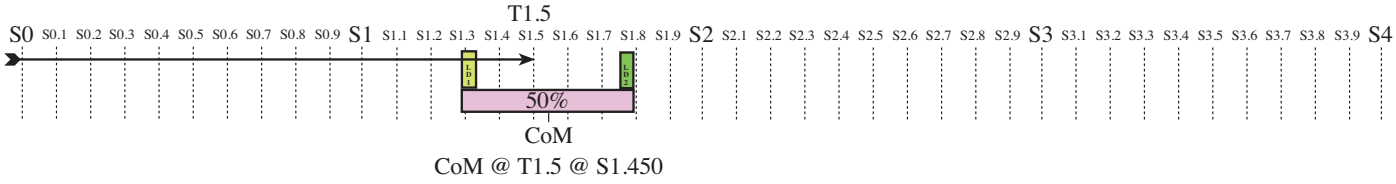
At T1.3, the Entity/CoM would have moved a distance of S0.086 to S1.368 [S1.282 + S0.086 = S1.368]



CoM @ T1.4 @ S1.454

Light Motion T1.4 CoM at S1.454

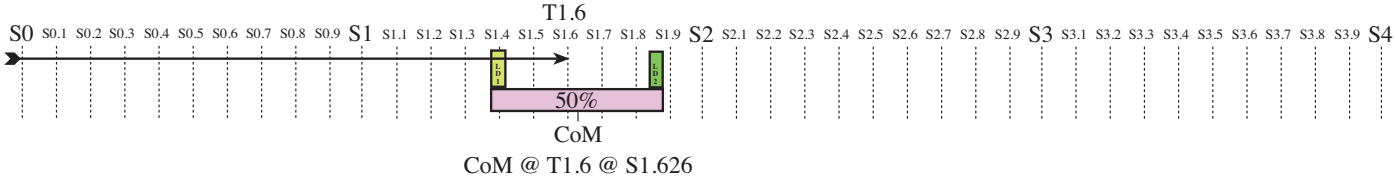
At T1.4, the Entity/CoM would have moved a distance of S0.086 to S1.454 [S1.368 + S0.086 = S1.454]



CoM @ T1.5 @ S1.450

Light Motion T1.5 CoM at S1.540

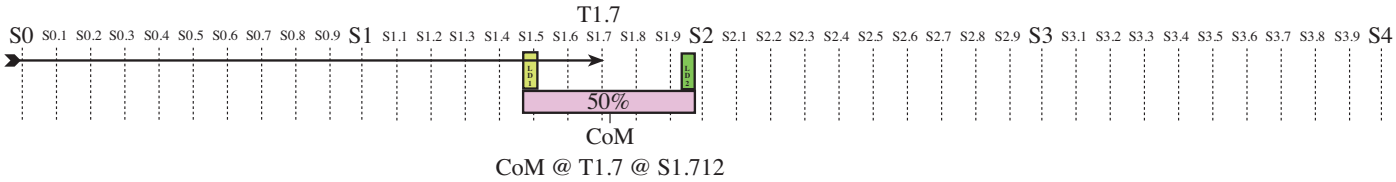
At T1.5, the Entity/CoM would have moved a distance of S0.086 to S1.540 [S1.454 + S0.086 = S1.540]



CoM @ T1.6 @ S1.626

Light Motion T1.6 CoM at S1.626

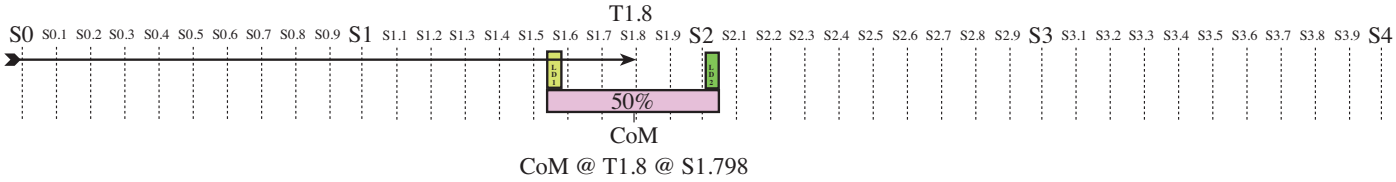
At T1.6, the Entity/CoM would have moved a distance of S0.086 to S1.626 [S1.540 + S0.086 = S1.626]



CoM @ T1.7 @ S1.712

Light Motion T1.7 CoM at S1.712

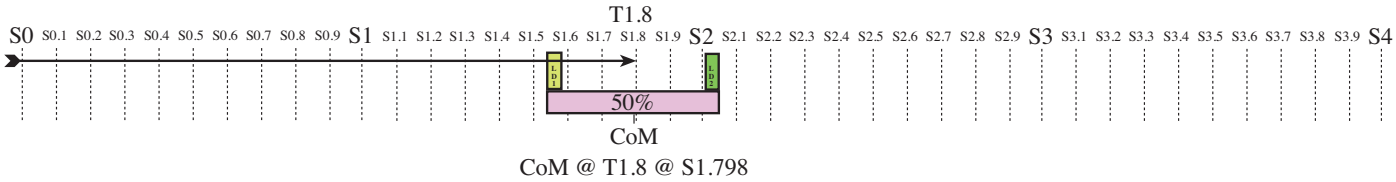
At T1.7, the Entity/CoM would have moved a distance of S0.086 to S1.712 [S1.626 + S0.086 = S1.712]



CoM @ T1.8 @ S1.798

Light Motion T1.8 CoM at S1.798

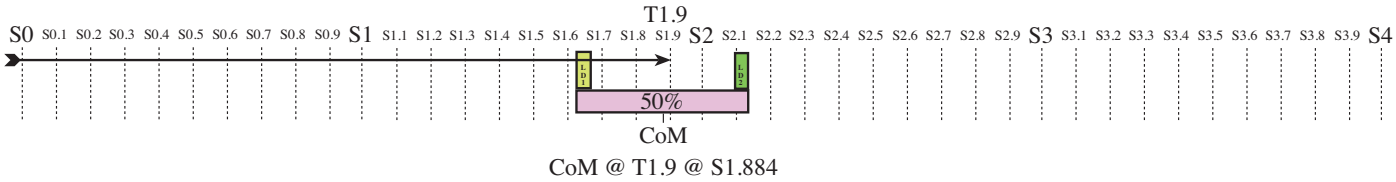
At T1.8, the Entity/CoM would have moved a distance of S0.086 to S1.798 [S1.712 + S0.086 = S1.798]



CoM @ T1.8 @ S1.798

Light Motion T1.9 CoM at S1.884

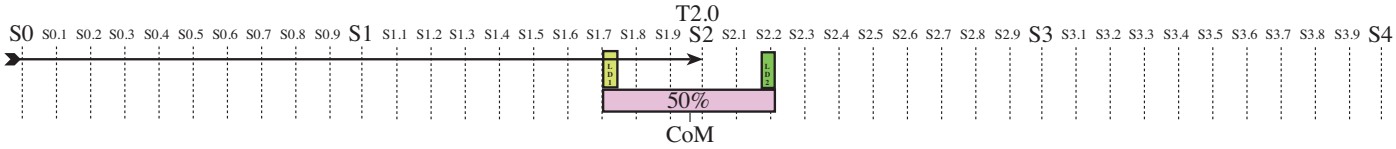
At T1.9, the Entity/CoM would have moved a distance of S0.086 to S1.884 [S1.798 + S0.086 = S1.884]



CoM @ T1.9 @ S1.884

Light Motion T2.0 CoM at S2.056

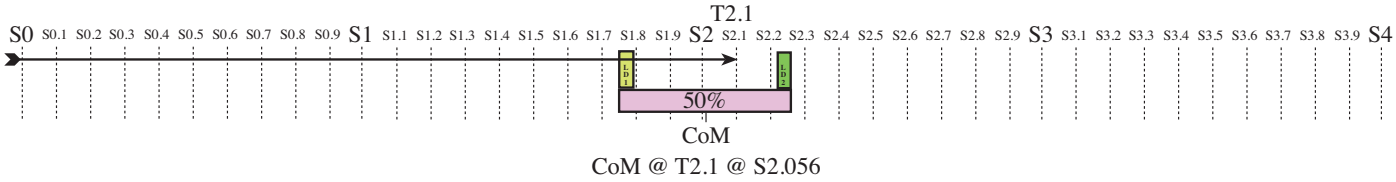
At T2.0, the Entity/CoM would have moved a distance of S0.086 to S2.056 [S1.884 + S0.086 = S1.970]



CoM @ T2.0 @ S1.970

Light Motion T2.0 CoM at S1.970

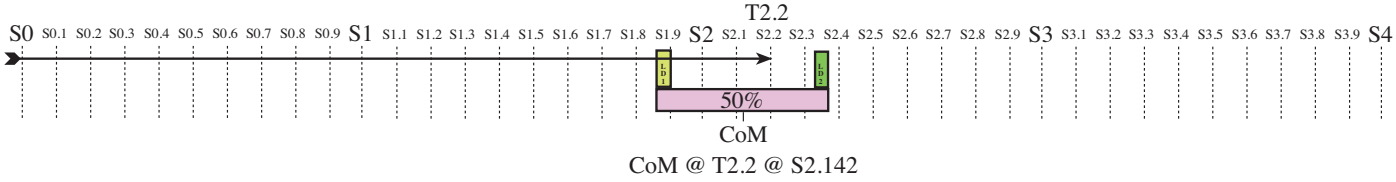
At T2.1, the Entity/CoM would have moved a distance of S0.086 to S2.056 [S1.970 + S0.086 = S2.056]



CoM @ T2.1 @ S2.056

Light Motion T2.1 CoM at S2.056

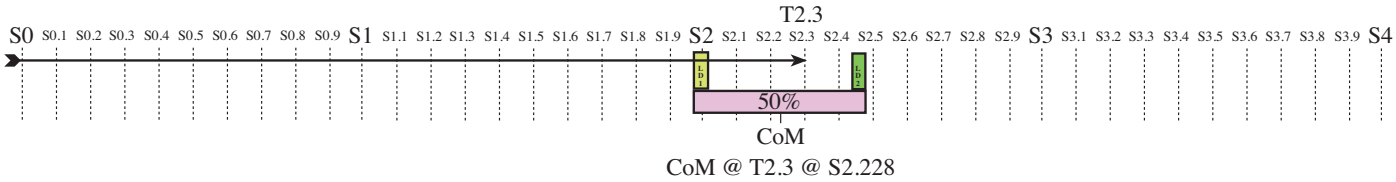
At T2.2, the Entity/CoM would have moved a distance of S0.086 to S2.142 [S2.056 + S0.086 = S2.142]



CoM @ T2.2 @ S2.142

Light Motion T2.2 CoM at S2.142

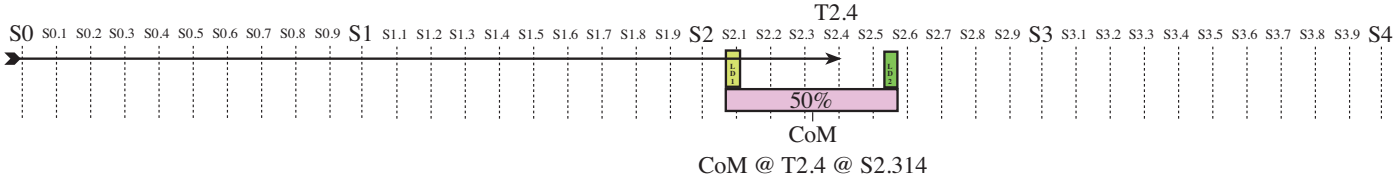
At T2.3, the Entity/CoM would have moved a distance of S0.086 to S2.228 [S2.142 + S0.086 = S2.228]



CoM @ T2.3 @ S2.228

Light Motion T2.3 CoM at S2.228

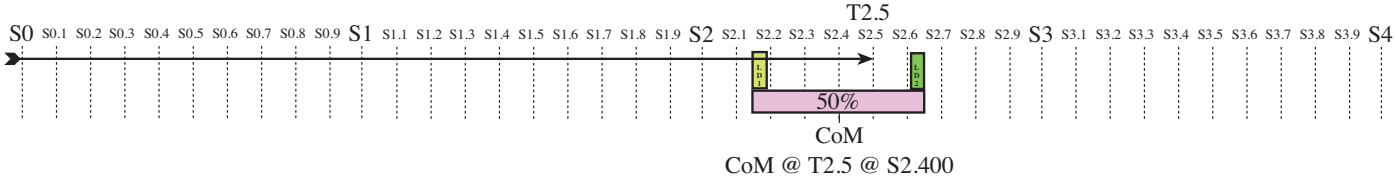
At T2.4, the Entity/CoM would have moved a distance of S0.086 to S2.314 [S2.228 + S0.086 = S2.314]



CoM @ T2.4 @ S2.314

Light Motion T2.4 CoM at S2314

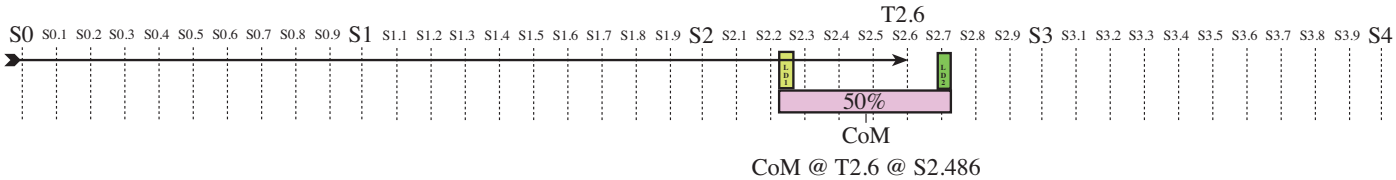
At T2.5, the Entity/CoM would have moved a distance of S0.086 to S2.400 [S2.314 + S0.086 = S2.400]



CoM @ T2.5 @ S2.400

Light Motion T2.5 CoM at S2.400

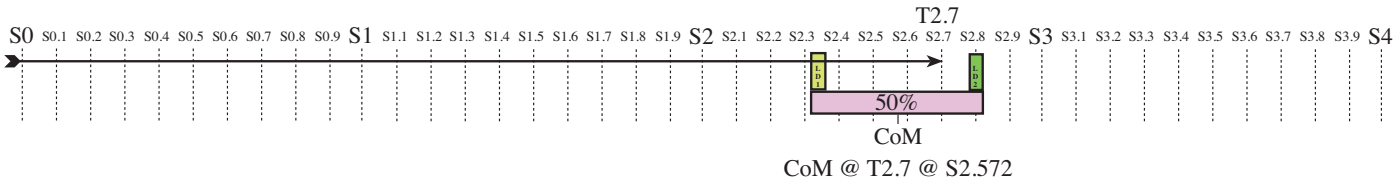
At T2.6, the Entity/CoM would have moved a distance of S0.086 to S2.486 [S2.400 + S0.086 = S2.486]



CoM @ T2.6 @ S2.486

Light Motion T2.6 CoM at S2.486

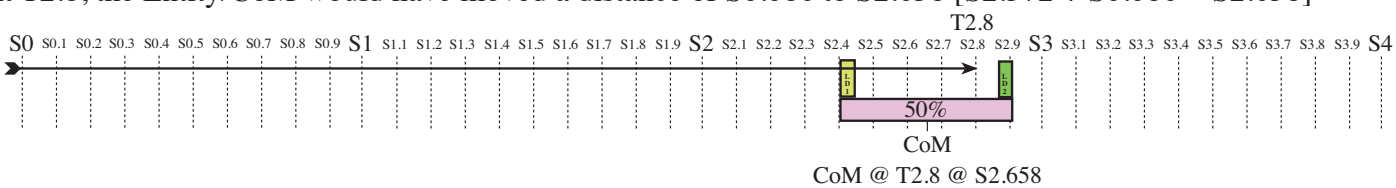
At T2.7, the Entity/CoM would have moved a distance of S0.086 to S2.572 [S2.486 + S0.086 = S2.572]



CoM @ T2.7 @ S2.572

Light Motion T2.7 CoM at S2.572

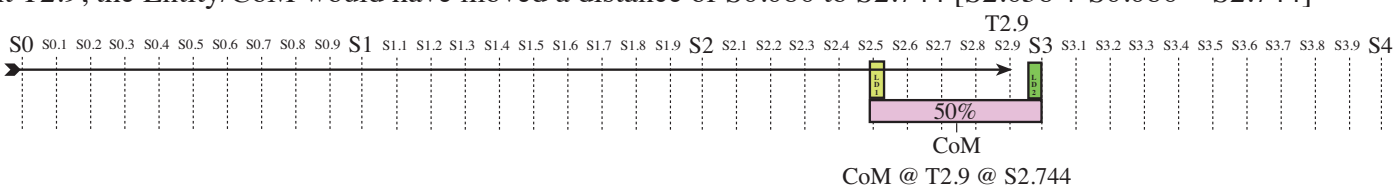
At T2.8, the Entity/CoM would have moved a distance of S0.086 to S2.658 [S2.572 + S0.086 = S2.658]



CoM @ T2.8 @ S2.658

Light Motion T2.8 CoM at S2.658

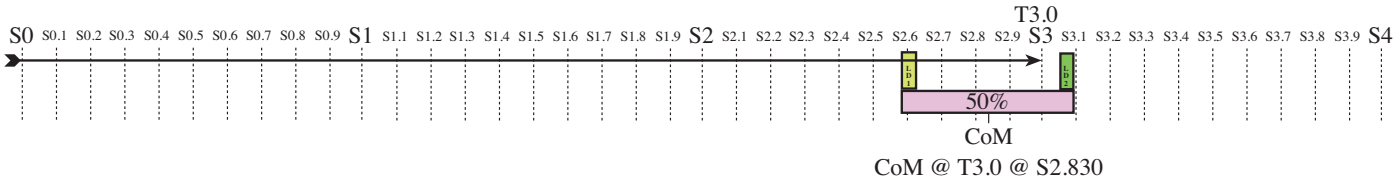
At T2.9, the Entity/CoM would have moved a distance of S0.086 to S2.744 [S2.658 + S0.086 = S2.744]



CoM @ T2.9 @ S2.744

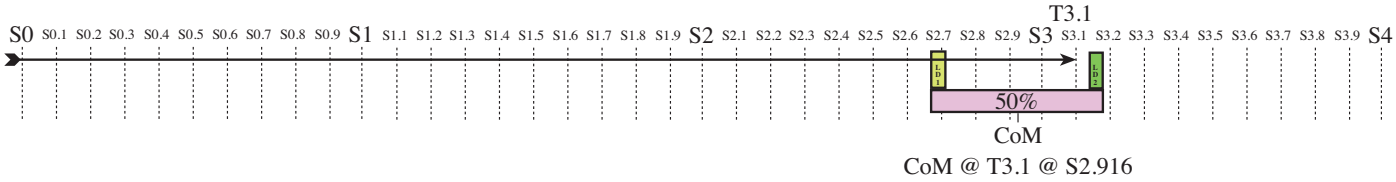
Light Motion T2.9 CoM at S2.744

At T3.0, the Entity/CoM would have moved a distance of S0.086 to S2.830 [S2.744 + S0.086 = S2.830]



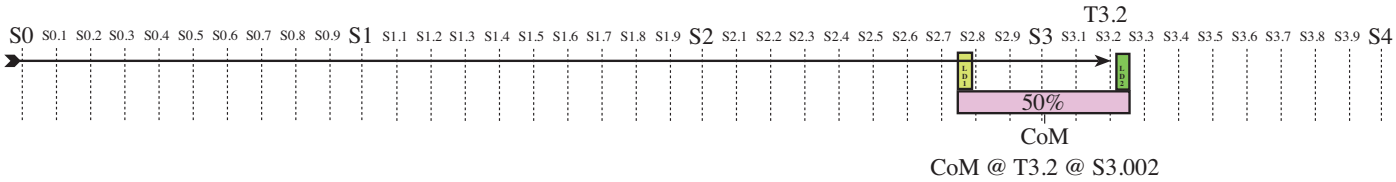
Light Motion T3.0 CoM at S2.830

At T3.1, the Entity/CoM would have moved a distance of S0.086 to S2.916 [S2.830 + S0.086 = S2.916]



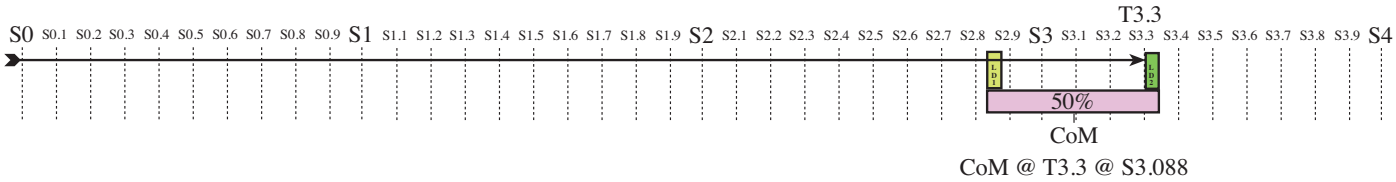
Light Motion T3.1 CoM at S2.916

At T3.2, the Entity/CoM would have moved a distance of S0.086 to S3.002 [S2.916 + S0.086 = S3.002]



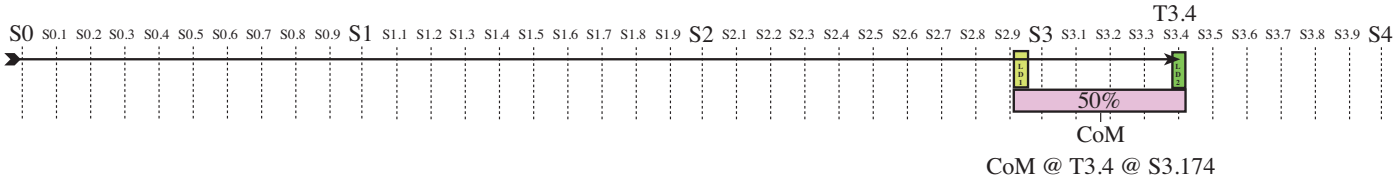
Light Motion T3.2 CoM at S3.002

At T3.3, the Entity/CoM would have moved a distance of S0.086 to S3.088 [S3.002 + S0.086 = S3.088]



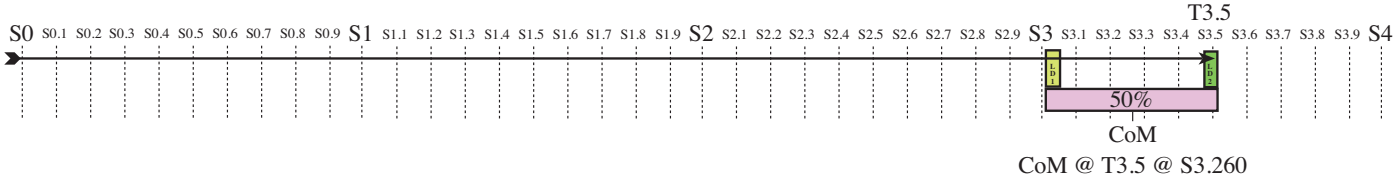
Light Motion T3.3 CoM at S3.088

At T3.4, the Entity/CoM would have moved a distance of S0.086 to S3.174 [S3.088 + S0.086 = S3.174]



Light Motion T3.4 CoM at S3.174

At T3.5, the Entity/CoM would have moved a distance of S0.086 to S3.260 [S3.174 + S0.086 = S3.260]



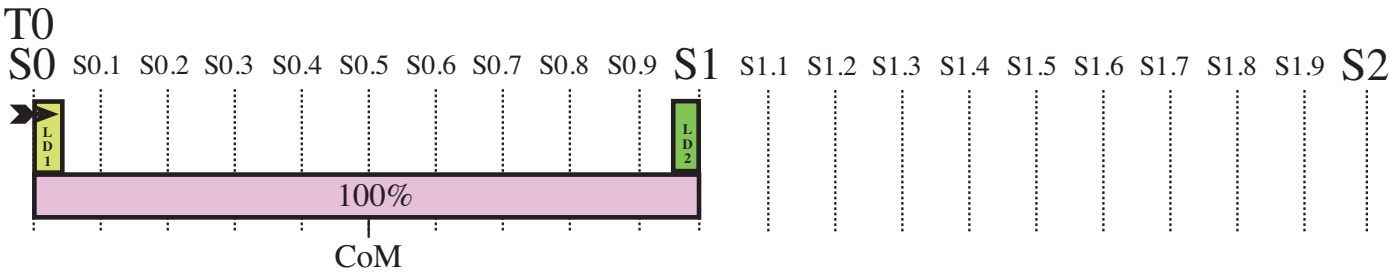
Light Motion T3.5 CoM at S3.260

At T3.5, the Photon has been detected by LD2.

The total time duration for the single event which is the detection of the Photon by the LD system comprised of LD1 - LD2 is T3.5, meaning 3.5 time units (or 35 time subunits), whatever duration they may be chosen to be, were required for the Photon to traverse the Entity from LD1 to LD2.

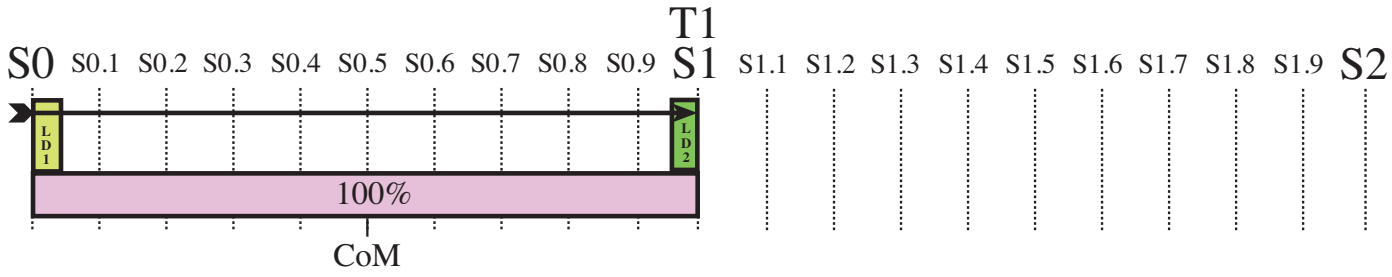
The ratio of time/duration to space/distance, time/duration:space/distance, is 1.00:0.86, meaning during the time/duration of one time unit, 1.00, the Entity moves 0.86 space/distance unit.

When the Entity was at-rest/not-in-motion, meaning the Entity did not move/had no velocity, and its length was unchanged, the Photon would have traversed the Entity from LD1 to LD2 in one time unit, during the duration from T0.00 to T1.00.



Light Motion 0.0***c*** @ S0 @ T0

Light Motion: Photon at S0 at T0.0 Entity At-Rest at 100% Length



Light Motion 0.0***c*** @ S1 @ T1

Light Motion: Photon at S1 at T1.0 Entity At-Rest at 100% Length

Thus, when the Entity is moving at the velocity of 0.86*c*, the Photon requires 3.5 time units (or 35 time subunits) to traverse the Entity from LD1 to LD2.

Thus, in accord with Einstein's Railroad Drawing, light has a motion which although *c* for the Embankment/*K* is not *c* for the Entity/*K'*, and, thus, the motion of light is independent of the Entity's reference frame.

Thus, the motion of light inre the Embankment reference frame *K* is an RV = *c* or an RV = 186,000 mps, but the motion of light inre the Train reference frame *K'* is an RV = *c* - *v* (the speed of light minus the velocity of the Train).

The link between space and time in the LM diagrams has been the stipulation that for every time-unit (TU, unit of time) the Entity moves one space-unit, one space unit of Entity motion/distance for every time unit/duration. The 'ruler' therein has been the Spacegrid and the 'clock' therein has been the duration of the motion of light inre the distance traversed: for every space-unit (SU) of distance traversed by the Photon the duration of one time-unit elapses.

Because neither the space/distance nor the time/duration of the Spacegrid has been altered by the spatial and temporal measurement processes, the space.distance therein has been absolute space (AS) or universal space (US) or cosmic space (CS) or common space (CS) and the time measured therein has been absolute time (AT) or universal time (UT) or cosmic time (CT) or common time (CT).

Because neither the distance defined by the Spacegrid nor the duration defined by the motion of the Photon (one SU per one TU) are altered by the motion of the Entity or the motion of the Photon nor the measurement of space/distance and time/duration, then the Spacegrid effectively becomes an absolute space ruler (ASR) or non-distortable ruler (NDR) and the motion of the Photon at one SU per TU becomes an absolute time clock (ATC) or a non-distortable clock (NDC).

The Entity could have had a clock whose timerate (rate of ticking) would have been altered by any accelerations (velocity changes) necessary to transform the Entity's velocity from 0.0*c* or 0.0 mps to 86% of *c* or 0.86*c* or 159,960 mps. This clock would have been a distortable clock (DC) or local time clock (LTC).

If the LTC's (local time clock's) timerate had been one TU per SU prior to acceleration from 0.0*c* or 0.0 mps to 85% of *c* or 0.86*c* or 159,960 mps, then, when the Entity's length would have shortened to 50% or 0.5 of its original at-rest length. the LTC's timerate at 85% of *c* or 0.86*c* or 159,960 mps would have been 0.5 or 50% of the original timerate.

When the ATC's temporal measurement resulted in 3.5 TUs for the temporal measurement of the Photon's traversal of the Entity's length by the LD1 - LD2 system when the Entity was traveling at 86% of *c* or 0.86*c*

or 159,960 mps and the LTC's timerate would have been 50% or 0.5 of the ATC's timerate, then the LTC's temporal measurement would have been 50% or 0.5 or one-half of the ATC's 3.5 TUs or 3.5 x .5 = 1.75 TUs.

The result wherein the LTC's temporal measurement of the duration of the motion of the Photon over the Entity's shortened length is 1.75 TUs is longer than the temporal measurement of one TU for the duration of the motion of the Photon over the Entity's undistorted original at-rest length (100%) of one SU when the Entity had a velocity of 0% of *c* or 0.0*c* or 0.0 mps.

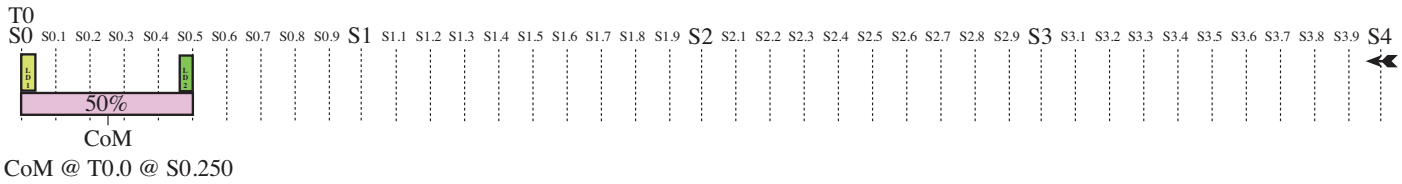
The original temporal measurement of the duration of the Photon over the original undistorted/unshortened length of the Entity when the Entity had a velocity of 0% of *c* or 0.0*c* or 0.0 mps by BOTH the ATC and the LTC would have been one TU.

When the Entity's velocity is 86% of *c* or 0.86*c* or 159,960 mps and the ATC's temporal measurement is 3.5 TUs and the LTC's temporal measurement is 1.75 TU, then the difference, 3.5 TUs - 1.75 TU = 1.75 TU, reveals that the time/duration of the motion of the Photon over the shortened/distorted length/distance of the Entity is nevertheless longer than the at-rest time/duration (1 TU).

This fact that the time/duration of the motion of the Photon over the shortened/distorted length/distance of the Entity is nevertheless longer than the at-rest time/duration confirms the hypothesis that the true motion of light inre an entity when the light is in-motion parallel to the motion of the entity is described by the relative velocity equation of RV = $c \pm v$ wherein *c* is the velocity of light *in vacuo* (zero gravity, no gravitational field) and *v* is the velocity of the entity *in vacuo*.

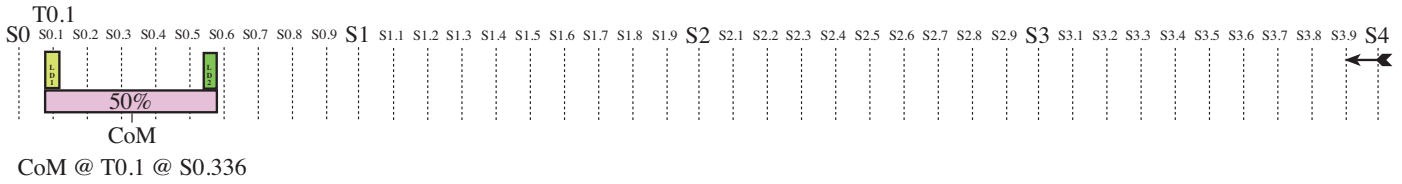
The Light Motion 2 Tx.x Diagrams

In another series of Entity Diagrams, the Entity is moving left-to-right while the Lightray/Photon is moving right-to-left therefore opposite the direction of motion of the Entity.



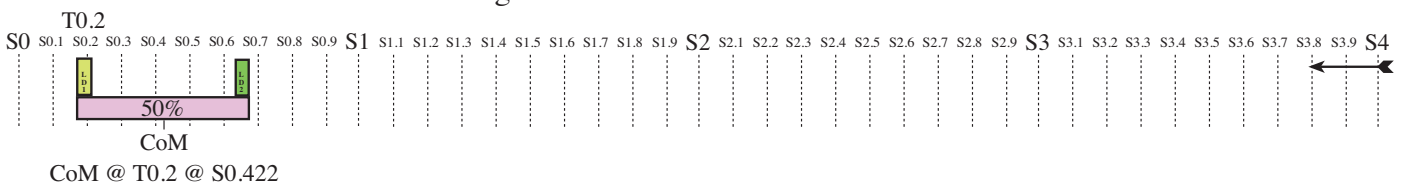
CoM @ T0.0 @ S0.250

Light Motion 2 T0.0 CoM at S0.250



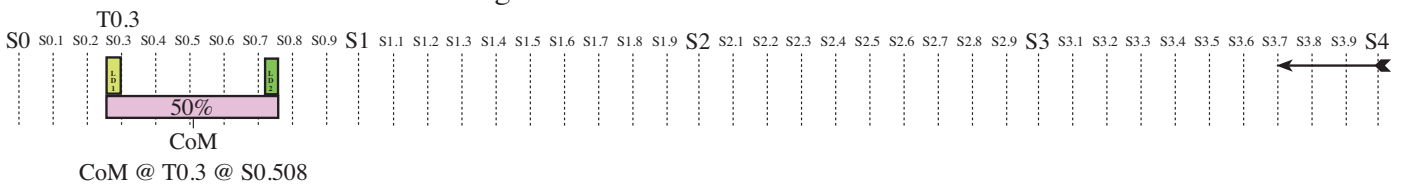
CoM @ T0.1 @ S0.336

Light Motion 2 T0.1 CoM at S0.336



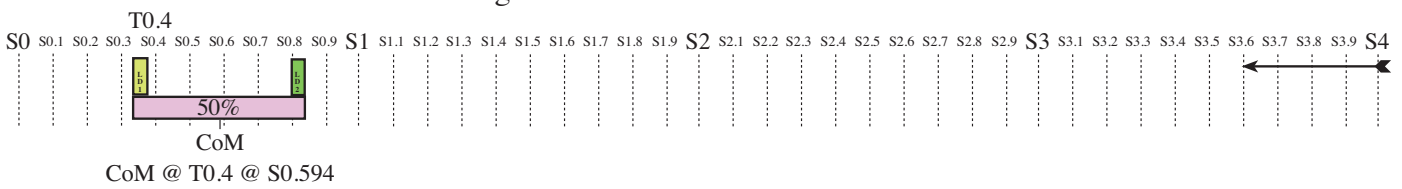
CoM @ T0.2 @ S0.422

Light Motion 2 T0.2 CoM at S0.422



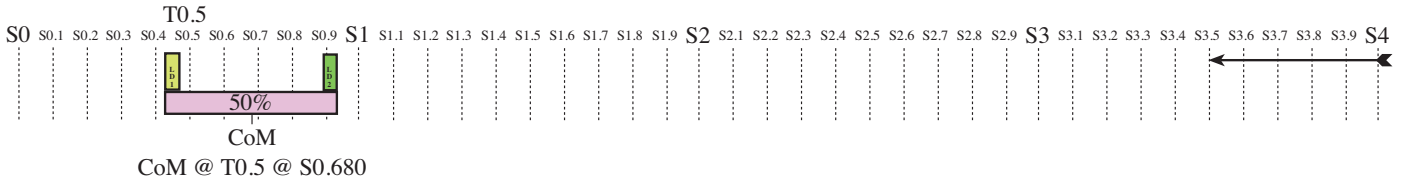
CoM @ T0.3 @ S0.508

Light Motion 2 T0.3 CoM at S0.508



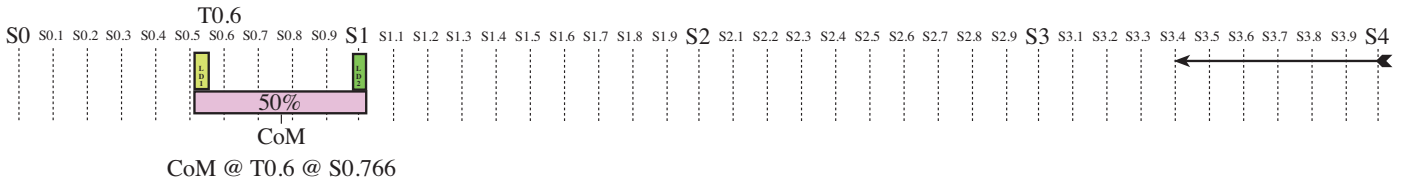
CoM @ T0.4 @ S0.594

Light Motion 2 T0.4 CoM at S0.594



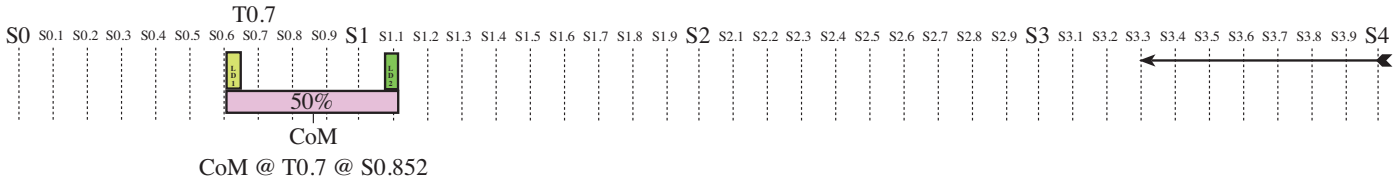
CoM @ T0.5 @ S0.680

Light Motion 2 T0.5 CoM at S0.680



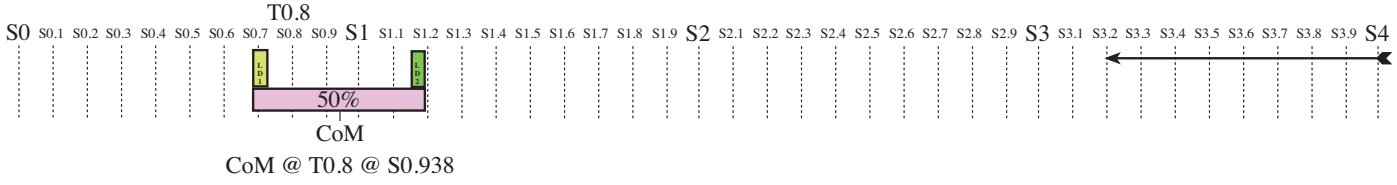
CoM @ T0.6 @ S0.766

Light Motion 2 T0.6 CoM at S0.766



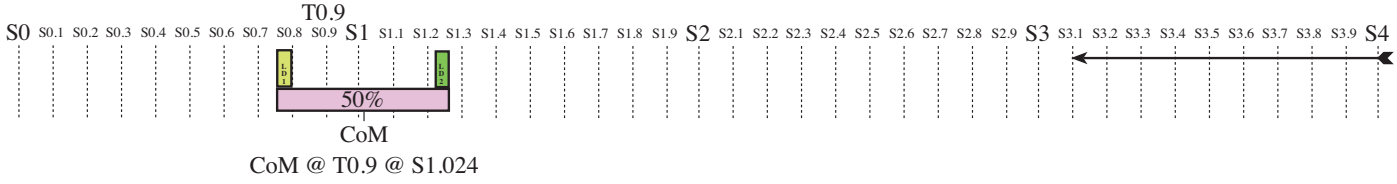
CoM @ T0.7 @ S0.852

Light Motion 2 T0.7 CoM at S0.852



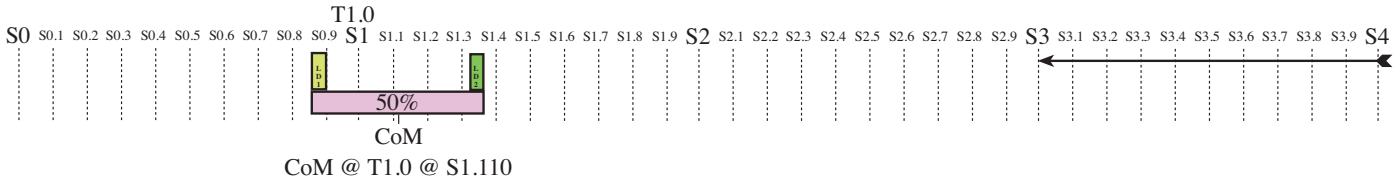
CoM @ T0.8 @ S0.938

Light Motion 2 T0.8 CoM at S0.938



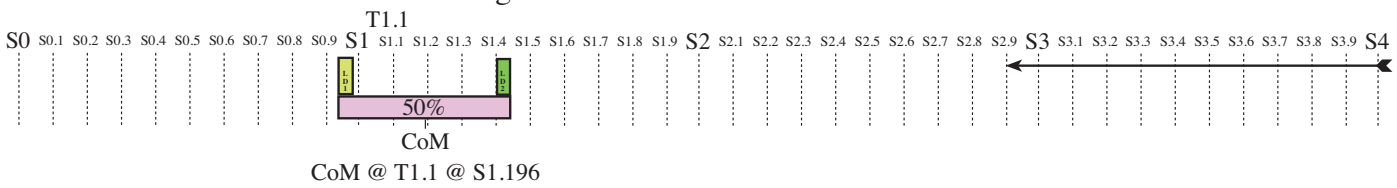
CoM @ T0.9 @ S1.024

Light Motion 2 T0.9 CoM at S1.024



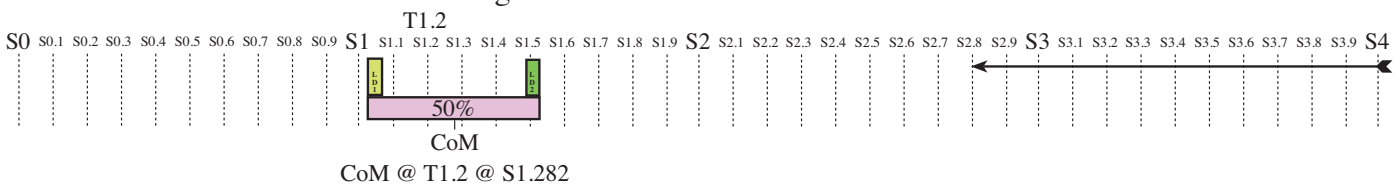
CoM @ T1.0 @ S1.110

Light Motion 2 T1.0 CoM at S1.110



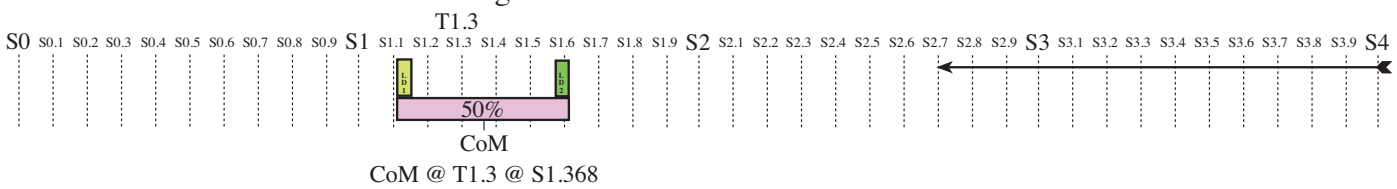
CoM @ T1.1 @ S1.196

Light Motion 2 T1.1 CoM at S1.196



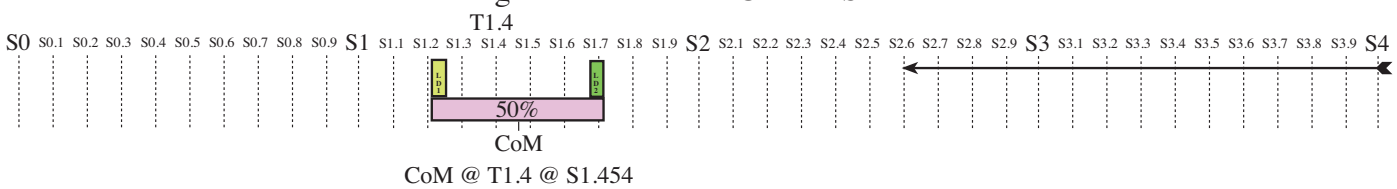
CoM @ T1.2 @ S1.282

Light Motion 2 T1.2 CoM at S1.282



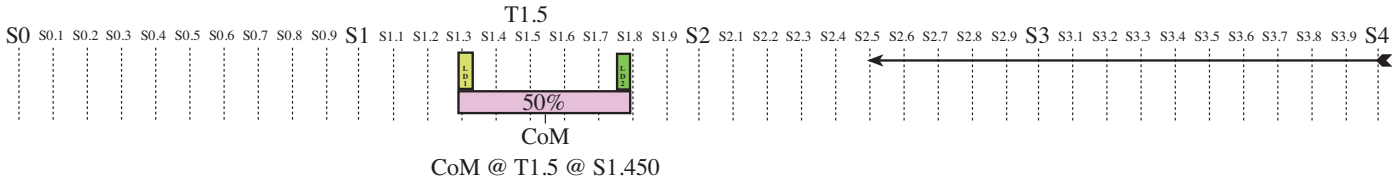
CoM @ T1.3 @ S1.368

Light Motion 2 T1.3 CoM at S1.368



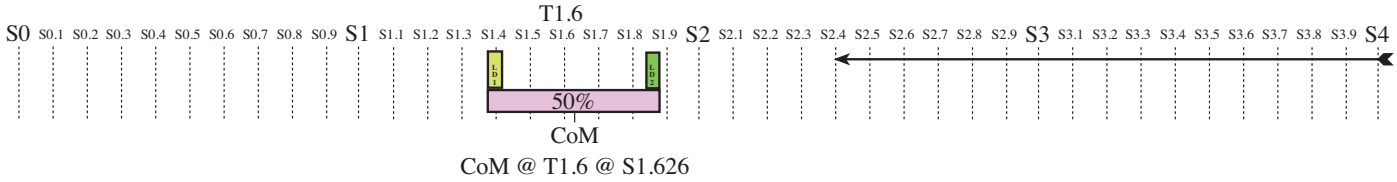
CoM @ T1.4 @ S1.454

Light Motion 2 T1.4 CoM at S1.454



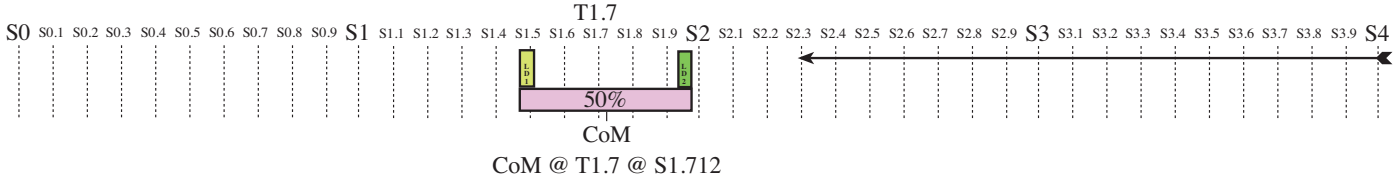
CoM @ T1.5 @ S1.450

Light Motion 2 T1.5 CoM at S1.540



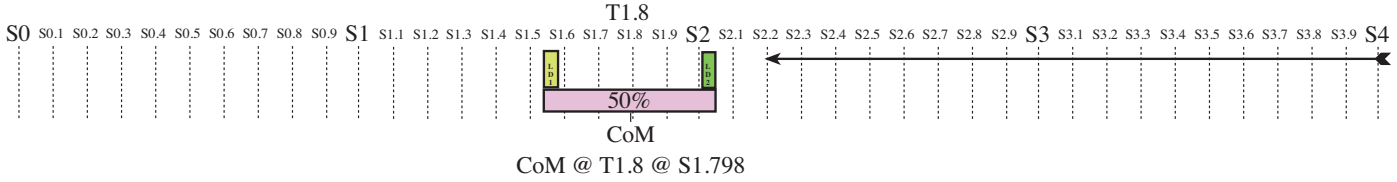
CoM @ T1.6 @ S1.626

Light Motion 2 T1.6 CoM at S1.626



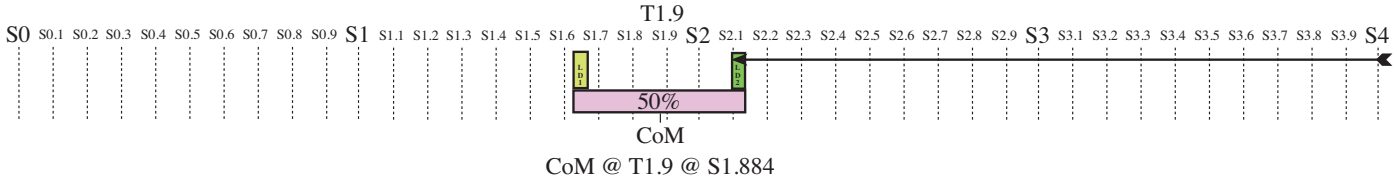
CoM @ T1.7 @ S1.712

Light Motion 2 T1.7 CoM at S1.712



CoM @ T1.8 @ S1.798

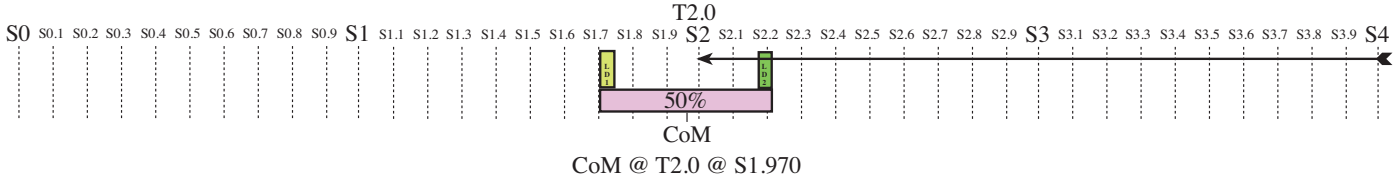
Light Motion 2 T1.8 CoM at S1.798



CoM @ T1.9 @ S1.884

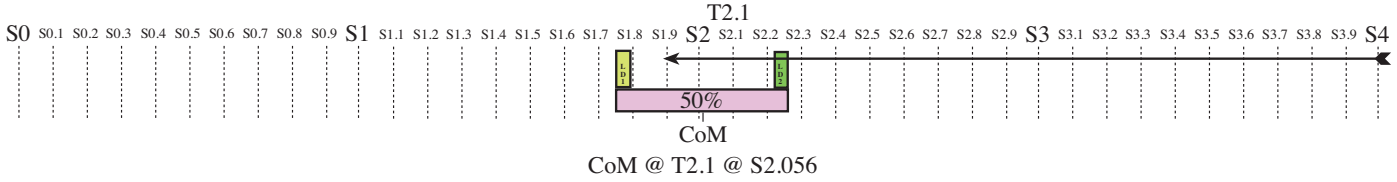
Light Motion 2 T1.2 CoM at S1.884

The Photon has been detected by LD2 at T2.1.



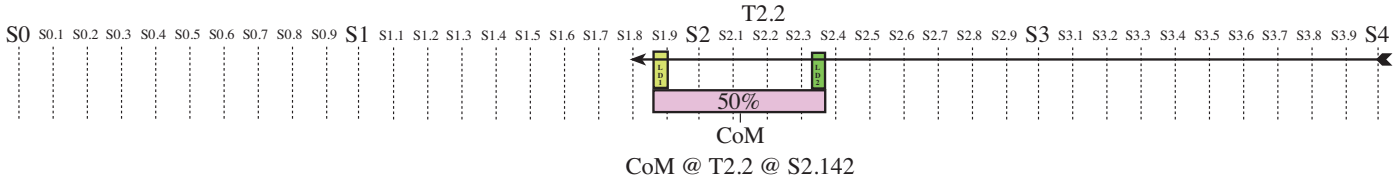
CoM @ T2.0 @ S1.970

Light Motion 2 T2.0 CoM at S1.970



CoM @ T2.1 @ S2.056

Light Motion 2 T2.1 CoM at S2.056



CoM @ T2.2 @ S2.142

Light Motion 2 T2.2 CoM at S2.142

The Photon has been detected by LD1 at approximately T2.15.

The time duration between the detection of the Photon by LD2 and LD1 is approx T2.15 - T2.1 or T0.05.

That time duration of T0.05 in the LM 2x.x Diagrams is shorter than the time duration of T3.5 for the detection of the Photon in the LM Diagrams.

The T or time or duration difference between the Photon detection by LD1 then LD2 of T3.5 in the LM 1.x.x Diagrams and the Photon detection by LD2 then LD1 of T0.05 in the LM 2x.x Diagrams is proof that the motion of light is independent of the motion of entities and when light photons and entities are in-motion parallel to each other and therefore the correct RV formula/expression is RV = $c \pm v$ when c is the speed of light *in vacuo* at 186,000 mps and v is the speed of an entity also *in vacuo*.

NOTE: The RV cannot exceed 2c, or 372,000 mps, nor can the RV be less than 0 mps.

The Mathematical Relationships Inre The Diagrams

The diagrams presented herein are not merely illustrations; they are also graphs showing the mathematical relationships between a photon's motion/velocity and an entity's motion/velocity. The graph is the grid represented by the equidistant vertical grid lines.

Because the velocity of the photon is constant at 1.00*c* or 186,000 mps *in vacuo* inre the grid, the motion of the photon generates a linear timepiece. Inre a linear timepiece, for every space-unit (SU) over which a entity (including a photon) travels there is a time-unit (TU) during which the entity travels over the space-unit. This mathematical relationship generates the linear timepiece.

The mathematical relationships which are illustrated and therefore graphed are the relative velocities (RVs) inre the motions/velocities of a photon and an entity.

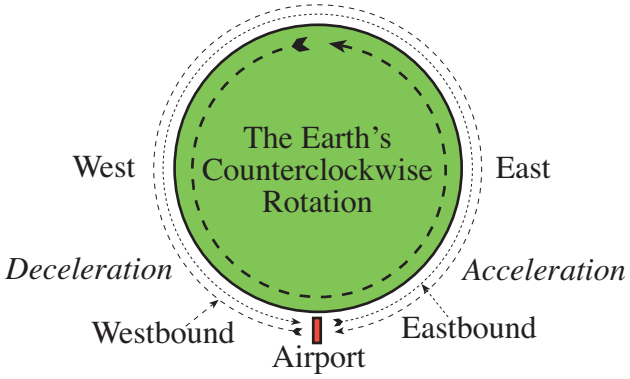
The Hafele-Keating C-Atom Clock Experiment [2]

The 19761 Hafele-Keating c-atom clock experiment reveals the relationship of clocks, directions of motion, accelerations and decelerations, timerates, timepoints, timelines, and timecounts inre time dilation or non-time-dilation.

http://hyperphysics.phy-astr.gsu.edu/hbase/relativ/airtim.html

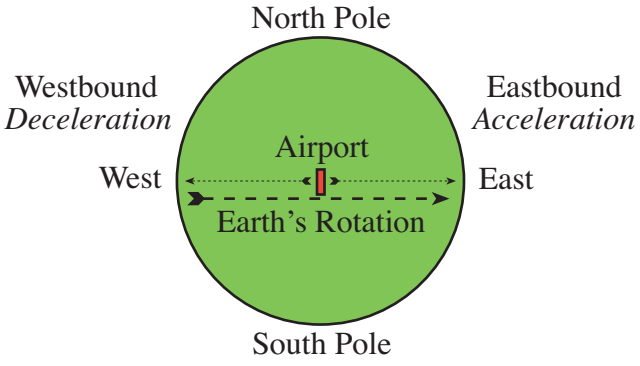
> "During October, 1971, four cesium atomic beam clocks were flown on regularly scheduled commercial jet flights around the world twice, once eastward and once westward, to test Einstein's theory of relativity with macroscopic clocks. From the actual flight paths of each trip, the theory predicted that the flying clocks, compared with reference clocks at the U.S. Naval Observatory, should have lost 40+/-23 nanoseconds during the eastward trip and should have gained 275+/-21 nanoseconds during the westward trip ... Relative to the atomic time scale of the U.S. Naval Observatory, the flying clocks lost 59+/-10 nanoseconds during the eastward trip and gained 273+/-7 nanosecond during the westward trip, where the errors are the corresponding standard deviations. These results provide an unambiguous empirical resolution of the famous clock "paradox" with macroscopic clocks."

J. C. Hafele and R. E. Keating, Science 177, 166 (1972)



Hafele-Keating FIG. 1A

The Hafele-Keating Experiment Observed from the Earth's North Pole
When an Observer Is Oriented with His/Her Right Shoulder to the East of the Airport



Hafele-Keating FIG. 2
The Hafele-Keating Experiment Observed from the Earth's Equator
When an Observer Is Faciong the Earth's Equator
and is Oriented with His/Her Head-Feet Aligned North-South
and His/Her Left-Right Shoulders Aligned toward West-East inre the Airport

The 1971 Hafele-Keating C-Atom Clock Experiment was intended by its authors to prove/disprove Einstein's claim that time is dilated (changed) when clocks are accelerated or decelerated.

The criteria for determining if/not time dilation occurred was to be a difference in the timecounts (readouts) inre the airborne clocks' timecounts and the Earthbound clock's timecounts: if a timecount difference was observed, then time dilation was to be considered to be proven.

The cesium-atom clocks (c-atom clocks) were the standard clocks of the USNO (RC clocks) used as the reference clocks and the airborne clocks (the 'flying clocks') used as the subject clocks.

Critical to the experiment was the fact that the airborne c-atom clocks were distortable clocks, VTICs. These distortable clocks, the airborne VTICs, would respond inversely to accelerations and decelerations with variations inre their timerates and timecounts. Accelerations would cause decreases in the airborne clocks' timerates and timecounts and decelerations would cause increases in the airborne clocks' timerates and timecounts.

Only timecount differences inre the airborne clocks' timecounts v the Earthbound clocks' timecounts would be used to determine if/not time dilation occurred:

Timecount Difference = Time Dilation
No Timecount Difference = No Time Dilation

If, however, timecount differences did in fact occur inre the airborne clocks' timecounts v the Earthbound clocks' timecounts, then that fact would imply/infer and thereby prove that the airborne clocks' timerates and therefore their rates of operations (rates of ticking) changed.

The fact that the distortable airborne clocks' timerates changed inversely with accelerations and decelerations will have a critical influence on the concept of time.

There were three reference frames/bodies inre the HK C-Atom Experiment: (1) The Earth's Reference Frame/Body; (2) The Eastbound Airliner Reference Frame/Body; and (3) The Westbound Airliner Reference Frame/Body.

Critical to the experiment was the fact that when launched from an airport which was the (1) Earthbound Reference Frame/Body the airliners ascended into two different reference frames: (2) The East-West Reference Frame (The Eastbound/Eastward Reference Frame) and (3) The West-East Reference Frame (The Westbound/Westward Reference Frame).

The Earth's counterclockwise rotation about its North-South axis produces the result of an acceleration of an airliner when flown eastward from an airport and the result of a deceleration of an airliner when flown westward from the same airport.

The eastward acceleration produced a decrease in the airborne clocks' timecounts; the westward deceleration produced an increase in the airborne clocks' timecounts.

The eastward acceleration and the resulting decrease in the airborne clocks' timecounts proves that while airborne eastward and therefore accelerated the airborne clocks' timerates decreased; the westward deceleration and the resulting increase in the airborne clocks' timecounts proves that while airborne and therefore decelerated the airborne clocks' timerates increased.

The eastward acceleration and the resulting decrease in the airborne clocks' timerates and timecounts proves that the clocks' mechanisms' motions decelerated/slowed down and not that the durations measured by the decelerated/slowed down clocks decreased/slowed down; the westward deceleration and the resulting increase in the airborne clocks' timerates and timecounts prove that the clocks' mechanisms' motions accelerated/speeded up and not that the durations measured by the accelerated/speeded up clocks accelerated/speeded up.

When time is defined as the measurement of duration by the use of a chosen duration (when time is defined as the use of a chosen duration to measure other durations) and the measurement of durations is coincidental/proximal (non-causal) to those measured durations, then we can intuit that there is no *thing* that exists in space, endures over time and is comprised of matter-energy that is *time*.

The Hafele-Keating C-Atom Clock Experiment confirmed not that time slowed or speeded when c-atom clocks were loaded aboard airplanes and sent into different directions at different velocities and therefore into different reference frames but that the clocks themselves slowed or speeded when accelerated or decelerated.

This slowing and speeding occurred regardless of where the clocks were located or oriented inre the x- and y- and z-axes inre the airplanes' reference frames.

This result suggests that the clocks' components' lengths and distances apart changed uniformly inre all axes, not only the x-axis. If that were not the case, then the clocks would not have operated as designed.

The cause of the c-atom clocks' slowing when accelerated or speeding when decelerated is the increase or decrease in the clocks' kinetic mass-energies (KMEs) caused by accelerations or decelerations.

With an acceleration, the clocks' KMEs increased and the clocks' timerates and timecounts decreased; with a deceleration, the clocks' KMEs decreased and the clocks' timerates and timecounts increased.

The airborne clocks in the HK c-atom clock experiment were distortable clocks and therefore they were VTICs.

Distortable clocks, VTICs, were therefore used to prove the 'reality' of time dilation.

Einstein's claim of time dilation in special relativity thus lives and dies by timecount and timerate differences inre airborne clocks vs the earthbound standard clocks.

Timecount Difference = Time Dilation
No Timecount Difference = No Time Dilation

Non-distortable clocks, ITICs, are realities. They are found as radio clocks (RCs) inre the USNO standard clocks, the US NIST standard clocks, the BIPM standard clocks, and the US GPS nav system clocks, and they are found as inertial clocks (ICs) in the inertial navigation systems (INSs) found in military and civilian aircraft and ships.

If the HK c-atom clock experiment were replicated using both distortable VTICs and non-distortable ITICs, then the VTICs would again reveal timecount and therefore timerate differences inre themselves and the Earthbound standard clocks but the ITICs would reveal zero timecount and therefore zero timerate differences inre themselves and the Earthbound standard clocks.

This result, VTICs = timerate and timecount differences = time dilation but ITICs = no timerate and no timecount differences = no time dilation, is proof that there are two types of time, VTICT/LT and ITICT/AT.

Timecount Difference = Time Dilation
No Timecount Difference = No Time Dilation

Newton was right: Absolute time is a temporal reality.

Absolute Velocity (AV)

One of the results of the HK experiment is the fact that when a clock has been returned to the earth's surface it resumes its original timerate and timecount.

This result suggests that there is an absolute relationship inre timepieces' timerates and timecounts and velocity and gravity that if the Earth's velocity and gravity were replicated inre an Earthclock then they will cause the Earthclock to have the same timerate and timecount as the Earthclock had while on Earth.

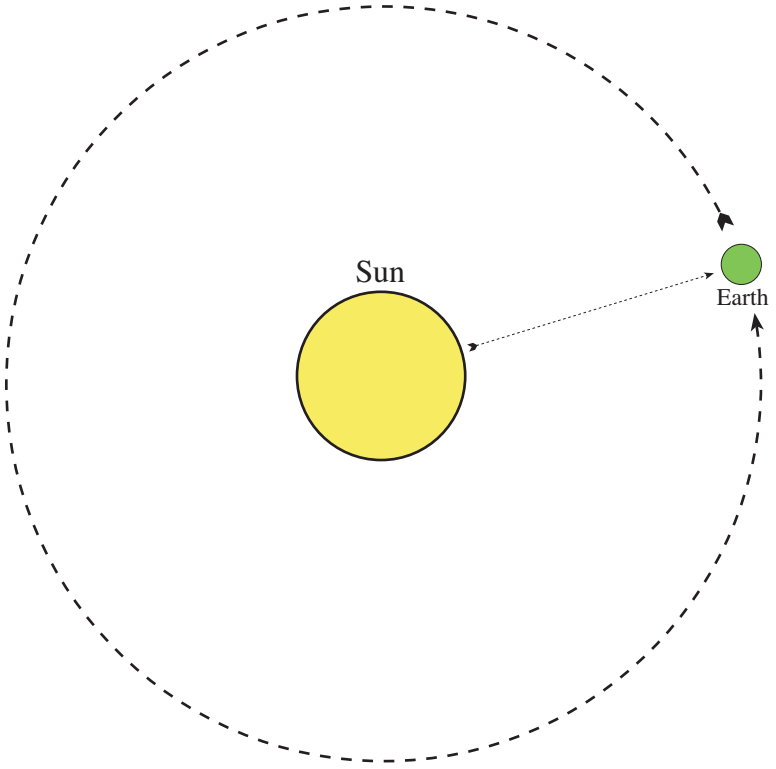
A clock will have a specific timerate and timecount on Earth. If the Earth's velocity and gravity values were replicated somewhere in space on a planet which has the same velocity and gravity as the Earth then an Earthclock relocated to that planet will have the same Earth timerate and timecount as it had while on Earth.

This result is the essence of proof of absolute relationships in the universe. Two of the universal components, distance as space, the spatial component, and duration as time, the temporal component, are independent of each other and of matter and energy and are therefore absolutes. The measurement of space and time will, under ideal conditions of coincidentiality and the use of adjustable/non-distortable clocks, produce no disturbances of distance nor duration nor the motions of stuffs that are comprised of m/e, therefore m/e is independent of space and time.

The Distance and Duration Relationship

Regardless of who or what is measuring the distance from the Sun to the Earth and the duration of the motion of a photon traveling from the Sun to the Earth, there is a distance inre the Sun and the Earth and a duration inre the motion of a photon traveling from the Sun to the Earth that do not change.

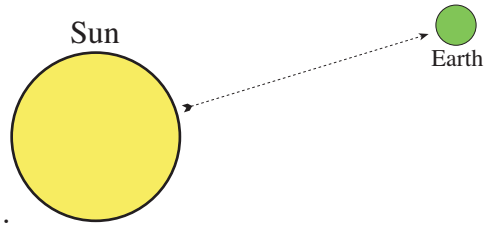
The Earth has an orbit about the Sun.



The Earth's Counterclockwise Orbit About The Sun
When Viewed Perpendicular to the Plane of the Earth's Orbit

There is a Sun-Earth distance/duration relationship that basically remains stable despite the fact that the Earth's orbit about the Sun is an elipse instead of a pure circle. At any chosen timepoint inre the Earth's position inre its orbit about the Sun the Sun-Earth distance is known to a reasonable degree of accuracy.

The stability of the Sun-Earth distance/duration relationship means that a photon that has a velocity of 186,282 mps or ***c*** will travel from the Sun to the Earth in approximately 8 minutes when "The *standard second* is defined to be 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom". [1]



The Photon Sun-Earth Distance/Duration/Motion Relationship

The fact that regardless of who/what measures the Photon Sun-Earth distance/duration relationship that relationship does not change is proof that there are absolute distances and absolute durations in the universe.

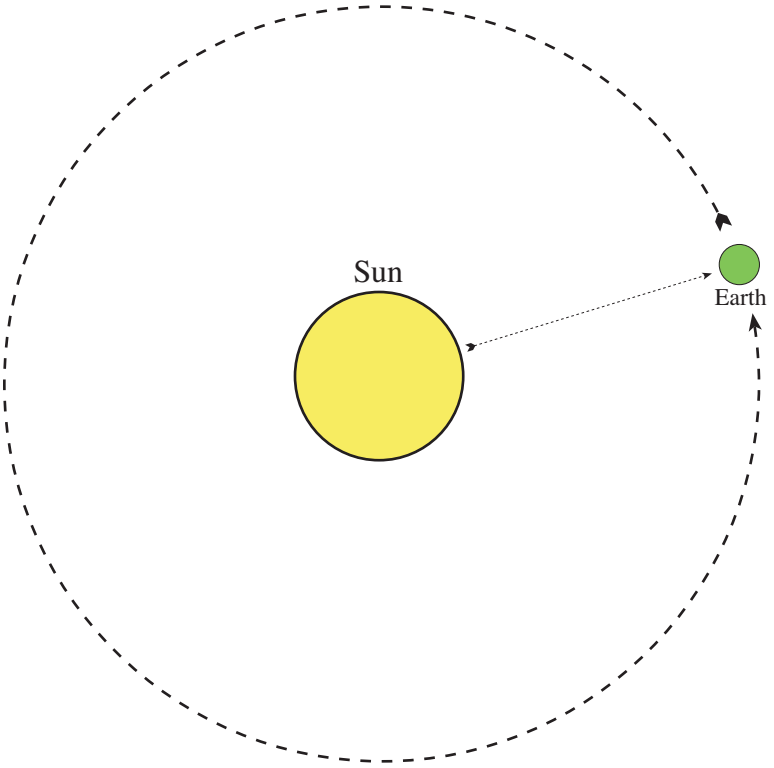
Regardless of who/what measures the Photon Sun-Earth distance/duration, that distance/duration relationship can be used to define an absolute distance (Sun-Earth) and an absolute duration (the duration of the motion of the Photon traveling from the Sun to the Earth through space over time).

Whereas any chosen distance can be used as a unit of spatial measurement, a space-interval (SI), and any chosen duration can be used as a unit of temporal measurement, the time-interval (TI), the Sun-Earth distance can be chosen as a standard distance for absolute space (AS) and the Sun-Earth Photon motion duration can be used as a standard duration for absolute time (AT, ITITC).

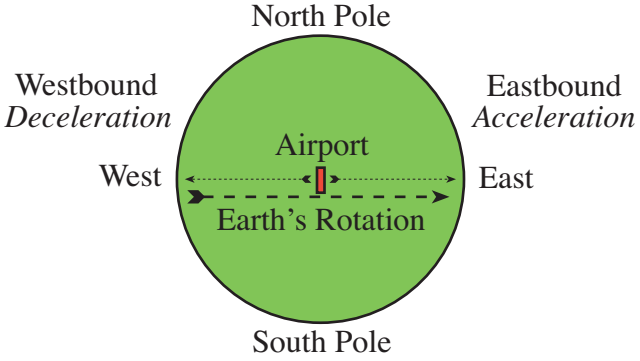
Problems develop when observers measure distances and durations with distortable measuring devices. When observers and their measuring devices, including rulers and clocks, rulers for measuring distance and clocks for measuring duration, are accelerated or decelerated, then the rulers change lengths and the clocks change timerates and timecounts. These changes which are distortions caused by accelerations and decelerations produce variations in the measurement values when the distortable measuring devices are used to measure those distances and durations including the Photon Sun-Earth distance/duration relationship that are known to be non-distorted and therefore absolute.

Under ideal measurement conditions, the rulers and clocks used for spatial and temporal measurement are coincidental to the distances and durations measured and thereby are not causal inre those measured distances and durations, meaning the rulers and clocks used for spatial and temporal measurement under ideal conditions do not cause changes in the measured distances and durations.

Any circular or rotating motion can be intuited to be straightened for the purposes of intuitive analysis.

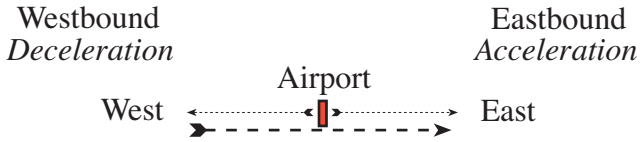


The Earth's Counterclockwise Orbit About The Sun
When Viewed Perpendicular to the Plane of the Earth's Orbit



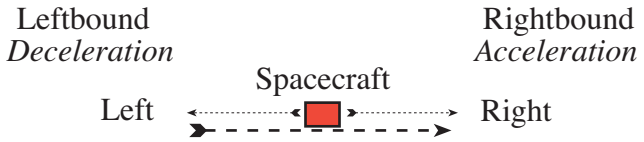
Hafele-Keating FIG. 1A
The Hafele-Keating Experiment Observed
When an Observer Is Facing the Earth's Equator
with His/Her Head Oriented towards the North Pole
and with His/Her Feet Oriented towards the South Pole
and with His/Her Right Shoulder Oriented towards the East
and with His/Her Left Shoulder Oriented towards the West

The circular pathways and motions of airliners launched from an Earthbound airport that itself has a circular motion caused by the Earth's rotation about its axis can be straightened.



The Straightened Pathway of an Airport Previously Located on the Earth's Equator

The Earth has been removed from the preceding diagram and the West-to-East motion of the Airport is now straightened. Because the Airport has a West-to-East motion, aircraft launched from the Airport westbound are observed to be decelerated while aircraft launched from the Airport eastbound are observed to be accelerated.



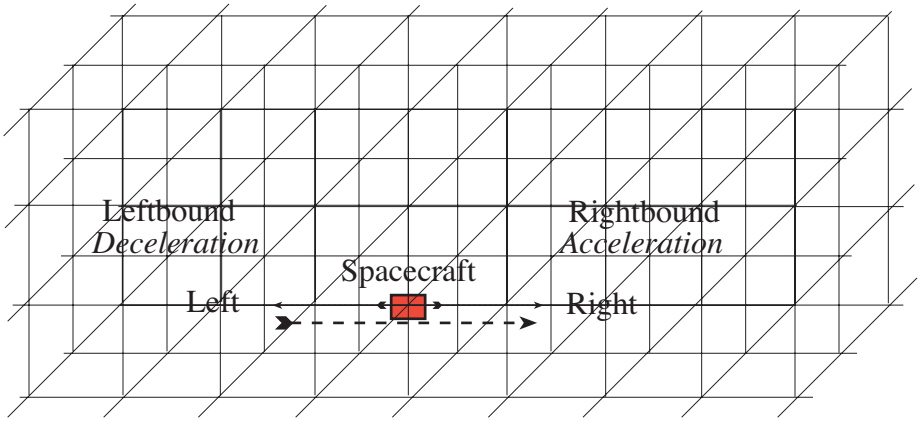
The Straightened Pathway with a Spacecraft Replacing the Airport

The Airport has been replaced by a Spacecraft. The Spacecraft is in-motion from left-to-right. The Spacecraft has the Earth's velocity. The Spacecraft's velocity is an absolute velocity (AV) because of the fact that clocks aboard the Spacecraft will be observed to re-assume their original timerates when the Spacecraft and the clocks are returned from space to the Earth's surface – an observation that could not occur if the Earth did not have an AV.

Any other Spacecraft launched from the Mother Spacecraft leftbound will be observed to be decelerated while other Spacecraft launched from the Mother Spacecraft rightbound will be observed to be accelerated.

Observers aboard the Spacecraft can determine if/not the Spacecraft has been accelerated or decelerated by observing the timerate and timecount changes of onboard VTICs and ITICs. Onboard VTICs'timerates and timecounts and onboard observer's perceptions of onboard VTICs' timerates and timecounts will change at the same rate with the result that the observers will observe no change in the onboard VTICs' timerates and timecounts. Onboard ITICs' timerates will not change but the onboard observers will observe changes in the onboard ITICs' timerates and timecounts because their – the observers' – perception rates changed with accelerations and decelerations. As the onboard observers' perception rates change with accelerations and decelerations, they – the onboard observers – will observe the onboard ITICs' timerates and timecounts increase with accelerations and decrease with decelerations. This set of observations is an illusion called the Moving Observer Illusion (MOI).

The result of the straightening of a Spacecraft's circular motions is the Spacecraft in-motion through a Spacegrid that is at-rest at AV = 0.00 mps in which lines are perfectly straight and extend infinitely equidistant and parallel or perpendicular to each other in three axes, x-axis, y-axis and z-axis, from equidistant origins.



The Spacegrid

From this intuition the motion of the Spacecraft can be observed to create a set of conditions wherein

regardless of the value of the Spacecraft's velocity (v = speed and direction) other Spacecraft launched from it will either be decelerated or accelerated because of their relative velocities (RVs) inre the Spacecraft's velocity inre the Spacegrid.

The concepts of acceleration and deceleration require a Euclidean Spacegrid to make sense. When an object is in-motion, it is in-motion relative to the Spacegrid and therefore has an AV which determines acceleration to occur when an object is launched in the same direction of motion (SDoM) and deceleration to occur when an object is launched in the opposite direction of motion (ODoM).

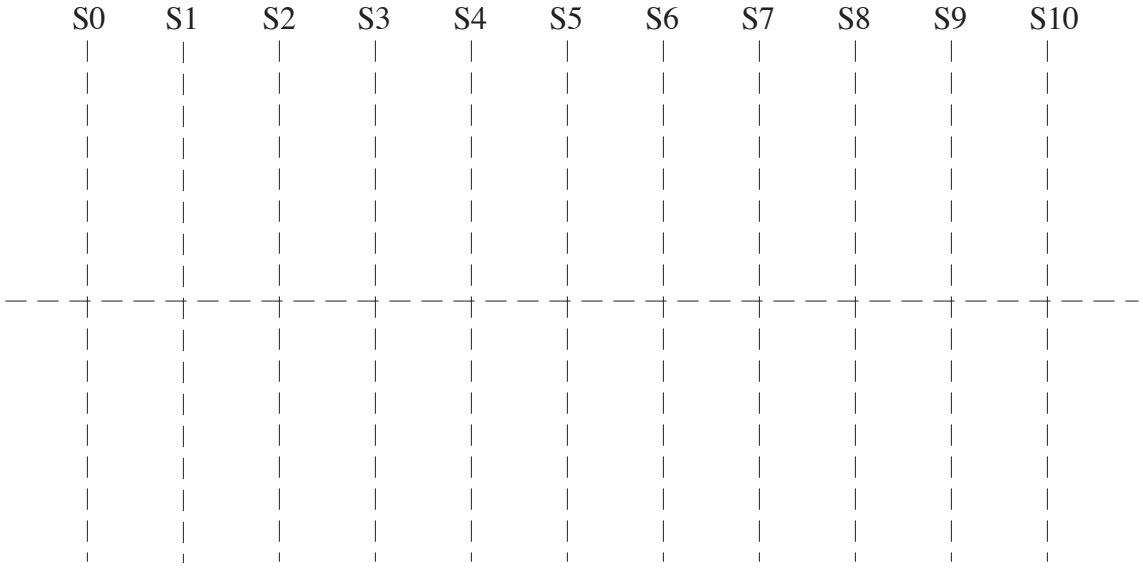
When an object is launched SDoM from a body that has an AV_1, then the object will have an AV_2 that will be greater than the body's AV_1, and there is a relative velocity (RV) inre the object and the body that is described by the formula $RV = AV_2 - AV_1$.

When an object is launched ODoM from a body that has an AV_1, then the object will have an AV_2 that will be less than the body's AV_1, and there is an RV inre the object and the body that is described by the formula $RV = AV_1 - AV_2$.

The Necessity for the Euclidean Spacegrid

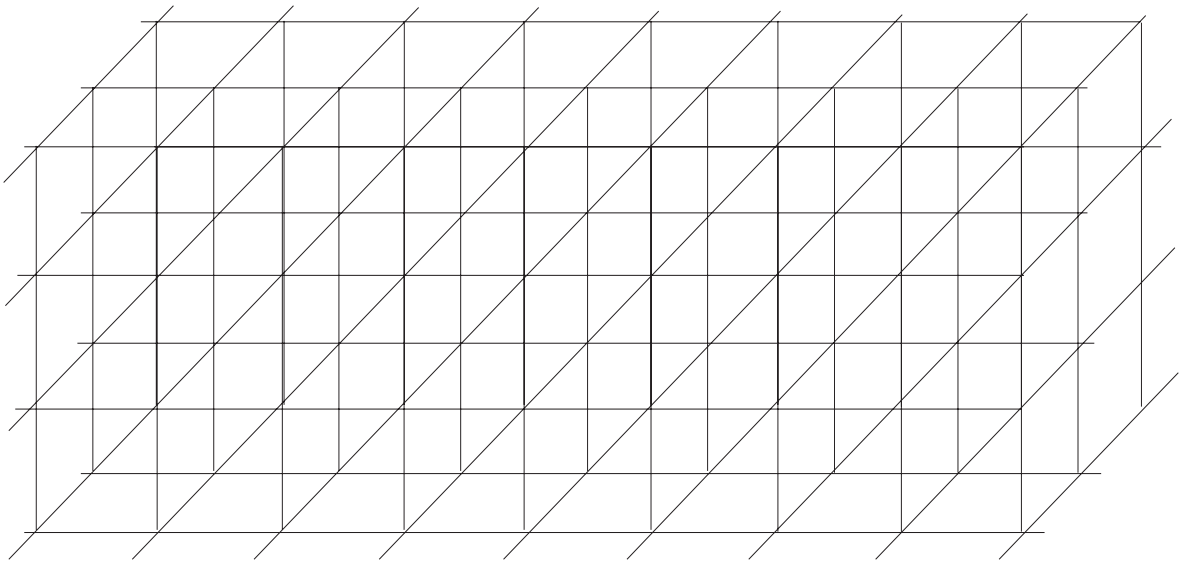
Many of the diagrams presented herein present a Euclidean Spacegrid as a reference frame. The Spacegrid consists of perfectly straight lines (they are not curved geodesics) of infinite length (1) which are extended from spacepoints which are equidistant from each other and (2) which are positioned equidistant from and parallel or/and perpendicular to each other. The Spacegrid is at-rest at absolute rest (AR) at an absolute velocity (AV) of $AV_0 = 0.00$ mps in the absolute rest reference frame (ARRF).

The Spacegrid is presented herein as a two-dimensional illustration.



Two-Dimensional Representation of the Spacegrid

The Spacegrid itself is three-dimensional.



Three-Dimensional Representation of the Spacegrid

The Spacegrid is not supposed to exist. It can only be intuited; it cannot be observed or measured.

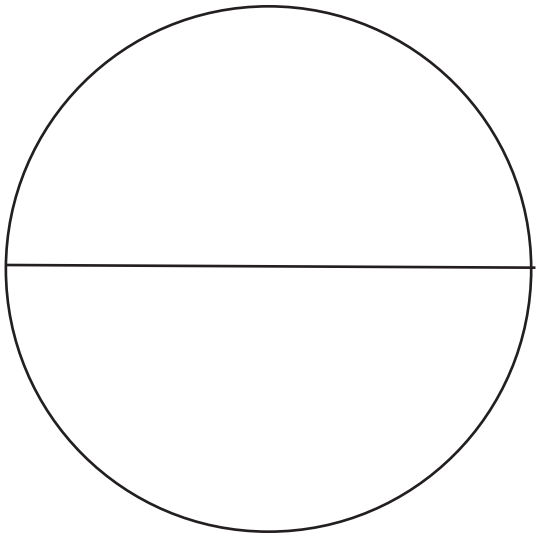
However, under the assumptions (1) that there is a specific spacepoint at which a light source (LS) emits a lightwave (LW) or a lightray (LR) or a photon and (2) that light emission spacepoint (LES) does not move because it is at-rest at AR at an $AV_0 = 0.00$ mps in the ARRF which is also the light emission spacepoint reference frame (LESRF), the Spacegrid can be intuited to exist as a reference frame within which entities are at $AV_0 = 0.00$ mps and $RV_0 = 0.00$ mps relative to each other and from which (relative to which) LWs or LRs or photons are emitted at ***c*** or AV = 186,000 mps.

The Spacegrid answers the question of to what is the motion of light relative: the motion of light is relative to the Spacegrid which is the ARRF which is the LESRF and the motion of light at AV = ***c*** or 186,000 mps is also relative to objects which are at AR at $AV_0 = 0.00$ mps and at RV = 0.00 mps relative to each other in the ARRF/LESRF.

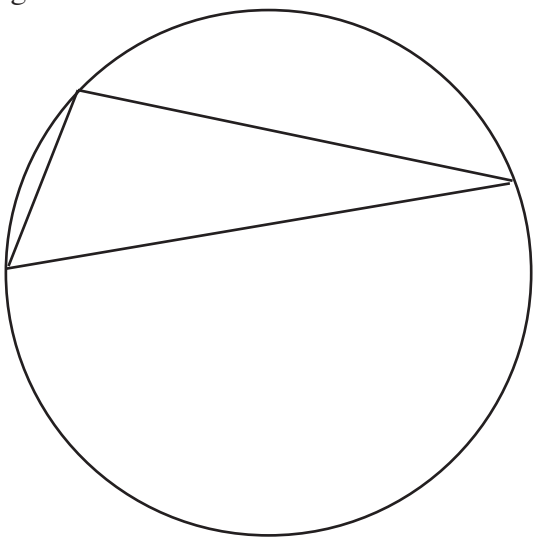
Recent experiments have proven that space is essentially flat, meaning it is neither positively or negatively curved. Whatever *that* means, the Spacegrid is supposed to exist only in whatever is flat space. Whereas space is proven to be flat, then the Spacegrid has the flat space required for it to exist, therefore it exists, and it exists regardless of whether or not observers can observe and measure it.

Without the existence of the Spacegrid, none of the diagrams presented herein, including Einstein's Railroad Diagram, make sense. There would be nothing available as a reference frame inre which observations and measurements could be made.

Any requirement that Spacelines somehow must be curved geodesics (curved lines) similar to lines drawn over the surface of the Earth is eliminated by the intuition that straight geodesics (straight lines) can be drawn within a reference body between points on the reference body's surface as if the reference body was hollow and devoid of m/e.

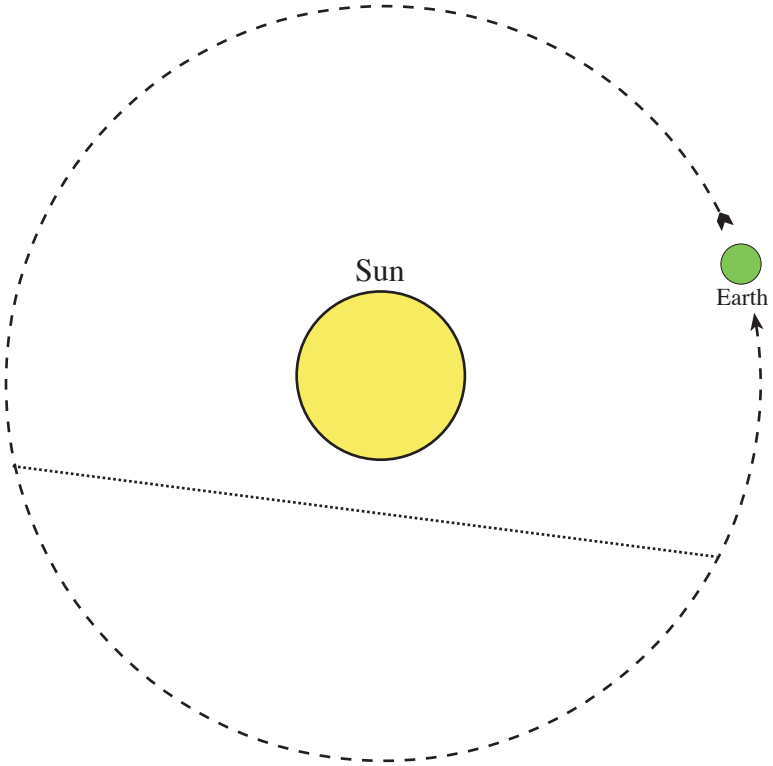


Straight Lines within a Hollow Reference Body 1

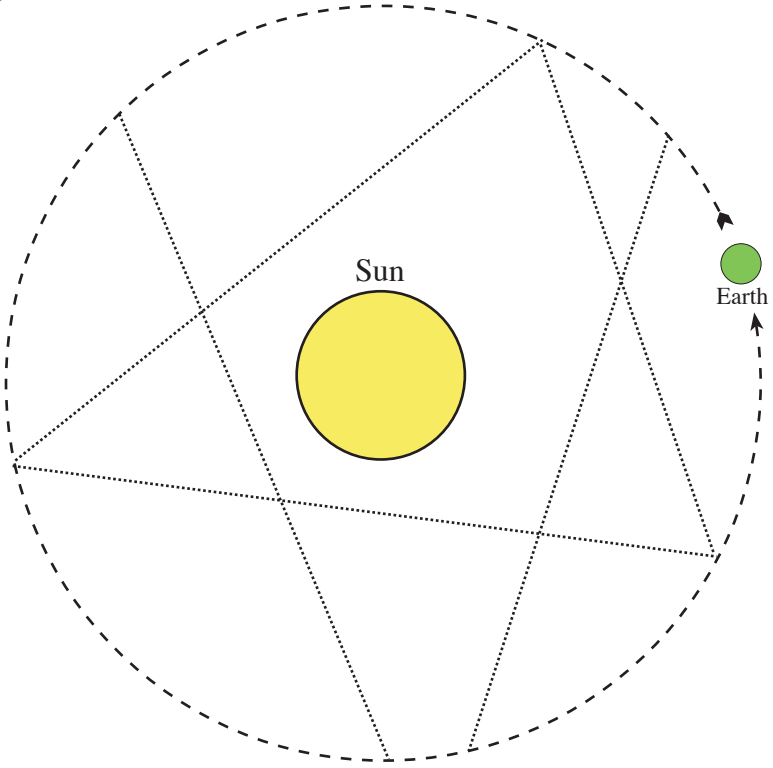


Straight Lines within a Hollow Reference Body 2

The straight lines drawn within a reference body as if the reference body was a hollow sphere are similar to the straight lines that can be drawn between points on the orbit of the Earth about the Sun.



Straight Line Drawn between Points on the Earth's Orbit about the Sun



Straight Lines Drawn between Points on the Earth's Orbit about the Sun

Whereas the straight line shown above are intuited to extend between points on the Earth's orbit about the Sun, and theoretically they cannot be observed and measured, nevertheless they are examples of an intuition that describes accurately a reality – that straight lines within space are realities.

Intuitions

Intuitions which are fact-based can reveal causal and coincidental relationships that are realities regardless of whether or not they can be observed and measured. Intuitions are mental representations (ideas) which can be relevant to observable and therefore actual people, objects and events or relevant to actual people, objects and events who/which are unobservable.

The key to an intuition is the use of imagination – wondering if/not a concept or a principle has a relationship and therefore a relevancy to another concept or principle.

When a continuum of absolute time (CoAT) is established, by intuition (the mental manipulation of mental representations of people, objects and events – concepts – and mental representations of causal and coincidental relationships between/among people, objects and events – principles) if not reality (by observations and measurements of people, objects and events who/which are comprised of m/e and who/which as causes cause as effects {A} changes in the physical states of pre-existing people, objects or/and events or {B} new people, objects or/and events from pre-existing m/e), then at each timepoint there will be a configuration of the universal m/e system (UMES) which will exist for only the duration of the time period assigned to the timepoint after which the UMES configuration will change because of the changes of the positions of particles and people and objects which constitute the UMES. There will be the totality of the UMES at each timepoint regardless of whether or not all particles, people and objects can be observed simultaneously. People, objects and events are observed directly by physical phenomena relevant to the five perceptual senses of sight, hearing, touch, smell, and taste. The most commonly used perceptual sense is the sense of sight which is the perception of light originating or reflected from people, objects and events. Observers know that there are people and objects which exist beyond their present timepoint observations because the observers could observe the previously unseen people, objects and events if and when the observers change their direction of motion (DoM) and light from those previously unobserved particles, people and objects is observed. Thus without being able to observe them directly, observers know that particles, people and objects are present but are beyond or outside or in addition to the particles, people and objects they observe at a timepoint.

If an individual is present during the timepoint when a photograph was taken he/she might not have observed another individual standing behind him/her because light from that other individual was not observed by his/her sight sensory organs but when he/she observes the photograph then he/she learns that the other individual did in fact exist during or at the timepoint when the photograph was taken.

Photographs are two-dimensional representations of reality. Nevertheless, they show the existence of people, objects and events that were present, that existed, that endured, that were realities when the photographs were taken regardless of whether or not observers in the photographs and therefore present during the timepoints when the photographs were taken observed those people, objects and events.

If three-dimensional holograms could be taken of the entire UMES at specific timepoints then those holograms would reveal additional people, objects and events who/which were present but unobserved by some of the observers who also were present at the timepoints when the holograms were taken.

Einstein's thought experiment wherein he intuited (imagined) himself traveling at the speed of light alongside and parallel to a lightwave and in the same direction of motion of the forward edge of the lightwave that was also traveling at the speed of light enabled him to determine that because light from the lightwave could not travel the distance (the space-interval) from the lightwave to him that he could not observe the lightwave. In his intuition, Einstein took liberties by assuming that he could travel at the speed of light parallel to and in the same direction of the forward edge of a lightwave that was also traveling at the speed of light. Whereas no human was ever observed traveling at the speed of light and no human is ever expected to travel at the speed of light then although the assumptions were imagined instead of observed nevertheless the intuition revealed a fact inre a physical phenomenon which is that although people, objects and events can be realities and therefore exist that it is possible that they cannot be observed directly because the motions of lightwaves coming from those people, objects and events may be such that the lightwaves may not be observable by some observers.

Thus, some realities can be intuited regardless of whether/not they have been observed in the past, are observed in the present, or could be observed in the future.

Absolute time (AT or ITICT) is a temporal reality because there is proof that ITICs (RITICs/RCs and IITICs/ICs) are realities and measure ITICT/AT, therefore ITICs and ITICT are not mere intuitions but are realities – are the manifestations of the absolute time temporal principle, the use of an invariable time-interval duration to measure other durations. By the use of intuition a network of ITICs can be imagined to be positioned throughout space that could provide the absolute time timepoints necessary to be able to determine the sequences of events, the simultaneities of events, the causalities and coincidentialities of people, objects and events, and the changerates of events, and thus if humans could never find natural cycles that were invariable inre their cycle rates that could be used as invariable time-intervals nevertheless humans could create artificial invariable cycles that could function as invariable time-intervals (ITIs) that could be used to measure ITICT/AT.

By the use of intuition, humans can imagine space to be infinite in volume and therefore infinite in size, and that this infinite volume eliminates any possibility of the existence of another infinite volume, and that possibility eliminates any possibility of the existence of another space that could exist at the same timepoints at which exists the one-and-only space.

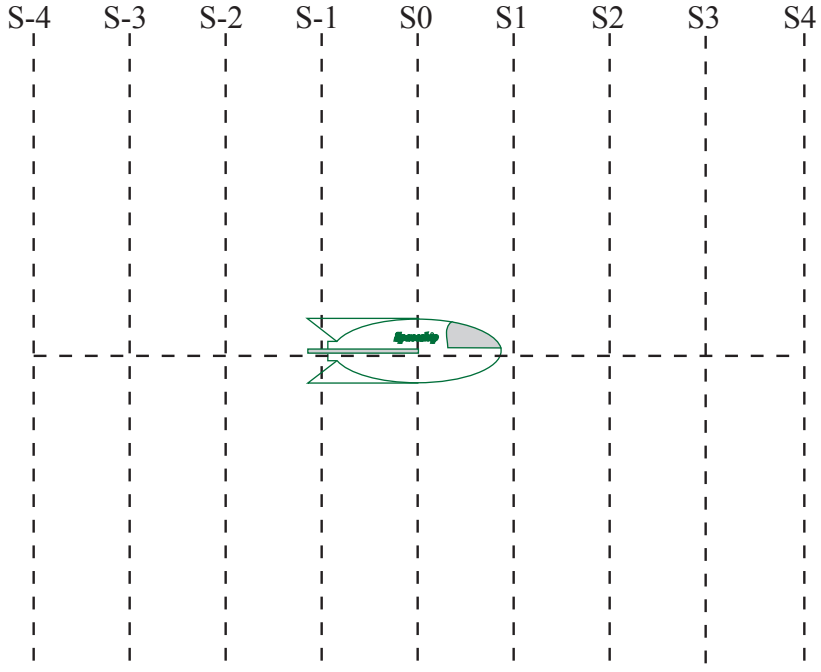
Thus, the use of intuition is one method by which knowledge (the set of accurate concepts and principles) of the realities of the space, time and m/e which are the components of the universe can be obtained.

The Intuition of the Spacegrid

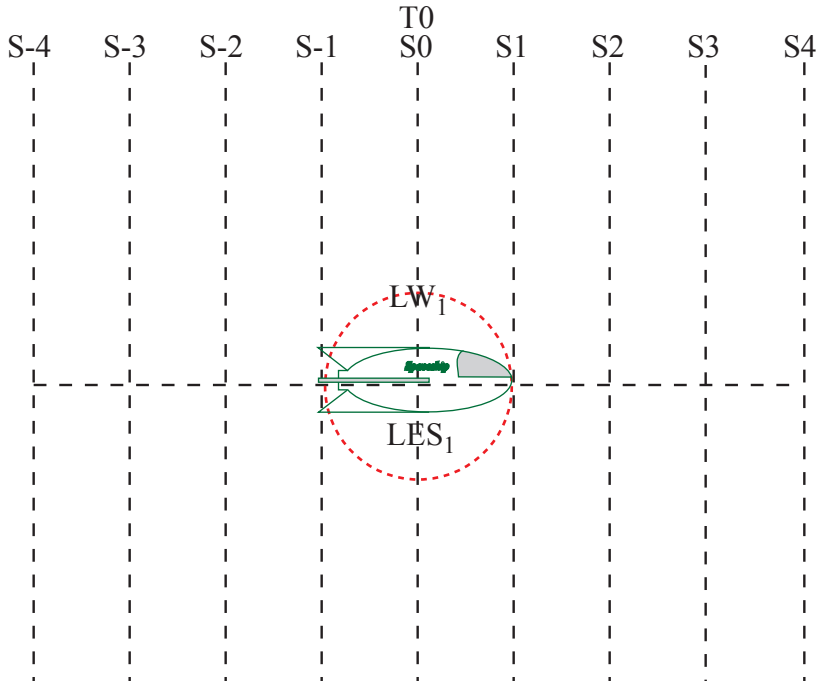
The Spacegrid can be intuited if not observed/measured directly or indirectly.

Imagine a Spacecraft traveling uniformly at any AV > 0.00 mps emitting lightwaves at equally-separated timepoints generated by an adjustable clock (non-distortable clock) and thereby at equally separated spacepoints.

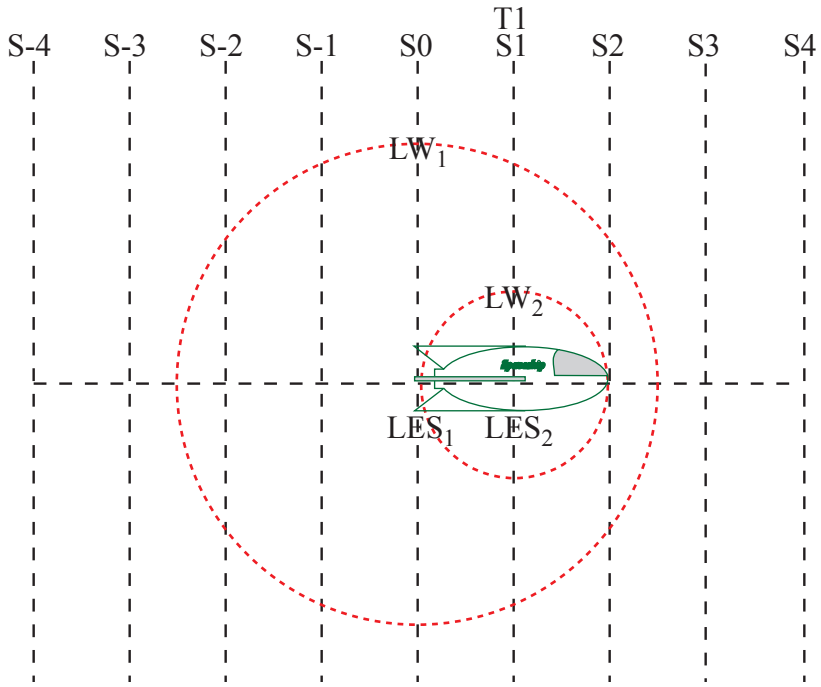
This process would generate the equally-spaced spacepoints necessary for the origins necessary for generating perfectly straight lines parallel and perpendicularly to each other which would be necessary for generating the Spacegrid.



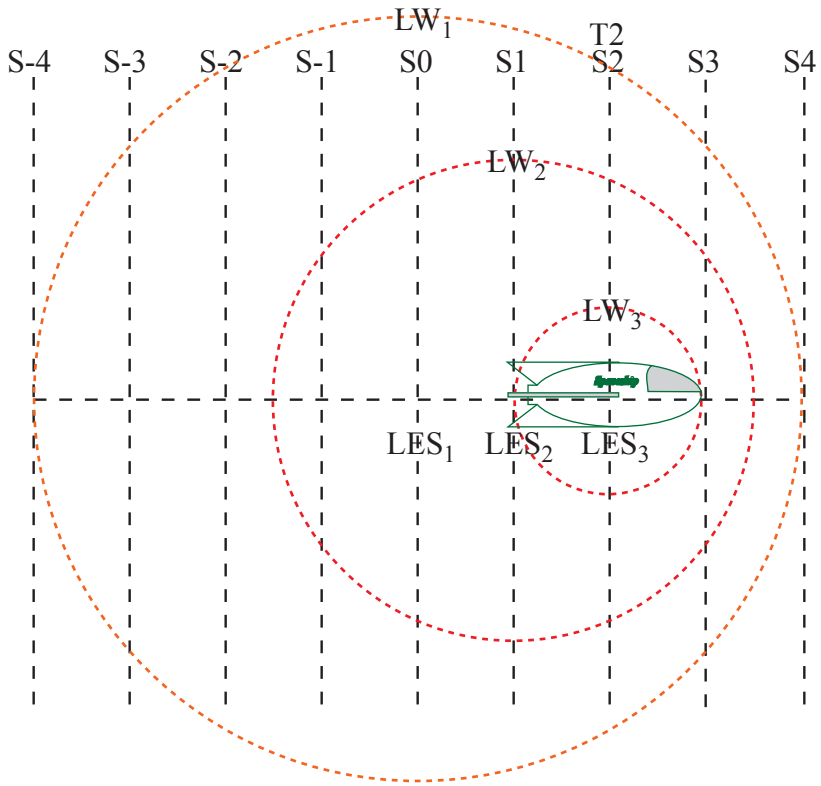
Spacegrid Diagram 1.0



Spacegrid Diagram 1.1.



Spacegrid Diagram 1.2.

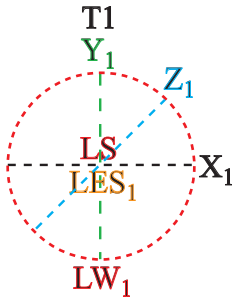


Spacegrid Diagram 1.3.

In the beginning (at Timepoint 0), there is a Light Source (LS) and a Light Emission Spacepoint (LES_0).

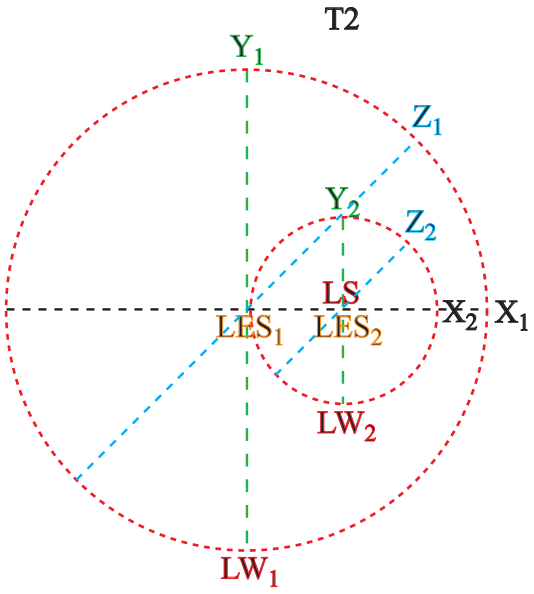
Spacegrid Diagram 1.0.1

At Timepoint T1, the LS has generated Lightwave 1 (LW_1) at Light Emission Spacepoint 1 (LES_1) from which Spacelines X_1, Y_1 and Z_1 extended.



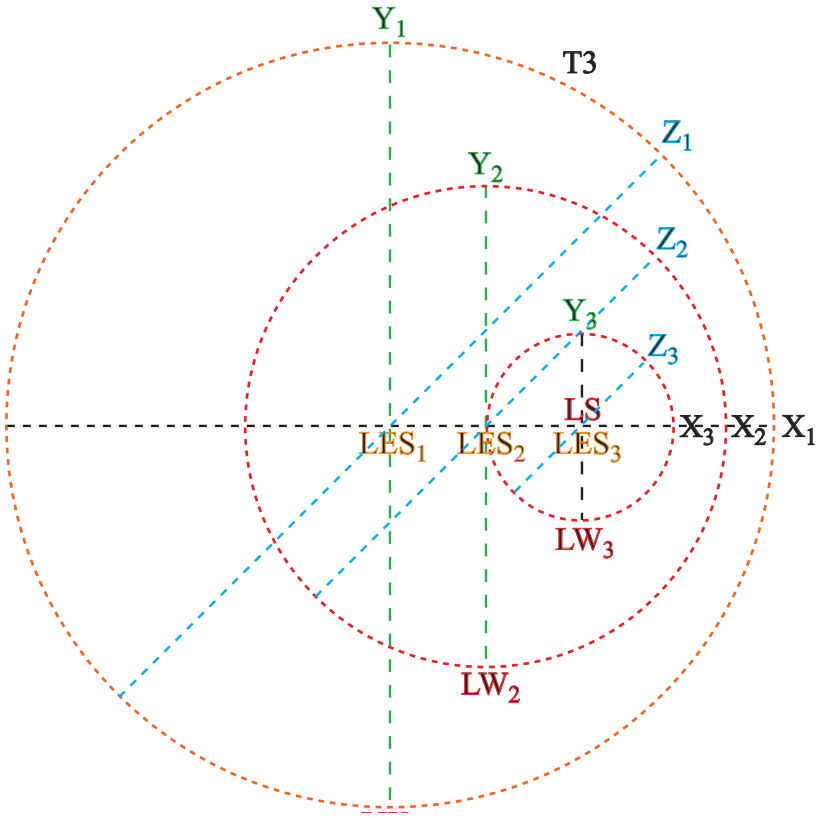
Spacegrid Diagram 1.1.1

At Timepoint T1, the LS generated Lightwave 2 (LW_2) at Light Emission Spacepoint 2 (LES_2) from which Spacelines X_2, Y_2 and Z_2 extended.



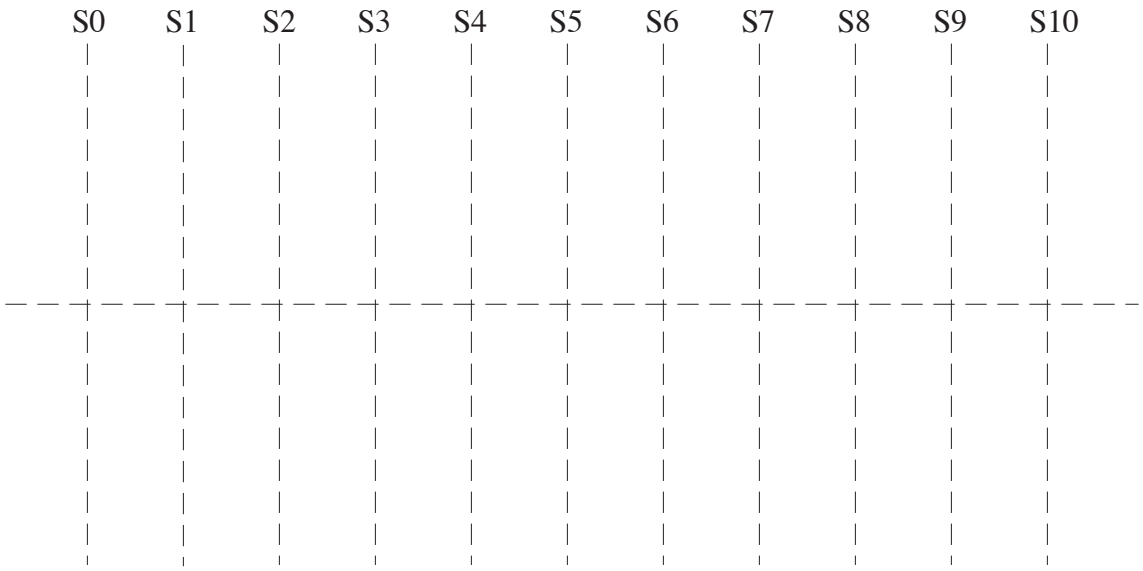
Spacegrid Diagram 1.2.1

At Timepoint T3, the LS generated Lightwave 3 (LW_3) at Light Emission Spacepoint 3 (LES_3) from which Spacelines X_3, Y_3 and Z_3 extended.



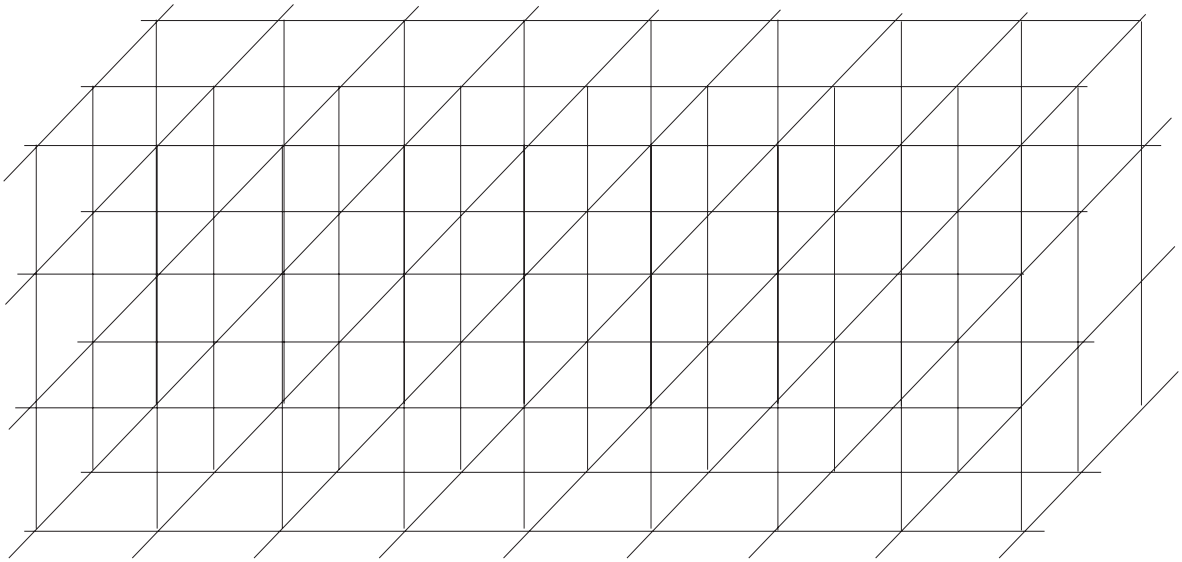
Spacegrid Diagram 1.3.1

The Spacegrid can be visualized and therefore intuited to be two-dimensional.



The Two-Dimensional Spacegrid

The Spacegrid can be visualized and therefore intuited to be three-dimensional.



The Three-Dimensional Spacegrid

Regardless of whether/not the Spacelines of the Spacegrid can be observed or measured, the intuition that has shown what the Spacegrid and its Spacelines can be is accurate because it is based upon the physical fact that the motion of a light source (LS) does not affect the motion – the velocity, the speed or direction – of a lightwave (LW) emitted from the light source and the assumptions (A) that there is a light emission spacepoint (LES) at which a lightwave is emitted and (B) that the light emission spacepoints (LESs) are at-rest and therefore are not-in-motion at AV = 0.00 mps at AR in the ARRF.

The Spacegrid's Spacelines are infinite in length. This condition causes the Spacegrid to have no boundary and therefore no surface and therefore no shape. The Spacegrid is essentially the i-volume which is space, the spatial component of the universe. The infinite size of the Spacegrid eliminates any possibilities that there could exist another Spacegrid under the assumption that two Spacegrids of infinite size could not co-exist within the i-volume, the one-and-only i-volume which is space.

The Concept of Absolute Velocity

In theory, and using intuition, the rotating motions of people and objects including particles and spacecrafts can be straightened.

In theory, and using intuition, the parallel motions of people and objects including particles and spacecrafts traveling in straight lines in opposite directions can be adjusted so they are parallel motions in the same direction of motion.

When the motions of people and objects including particles and spacecraft are adjusted so they are parallel and in the same direction of motion then the phenomena of absolute velocity (AV) and relative velocity (RV) become comprehensible.

If Spaceship A is traveling parallel to Spaceship B and in the same direction of motion, then both will have an AV and an RV.

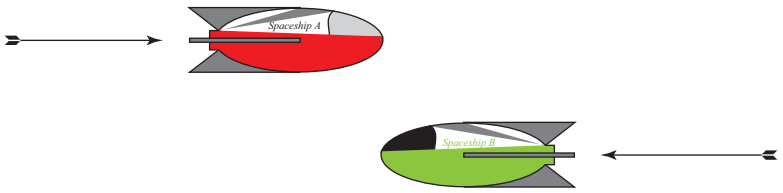
The RVs will be between themselves and can be determined by $RV_i = AV_1 \pm AV_2$ wherein AV_1 is the AV of one of the Spaceships, either Spaceship A or Spaceship B, and AV_2 is the AV of the other Spaceship, ie. $RV_i = AV_{Spaceship\ A} \pm AV_{Spaceship\ B}$.

Under these conditions, the motions of Spaceships A and B become RVs inre the motion of light, particularly, in theory, and using intuition, the AV of light which is measured to be 186,000 mps and theoretically is the absolute maximum velocity (AMaxV or $AV_{Maximum}$ or AV_{Max}) for any person or object including particles and spacecraft.

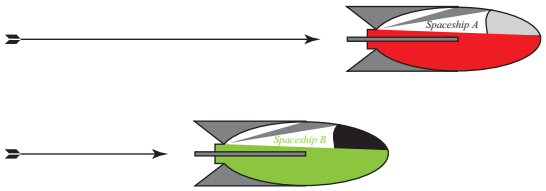
Thus, a light photon traveling parallel to and in the same direction of motion as that of Spaceships A and B would travel at AMaxV and therefore would be traveling faster than and Spaceship A or Spaceship B and would have an RV relative to Spaceship A of $RV_{Photon} = AV_{Photon} - AV_{Spaceship\ A}$.and an RV relative to Spaceship B of $RV_{Photon} = AV_{Photon} - AV_{Spaceship\ B}$.

When the AV_{Photon} is intuited to be an AV relative to some phenomenon in the concept of the universe as universe = space + time + m/e, the logical assumption is that the AV_{Photon} is relative to the spacepoint at which the photon was emitted from a light source (LS_{Photon}) at its specific light emission spacepoint (LES) in consideration of the fact that whereas the motion of a light source does not affect the motion of light/a photon the spacepoint at which a photon is emitted is not necessarily in motion and therefore can be assumed to be at rest at an absolute minimum velocity (AMinV or $AV_{Minimum}$ or AV_{Min}) of 0.00 mps which would be absolute rest (AR) and that spacepoint would be in the absolute rest reference frame (ARRF) which is also the light emission spacepoint reference frame (LESRF).

Here is an intuition of Spaceship A traveling parallel to Spaceship B but in the opposite direction of motion.



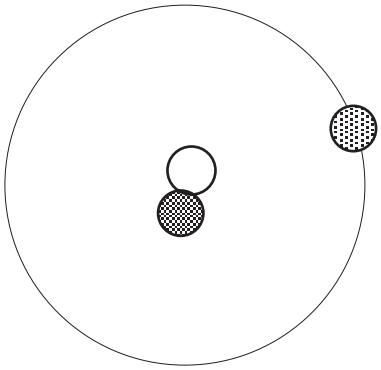
Here is an intuition of the motion of Spaceship B adjusted to travel in the same direction of motion as that of Spaceship A.



If the AV of Spaceship A is less than the AV of Spaceship B, then there would be an RV between Spaceships A and B which could be expressed by $RV_i = AV_{Spaceship\ A} - AV_{Spaceship\ B}$.

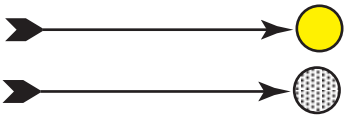
Here is an intuition of a photon traveling in a straightline motion at AV = 280,000 mps.

Here is an intuition of a hydrogen atom with one electron in a rotating orbital motion about its nucleus of one proton and one neutron.



Here is the intuition of adjusting the motion of the electron so the electron is in motion in a straight line.

Here is the intuition of the straightline motion of the electron traveling parallel to the straightline motion of a photon.



If the velocity of the electron is less than the velocity of the photon, then there will be an RV between the photon and the electron which could be expressed by $RV_i = AV_{Photon} - AV_{Electron}$.

These intuitions create the logical justification for the intuitions that the concept of absolute velocity (AV) and the concept of absolute rest (AR) are accurate mental representations (ideas) of actual physical phenomena.

These intuitions of the accuracy of the concept of absolute velocity (AV) and absolute rest (AR) create the logical justification for the intuitions of the absolute rest reference frame (ARRF) which is also the light emission spacepoint reference frame (LESRF).

References

[1] The Standard Second: http://physics.nist.gov/cuu/Units/second.html

The second is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium 133 atom.

[2] The Hafele-Keatiing C-Atom Clock Experiment

http://hyperphysics.phy-astr.gsu.edu/hbase/relativ/airtim.html

J. C. Hafele and R. E. Keating, Science 177, 166 (1972)

[3] Light Emission Theory Tests: The De Sitter Double Star Experiment

http://en.wikipedia.org/wiki/De_Sitter_double_star_experiment

ACRONYMS

AM = Absolute Motion
AR = Absolute Rest
ARRF = Absolute Rest Reference Frame
AS = Absolute Space
AT = Absolute Time (also Adjustable Time, NDT/Non-Distortable Time)
ATC = Absolute Time clock [Timerate does NOT vary with accelerations/decelerations; timerate does NOT vary directly with increases/decreases in an entity's kinetic mass-energy (KME or kme) caused by accelerations/decelerations]
AV = Absolute Velocity
AV_i = Absolute Velocity of an entity or a lightray or lightwave identified by an identification number ($\underline{i}$)
AV_E = Absolute Velocity of an Entity (E)
AV_L = Absolute Velocity (AV) of a Lightray or Lightwave (L)
c = The speed of light, 186,000 mps
ConFig = The ConFiguration (pattern) of the universal m/e system (UMES); a specific UMES ConFig is considered to occur at a specific timepoint (T0, T1, T2, ... etc.); the sum total of the m/e of the UMES is constant whereas because of the motions of people, objects and events including elementary, subatomic, and atomic particles and molecules which comprise people, objects and events the UMES ConFig is constantly changing
E = Energy
i = Identification number
I = Invariable
ITI = Invariable Time-Interval [Does NOT vary with accelerations/decelerations; does NOT vary directly with increases/decreases in an entity's kinetic mass-energy (KME or kme) caused by accelerations/decelerations]
ITIC = Invariable Time-Interval Clock [Timerate does NOT vary with accelerations/decelerations; timerate does NOT vary directly with increases/decreases in an entity's kinetic mass-energy (KME or kme) caused by accelerations/decelerations]
ITICT = Invariable Time-Interval Clock Time (also AT/Absolute Time)
K = Reference Frame
Ki = Reference Frame (K) with an identification number ($i - K1, K2, K3$, ... etc., or $K^i - K^1, K^2, K^3$, ... etc.); used instead of K', K'', K''', ... etc.
KME = Kinetic Mass-Energy [The mass of an entity at-rest or in-motion]
L = Local
LT = Local Time (Proper Time)
LTI = Local Time-Interval
LTC = Local Time Clock [Timerate varies inversely with accelerations/decelerations; timerate varies directly with increases/decreases in an entity's kinetic mass-energy (KME or kme) caused by accelerations/decelerations]
LES = Light Emission Spacepoint
LESRF = Light Emission Spacepoints Reference Frame
LESs = Light Emission Spacepoints
LR = Lightray
LRs = Lightrays
LS = Light Source
LSs = Light Sources
LW = Light Wave
M = Matter
M/E = Matter/Energy = Matter-Energy, the designation of the fact that matter and energy are two forms of the

same phenomenon, wherein $E = mc^2$ and $m = E/c^2$

n = The last number (n) of a series of numbers or the last of a series of persons, objects or events.

NCR = Natural Causal Relationship = Relationships wherein people, objects or/and events who/which are comprised of m/e in contrast to being concepts (mental representations/ideas of people, objects or/and events) or principles (mental representations/ideas of causal or proximal relationships between or among people, objects and/or events) cause as effects (A) changes in the physical states of pre-existing people, objects and/or events or (B) new people, objects and/or events from pre-existing m/e.

NPR = Natural Proximal Relationship = Relationships wherein people, objects and/or events who/which are comprised of m/e in contrast to being concepts and principles are coincidental/nearby but non-causal inre other people, objects and/or events

RF = Reference Frame

RV = Relative Velocity, the velocity difference between the motions of two entities ($RV_i = AV_1 \pm AV_2$) or the velocity difference between an entity and a reference frame, esp. the absolute rest reference frame (ARRF) or the light emission spacepoint reference frame (LESRF)

RV_E = Relative Velocity of an Entity inre a person, an object or an event.

RV_L = Relative Velocity of Light (or of an LR/Lightray or an LW/Lightwave) inre a person, an object or an event or inre a light emission spacepoint (LES) or inre another LR or LW; the RV_L of a lightray or lightwave inre a light source is $RV_L = AV_L \pm AV_E$ or is $RV_L = AV_L$ inre a light emission spacepoint (LES)

S = Space or Spacepoint; Space is the component of the universe whose dimension is distance which is measured by space-intervals which are chosen distances

Sx = Spacepoint x, wherein x is a number assigned to the spacepoint

T = Time or Timepoint; Time is the component of the universe whose dimension is duration which is measured by time-intervals which are chosen durations of periodic motions, cycles

TI = Time-Interval; the duration chosen of the unit of temporal measurement

Tx = Timepoint x, wherein x is a number assigned to the Timepoint

U = Universe (Universe = Space + Time + M/E)

UMES = Universal Matter-Energy System

USTME = Universe = Space + Time + M/E = Universe is *comprised* of Space/S, Time/T, Matter/M and Energy/E (Matter-Energy or M/E)

V = Velocity (sometimes *v* inre a specific velocity)

V = Variable

VTI = Variable Time-Interval [Varies inversely with accelerations/decelerations, varies directly with increases/decreases in an entity's kinetic-mass-energy (KME or kme) caused by accelerations/decelerations]

VTIC = Variable Time-Interval Clock [Timerate varies inversely with accelerations/decelerations; timerate varies directly with increases/decreases in an entity's kinetic mass-energy (KME or kme) caused by accelerations/decelerations]

VTICT = Variable Time-Interval Clock Time (also LT/Local Time, DT/Distortable Time)

GLOSSARY

Absolute (A) = Independent; that which is absolute cannot be caused to change.

Absolute Motion (AM) = The motion of an entity when that motion is observed either from the Absolute Rest Reference Frame (ARRF) or by an observer whose is using an Absolute Space Ruler (ASR – Non-Distortable Ruler, ISIR) and an Absolute Time Clock (ATC – Non-Distortable Clock, ITIC).

Absolute Rest (AR) = The physical state of having no motion, described by AV = 0.00 mps (Absolute Velocity = 0.00 miles per second); the physical state of being in the ARRF (Absolute Rest Reference Frame) which is also the LESRF (Light Emission Spacepoint Reference Frame).

Absolute Rest Reference Frame (ARRF) = The reference frame (RF) which has no motion (which is not in-motion) and which has an AV (Absolute Velocity) which is AV = 0.00 mps (or AV_{ARRF} = 0.00 mps)

Absolute Sequence = A_{SEQ} = The sequence of two or more event when measured using the timepoints and timeline of an invariable time-interval clock (ITIC – or Absolute Time Clock, ATC, either a radio clock or an inertial clock).

Absolute Simultaneity = A_{SIM} = The simultaniety (or non-simultaneity) of two or more events when measured using the timepoints and timeline of an invariable time-interval clock (ITIC – or Absolute Time Clock, ATC, either a radio clock or an inertial clock).

Absolute Space (AS) = Space defined as the i-volume which has no surface and therefore no shape, which is a pure vacuum, and which is measured by invariable (non-distortable) space-intervals (ISIs), which are spacemarks on invariable space-interval rulers (ISIRs), and which has no structure, i.e. which is NOT comprised of matter-energy (m/e), and thereby is not distortable.

Absolute Time (AT) = Time defined as the measurement of the durations between the occurrences of events, the durations of single events, and the durations (ages) of people and object by chosen durations which are invariable (non-distortable) time-intervals (ITIs), which are timemarks or timepoints on invariable time-interval clocks (ITICs) which are non-distortable because they are adjusted to compensate for the changes of their kinetic mass-energies (KMEs) caused by accelerations and decelerations.

Absolute Velocity (AV) = The velocity of an entity when measured (A) by observers from the absolute rest reference frame (ARRF) using rulers and clocks that have not been accelerated or decelerated (deceleration from the state of absolute rest – AR – is not possible because no entity can be decelerated from the AV = 0.00 mps which is AR in the ARRF) or (B) by observers using absolute space rulers (ASRs) and absolute time clocks (ATCs).

Causality = People, objects or/and events who/which are comprised of m/e and who/which as causes case as effects (A) changes in pre-existing people, objects and/or events or (B) new people, objects and/or events from pre-existing m/e.

The Causality Sequence (using numbers 1, 2, etc.) ...

1. P/Conditions/Causes → 2. Q/Consequence(s)/Effect(s)

The Causlity Sequence (using numbered timepoints T1, T2, etc.) ...

T1. P/Conditions/Causes → T2. Q/Consequence(s)/Effect(s)

Cause = Force which produces a change of inertial or physical state.

Changerate = Rate of change, rate at which change occurs, rate at which causality causes effects.

Coincidence/Coincidentiality = People, objects or/and events who/which are proximal to (near to, nearby, close to, related only distance, in position or location inre) other people, objects or/and events but who/which are not causal inre those other people, objects or/and events.

Condition (P) = A cause of an effect.

Consequence (Q) = An effect caused by a cause.

Continuum = Continuous whole, esp. inre dimensions of space/distance and time/duration.

Corollaries of the Law of Inertia = Laws which derive from the Law of Inertia:
1. A force is a form of m/e (matter-energy).
2. A force is either a push-force (that pushes an entity away from a position in space and thereby changes the entity's velocity) or a pull-force (that pulls an entity away from a position in space and thereby changes the entity's velocity).
3. Only a force can cause a change of an inertial state.
4. The observation of a change of an inertial state implies/infers that change to be an effect caused by a cause that is a force and therefore a form of m/e.

Corollaries of the Law of Physical States = Law which intuitively as well as physically derive from the Law of Physical States:
1. A force is a form of m/e (matter-energy).
2. A force is either a push-force (that pushes an entity away from a position in space and thereby changes the entity's velocity) or a pull-force (that pulls an entity away from a position in space and thereby changes the entity's velocity).
3. Only a force can cause a change of a physical state.
4. The observation of a change of an physical state implies/infers that change to be an effect caused by a cause that is a force and therefore a form of m/e.

Dimension = Characteristic or feature which can be measured; The three fundamental dimensions of physics are space/length/distance, time/duration, and mass.

Distortable (D, in Physics) = Being deformable when accelerated or decelerated. (*See* Non-Distortable)

Finite = Having spatial, temporal or/and physical limitations; *finity*, the state of being finite (contrast with *infinite* and *infinity*).

Finity = The state of being finite (contrast with *infinity*).

Force = The action of matter-energy (m/e) which results in a change of inertial state or of a physical state.

Inertia = Resistance to a change.

Inertia, The Law of (The Law of Inertia) = An entity having an inertial state of being in-motion or at-rest will remain in-motion or at-rest until acted upon by a force. (*See* also The Corollaries of the Law of Inertia.)

Inertial = Referenced to a state of being either in-motion or at-rest.

Inertial State = An entity's state of being either in-motion or at-rest.

Infinite = Having no spatial, temporal or/and physical limitations: *infinity*, the state of being infinite (contrast with *finite* and *finity*).

Invariable = Being unchangeable, unchanged, cannot be caused to change.

Non-Distortable (ND, in Physics) = Not deformable when subjected to accelerations or decelerations.

Origin = Reference from which measurements can be made, esp. inre measurements of space and time; measurements of space/distance/length are made in reference to a spatial origin (however, space is of infinite size, and space is of infinite duration, i.e. space has no beginning and no ending), measurements of time are made in reference to a continuum of time which has a temporal origin (however, time is of infinite duration, i.e. time has no beginning nor ending).

Physical = Having characteristics or features which can be observer and/or measured.

Physical State = State of having more characteristics and dimensions than an inertial state. (*See* Inertial State.)

Reference Body (RB) = The entity inre which measurements can be made of the positions and motions of other entities including people, objects and events.

Reference Frame (RF) = The set of coordinate axes used for the measurement of distances and durations inre people, objects or/and events, within which entities are at-rest inre each other (entities which have RVs = 0 mps inre each other, *see Relative Velocity* or *RV*).

Relative Velocity (RV) =

Sequence = An order or pattern inre people, objects or/and events as measured by a timepiece (clock, watch, etc.) A relative sequence is measured by local space rulers (LSRs, distortable rulers – DRs, non-adjustable rulers – NARs, relative space-interval rulers – RSIRs). An absolute sequence is measured by absolute space rulers (ASRs, non-distortable rulers, adjustable rulers, absolute space-interval rulers – ASIRs) and absolute time clocks (ATCs, non-distortable clocks, adjustable clocks, ITICs).

Simultaneity = The occurrence(s) of two or more events at the same timepoint, instant, moment, or timemark on the continuum of time. Local simultaneity is measured by Absolute simultaneity is measured by

Space (S) = The volume of infinite size, the *infinite volume*, or *i-volume*, which has no surface and therefore no shape, which is a perfect vacuum, the *void*, which surrounds (encompasses, includes) all finite-volumes, f-volumes (subvolumes of the i-volume which is space/the *void*) and which is the location in which entities comprised of matter-energy (m/e, including people and objects) endure over time (have a duration within time), space is the place; there is on-and-only space/i-volume, i.e. there are no other *spaces* which are outside, beyond, or in addition to, the one-and-only space/spatial component of the universe; because there is one-and-only-one space, and space is one of the components of the universe, then there is one-and-only-one universe; The combination of The Spatial Principle and The Spatial Process: The Spatial Principle: The measurement by the

use of chosen distances as space-intervals (SIs) of the distances between people, objects or/and events, and the distances inre which events occur (the use of chosen distances for the measurement of other distances), for the determination of the locations or positions of people, objects or/and events within space; The Spatial Process: The incorporation of the spatial principle into the design, fabrication and deployment of spacepieces (rulers, yardsticks, metersticks, etc.) which are used for spatial measurement; neither the spatial principle nor the spatial process are causal inre changing the measured distances.

Spacegrid = The set of equidistant perfectly straight lines of infinite length which originate from equidistant origins and which are either perpendicular or parallel to each other; the Spacegrid is the absolute rest reference frame (ARRF), the reference frame in which entities are at-rest inre each other and inre which light (lightrays, lightwaves, photons, etc.) travel past entities at *c*, the speed of light, 186,000 mps, and inre which light emission spacepoints (LESs) are at-rest inre each other and from which lightrays are emitted at *c*.

Spacepoint = Point in space, position, location; requires an origin.

Spatial Principle, The = The measurement by the use of chosen distances as space-intervals (SIs) of the distances between people, objects or/and events, and the distances inre which events occur (the use of chosen distances for the measurement of other distances), for the determination of the locations or positions of people, objects or/and events within space.

Spatial Process, The = The incorporation of the spatial principle into the design, fabrication and deployment of spacepieces (rulers, yardsticks, metersticks, etc.) which are used for spatial measurement.

Temporal Principle, The = The measurement by the use of chosen durations as time-intervals as units of temporal measurement of the durations between the occurrences of events, the durations of single events, and the durations (ages) of people and objects (the use of chosen durations for the measurement of other durations) for the determination of the sequence(s) of events, the simultaneities of events, the causalities of events, and the changerates of events, inre multiple or single reference frames/bodies.

Temporal Process, The = The incorporation of the temporal principle into the design, fabrication (construction) and deployment (usage) of timepieces (clocks, watches, etc.) which are used for temporal measurement.

Time (T) = The combination of the Temporal Principle and the Temporal Process: The Temporal Principle: The measurement by the use of chosen durations as time-intervals as units of temporal measurement of the durations between the occurrences of events, the durations of single events, and the durations (ages) of people and objects (the use of chosen durations for the measurement of other durations) for the determination of the sequence(s) of events, the simultaneities of events, the causalities of events, and the changerates of events, inre multiple or single reference frames/bodies; The Temporal Process: The implementation of the temporal principle into the design, fabrication (construction) and deployment (usage) of timepieces (clocks, watches, etc.) which are used for temporal measurement; neither the temporal principle nor the temporal process are causal inre changing the measured durations.

Timecount = Number designating the accumulation of time-intervals or durations, always from the past through the present into the future (the *arrow of time* being the progression of timepoints on a timeline from the past through the present into the future).

Timeline = Continuum of time, history, set of equidistant timepoints or timemarks from the past through the present into the future.

Timepoint = Point in time, timemark, mark on a timeline, mark on a contonuum of time, instant, moment.

Timerate = Rate of ticking of a clock (RoT), the rate at which time passes, is measured, is observed, the rate at which durations occur between events, durations occur inre single events, and durations (ages) in which people and objects endure (age).

Universe = Space + Time + M/E = The combination of the three components which are Space, Time and M/E (Matter/Energy).

Velocity = Speed and direction; the combination of speed and direction of motion. An entity that is in-motion has both a speed and a direction of motion. (*See* Relative Velocity – RV and Absolute Velocity – AV.)