

## The Light as a Super Reference Frame

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**Abstract:** Light kinematics and the special relativity can be reviewed accompanied with more dimensions, factors, conditions and especially revision of postulates. The Special Theory of Relativity gives the reference role to a moving body or its fictive light source. We analyzed reverse/opposite arrangement: The light is assigned as a reference frame and the other/local actors (moving body/source/observer) undertake relative roles. This revise/new concept is supported by the same experiments that they are effective for special theory. And new method is more functional for light kinematics and it allows cosmological analysis by providing the simultaneity and equivalency.

**Keywords:** Light kinematics, postulate, cosmologic analysis, alternate relativity, second Galilei event.

### I. Introduction

The human had a dogmatic opinion about the motion of the Sun (as, “it turns around the Earth”) up to Galilei; but this determination had a serious mistake although a strong -visual- evidence. Because, local paradigm was giving the reference role to the Earth while actually the Earth is relative actor according to the Sun; the coverage capacity of a star (sun) is bigger than it’s a planet (Earth). The reference quality or candidacy of the Sun is major on hierarchic ranking.

May the Special Theory of Relativity (STR) have a similar/serious mistake?

The STR is a product of 1900’s. But the definitions for natural reality were inadequate up to 1929; for example the galaxies, clusters were not known. Also, the studies on energy based are improving recently; and for one hundred years, methodology and the concept of perfect objectivity can be better / more effective / more practiced. Finally, relativity analyses on universal scale can/must be realized by considering the all possible dimensions and conditions. Today, human has the sufficient capability to advance the STR; e.g. that points can be considered (actually, some of them are used on actual protocol; but, they may not be applied in STR and Lorentz transformations):

### II. Some Requirements for Universal Analysis

1. The postulates (and some of the principles) are formed by becoming inured to the repetitive perceptions of local conditions; they must be reformed by methodology and project discipline for universal scale.
2. The result of an experiment must be interpreted independently from its preliminary intention. It can be discussed systematically which potential theses are supported by the same experiment.
3. The determinations/definitions (that performed by routine reduction and isolation methods) must be examined for their validity according to natural reality when it adapted to universal scale (STR had used excessive isolation: a moving body and its fictive light, for only single direction; whereas the universe never consists by only a body).
4. The data of astronomical observations have not simultaneity because of natural visual error (NVE). The components of target object (even its position and the angles of this position) are belonging to past time while the observer’s components and position are belong to present time; their resultant is not accurate

for cosmological analysis. These data must be transformed to simultaneous values. The primary reason of NVE and observational illusion is the finite/limited value of light's speed. If the velocity of light may be infinite, the NVE would not be mentioned.

5. In relativity, the hierarchic ranking of reference frames according to their coverage capacities is important. And the major object (for the role of reference frame) which has higher capacity must be preferred to eliminate wrong perception (like on the relation of the Sun and Earth).
6. On cosmological analyses, -to guarantee the equivalence of objects' parameter- the analysis must be organized between biggest formations (clusters or super clusters) in universe (not a target galaxy and the Earth).
7. The parameters of the objects must get value according to a co-reference frame. This point has critical importance when the light is an actor/object of the process/analysis. Are we allowed to use the value of light's velocity and the local speed of the other object (light source or observer) together in the same formula? STR and Lorentz allowed to this without enough discussing; whereas, the equivalence can be guaranteed when the most external frame is considered the mission of co-reference frame for relativity and light kinematics. The velocity of light is "c" again; and universal speeds of other/local actors (source or observer on the Earth) will be used.
8. The definition/concept of direct relativity between the Light and the light source must be examined again (look at the analogy "lake surface" section VI).
9. The nuance about the concepts of "direct relative" and "indirect/nominal relative" must be distinguished and considered (look at its own section VII).
10. On experiments and analyses it must be applied a defined/unique photon by numerating instead of the continuous light.
11. Energy and light kinematics require the thinking like in abstract mathematics.

### III. Reference Role of the Light

On classical relativity analyses, each one of the objects can be chosen for the role of reference frame; if the objects have equivalency (If their parameters' values are calibrated according to a co-reference frame). When the capacities of objects are different; to choose the higher one for reference role is well (The roles and results are appropriate for that phrase: "The Moon turns around the earth"). Reciprocity can be possible with equivalency. If we rank the formations according to their coverage capacity:

Macro frame (Entire space/vacuum)

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Observable universe

Super clusters

Galaxy clusters (e.g. Local group)

Galaxies (e.g. Milky Way)

Star systems (e.g. the Solar system)

Planets (e.g. the Earth)

Secondary planets or vehicles on the planet (e.g. the Moon or a train)

.....

Micro frames (a lamp, moving bodies)

Where is the light located on this scale? Or the light gets relative value for its velocity according to which one? STR said that "to assign all of them is possible" and analyzed with the light source or the local place (actually every moving bodies). A fictive light escapes by the velocity  $c$  from any – even, moving- object according to STR.

The experimenters can have proclivity to consider his local environment as a reference frame like in mechanics; if the object (A) obtains its speed due to the object (B), its speed has meaning of "relative" [intrinsically, the object (A) does not get its speed without the mass of object (B)]; this meaning of "relativity" is first hand/genuine/direct. The light has not a measurable mass and it has not a mechanic relation with its source. Lorentz and Einstein had supposed that the velocity of light "c" is direct relative according to its source. Because they had stronger evidence than visual evidence: the measuring experiments for the velocity of light give always same result on every direction. Moreover,

when the experimenter considers an outer (sequential) frame, he hopes the value as “ $c \pm v$ ”; but the result is always “ $c$ ”. So, this conclusion becomes a key postulate of STR with the labeling of “direct relative”.

Otherwise, another/an alternate interpretation is possible for the result of these experiments: the special measuring experiment for the light cannot measure the relative velocity according to local place/moving body or its source; it can measure only the universal velocity according to macro frame or most external frame (the special measurement method isolates the speed of the Earth/source). We want to call this macro frame by coding “light coordinate system (LCS)”. The relation of the identified photon (we must use “unique/defined photon” instead of “light” anymore) and its source finishes after emitting moment. The source and this photon can travel or escape on different ways/directions from the emitting point which is marked on LCS. Even if you want, the source cannot follow its all photons; already the photons spread to the spherical directions (The light must be considered as a pulse like flashing).

If the experimenter intends to measure the universal velocity of light instead of local/relative speed; he would have to use the same measurement setting (uninterrupted light, double paths with a mirror, turning wheel/mirrors); and he would label the result as universal value of light’s velocity. But Lorentz, Einstein and others perceived this measured value as escaping speed from the source or moving body; and so, the STR was formed.

#### IV. Light Kinematics and Cosmological Analysis without STR

Current paradigm and STR will allow assigning the macro frame as co-reference system too, because all inert frames (no accelerating objects) can be used as a reference frame according to their concept; LCS or entire space is an absolute inert frame. Thus, entire space (that we prefer to call “Light Coordinate System”: LCS) becomes the most external frame. If we adapt/transform the local value ( $V_L$ ) of the observer’s speed or light source to universal value of speed according to LCS ( $V_U$ )<sup>1</sup>; the values of  $c$  and  $V_U$  can be used in the same formula/equation; so, the doubt of nonequivalence is eliminated (or the concept of STR cannot object for this option). Also the principle of Galilean relativity supports the concept of LCS: according to this principle the object (which has not acceleration) can be consented as stable/inert frame. The light has never acceleration; even, it does not need to accelerate for its maximum velocity, consequently the candidacy of the light (or LCS)<sup>2</sup> is more appropriate for the mission of co-reference frame. When the values of all (light’s and other objects’) parameters are arranged according to LCS, and when this method (that is defined above) is proceeded, the cosmological analysis can be possible by classical methods. And then the accurate numerical values can be obtained due to observational data. We had performed a sample of cosmological analysis [2].

#### V. Final Theories will Become Energy Based

This study has an opinion and arguments that the velocity of light has relativity concept according to only LCS not all frames. The measurement device for light’s velocity (continuous light, double path by mirror turning wheel/mirror etc.) cannot measure the escaping speed from its source. It measures just only the velocity of light according to LCS (entire space). Measured value for the velocity of light is always universal value.

But by now, the measured velocity for light has been labeled as the meaning of “direct relative” according to its source by STR. The credit of this opinion was high; because generally, the results of experiments and observations are accepted as force major evidences. Besides, that interpretation is possible too: **If the known measurement device can measure only the universal velocity of light (the relative speed according to LCS or most external frame);**

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<sup>1</sup>  $V_U \neq V_L$  the reciprocity principle does not work.  $V_U$  and  $c$  can be used at the same Formula absolutely; but  $V_L$  and  $c$  ?

<sup>2</sup> LCS (instead of light) is the most external frame.

therefore the same fixed value will be found on everywhere. With other words, if the light's speed is measured as the same fixed value "c" on everywhere; that interpretation is possible too: we can be always measuring just the universal velocity of the light.

We human have many practices and opinion/decision about every speed that are "relative value" according to local place or first frame. Of course it is correct for the objects which have mass. Light has not measurable mass; it is a kind of energy which has radiation speed. Our thinking activity or computers have proceeding speed; but this kind of speed does not require analyzing in a relativity concept with a moving body. Yes, the light can travel the distances; the velocity of light is just a single co-quality with other concrete things; but that is all.

## VI. An Analogy to Clarify the Relativity of the Light

When a pebble is dropped to the flat/quiet surface of a lake, a ring/circle wave happens and its radius expands by a value of speed (figure 1)[3]. The expanding speed of ring wave does not change while the experimenter is standing, walking or running; it keeps the value of its speed on every standard dropping the pebble. On this analogy ring wave represents the light, the surface of lake represents LCS, and the experimenter (who drops the small stones) represents the light source. As will be understood, the source (experimenter) can go every direction independently while the light (ring wave) is escaping from the emitting point (which is marked on the surface of lake). If the experimenter (when he has a motion) drops serially the pebbles in standardized conditions, it means it is like "continuous light" on natural status. The starting point or the centre of ring wave is marked on surface of the lake, not with entity of the source/experimenter. STR accepts that the light source itself is always starting point for the photon's motion. Space or vacuum (LCS) does not point an entity or concrete frame; actually (by abstract thought in math.), **the light is a super reference frame itself**. It is possible on a sheet of paper and is sufficient for analyzing instead of LCS. The surface of the lake is co-reference frame for ring wave and the experimenter/source; similarly space or LCS is co-reference frame for the light and other objects. The expanding speed of the ring wave is not relative value according to source (experimenter). To consider the relativity concept about speeds (between object and its reference frame) is not necessity and valid for the relation of light and its source. Direct relativity is essential and significant in mechanics, but not in light kinematic.

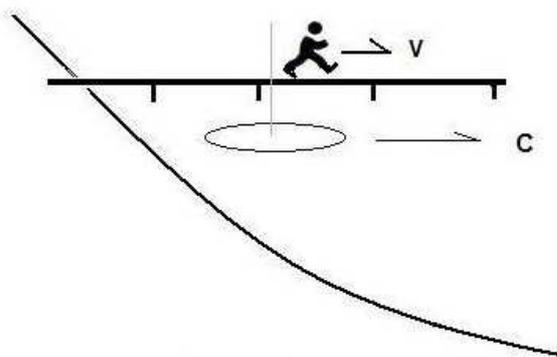


Figure 1 : The analogy of lake surface

## VII. Direct (genuine) Relativity – Indirect (nominal/notional) Relativity

In mechanics, an object needs another object (mass) to impose frictional force for its moving and it gets speed by accelerating. If it is a vehicle, its speed is a value according to the road and this value of speed has meaning of “genuine/direct relative” and its reference frame is the road. This vehicle moves away by its speed from the starting point on the road (which is the ratio system of its relativity). The road is the first reference frame of this vehicle and it gets speed due to this first reference frame. The distinguishing quality of direct relativity is mentioned with genuine cooperation of another mass (that is actually its own reference frame or ratio system for its direct relativity).

The light has not measurable mass and it does not need to impose any power to other object/mass. The light is a kind of energy and it travels in vacuum according to Maxwell’s definition. The source emits the light; but it does not push or throw the photons. Direct relativity is not mentioned between the light and its source. The light travels due to its own energy and electromagnetic cycles. The light never gets its velocity due to its source. We may say that the first reference frame of a light is just/only this light itself; or its ratio system is “Light Coordinate System (LCS)”.

Otherwise, two independent objects (if each one does not use other one’s mass to get its speed) are possible (e.g. simply, two automobiles or the earth and Fornax cluster); and if the relativity method is preferred (one of them takes the reference role; it is supposed inert frame) for their motions, the speed of other (in moving role) object is relative characteristic according to other one; but, this relative speed is meaning as nominal/notional or “**indirect relative**”. This nuance and labeling has importance in light kinematics; because first, the relation of photon and observer is an indirect relative status. Also the top limits for the speeds of direct and indirect options are different. The top limit of original speed or direct relative speed<sup>3</sup> for any body and the light is “c”; but, the top limit of indirect/notional relative speeds is “2c” (The diameter of a light sphere increases by “2c” while its radius increases by “c”). The top limit of “2c” may be perceived better by the LCS concept. To apperceive may be difficult; but the relation the photon and its source is “indirect relativity” too (it can be understood by LCS concept and considering the the distance between them). Indeed we cannot measure bigger value than “c” because of special measuring system (unfortunately, the known device works by using the light’s capacity; similarly the radar cannot measure the velocity of light because of the same reason). Perhaps, indirect relative speed of light (as the changing speed of the distance between the photon and its source) can be measured by a new experiment (Single path, single photon, analog cinema films and technology and sufficient precision etc).

## VIII. The Relativity in Universal Scale

Anything is never seen at its simultaneous position and actual age because of NVE (natural visual error or the limited/finite value of light’s velocity). The observing moment is at present time but the time and its position of observing object’s “view” are not belonging at present time. In addition, the components of some parameter (e.g. radial velocity) have not equivalency about simultaneity; the observer’s component of measured the value Z (redshift) or radial velocity is the value of present time, but not for observing object. The measured value of an astronomical parameter (that is the resultant of inappropriate values) has not scientific integrity. The reason of this inconsistency is the limited/finite value of light’s velocity.

We see the Sun at the position of ~ 8 minutes old. The photons of observed view had began to travel before 8 minutes and the Sun has leaved this position after the emitting moment of these photons; as result, at observation moment, the Sun does not locate at the point of other tip of the photon’s way. We can examine similar event in universal condition (fig. 2):

The Earth (or observer) and the star (light source) are at their positions of  $E_1$  and  $S_1$  at the moment  $T_1$  (the emitting moment for the photons which will arrive to observer’s eye at the moment  $T_2$ ); and they are at new positions of  $E_2$  and  $S_2$  at the moment  $T_2$  (observing moment of same photons). The photons travel the way  $S_1E_2$  during the time

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<sup>3</sup> And the universal speeds which are increased by the method of serial/sequential relativity.

“ $T_2 - T_1$ ” with their speed “ $c$ ”. The star/source transits the point  $S_2$  at the observing moment  $T_2$  and the observer transits the point  $E_2$  at the moment  $T_2$ .

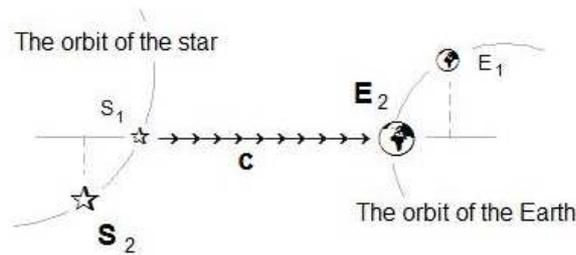


Figure 2 - Special relativity on universal scale

The starting point of the photons ( $S_1$ ) must be marked on LCS, not with the image view of the star. The star/source had transited the point  $S_1$  at the moment  $T_1$ . And the relation of “direct relativity” between these photons and their source (the star) will end from the moment  $T_1$ . This examining indicates that the starting point of the photons ( $S_1$ ) is marked on LCS. The star/source had transited the point  $S_1$  at the moment  $T_1$ . And the relation of “direct relativity” between these photons and the source will end from the moment  $T_1$ .

On the observing moment, the new and genuine position of the star/source ( $S_2$ ) is not effective or important for kinematics analyses of these photons. The light has arrived to observer’s eye by always the velocity “ $c$ ”; but this determination does not mean that the distance  $S_1E_1$  is traveled by the speed “ $c$ ”. While the photon travels the way  $S_1E_2$ ; the observer travels the way  $E_1E_2$  for the same duration.

## IX. Discussion

Astronomical observations are just an image view or illusion because of NVE. We cannot see anything simultaneously; of course this determination is significant for distant objects. The managing the qualities of these views for scientific function or efficacy are required. Observational data are a kind of raw material; they must be processed for usable data.

STR concept does not consider that hierarchic ranking of reference frames and location of observer in this scale; this nuance can be indicative for correct perception. STR contains some locality signs although its target about universality.

The light has high and different/specific qualities according to materials; therefore the measurement experiment and device for the velocity of the light is specific. It cannot be used to measure the speeds of other objects. Also, it does not resemble to the measurement methods in mechanics (In mechanics, the result values of speed measurements are “relative”; the cooperation of the mass and power is mentioned to cause and accelerate for an object’s speed. Generally the bigger mass (the Earth) is first reference frame and origin for the rate of local object’s speed. The measurement of light’s velocity does not contain similar easiness/simplicity and we must have high precision to interpret about which kind of speed (local or universal, etc.) we do/can measure.

Two different interpretations are mentioned for the fix value of measured velocities of light:

**1-The report of STR:** The velocity of light is same value according to everything. Physical principles are valid on everywhere in universe. The light is never impressed from its source's speed. If the source is not accelerated it can be use as an inert frame according to Galilean principle and the relativity analysis is possible between the light and its source. In the measuring experiment of light's velocity, preliminary expectation is what the result will be "c +/- v" but it is always got the fix value "c". So, the opinion "the light always moves away from its source by the speed c" is adopted and the concept of "direct relativity" accompanies to this opinion/decision without any doubt and discussion.

**2- The interpretation of this revised thesis:** The measurement device presents always the same fixed value for the velocity of light; because it can measure just the speed according to entire space not local/relative speed. This opinion/option is compatible with the principle "physical rules are valid on everywhere in universe" with the semantic form "it is always measured..."; not "it always travels ...". Also, finding the same value for all directions indicates and verifies this thesis.

As will be understood, the result of an experiment can support two different theses which is mentioned of respectable difference in meaning.

Otherwise, STR had used much isolation/easiness by analyzing (just only a moving body and a fictive light on it) at same line and single direction (+ x). Lorentz had added another sequential frame into analysis and constituted Lorentz transformations. But they had not realized to superpose by other sequential outer frames and not discussed according to natural reality; and they had neglected other directions (for 41253 spherical degrees and their fractions) especially for option of opposite direction. If we consider this, the inferences just like STR for the photons at other directions -which are emitted by same source on same moment- are not consistent. Lorentz's transformations<sup>4</sup>:

$$x' = \gamma(c - v) t \quad t' = \gamma[1 - (v/c)] t \quad \underline{x' / t' = c} \quad (1)$$

If this analysis is repeated for the source which goes to the direction - x, while the photon travels again to the direction + x (the speed of source with negative sign: - v):

$$X'' = \gamma(c + v) t \quad t'' = \gamma[1 + (v/c)] t \quad \underline{x'' / t'' = c} \quad (2)$$

The velocity of light "c" is kept on these two options. On inverse process (the source goes to the direction + x, while the photon travels to the direction - x) the result remains just the same. But there is a very important detail which can be overlooked:

$$t' \neq t'' \quad ; \quad \text{and} \quad t' < t < t'' \quad (3)$$

Of course (x' ; t') and (x'' ; t'') represent the locations of the photon on the apses. These two options can be organized simultaneously. So, the same routing requires time dilation (lower tempo); the opposite routing requires time contraction (higher tempo). But naturally, these tempos can never be realized for the same clock or body simultaneously. This result is clearly inconsistent to causality.

We can see many settings which support the STR. Generally they use excessive isolation and these isolations capture the logic. According to STR concept, the source or moving body is always located on the centre of light sphere of a single/unique light pulse (that its radius increases by the velocity of light) while the source travels. In this case, the lights on other directions disprove the STR: e.g. while the train goes, the path of perpendicular light becomes diagonal path option like a light clock; OK; but what do other directions of light sphere do? For example, the path of the light (that is on the angle of former diagonal path because of the train's speed) transforms a perpendicular path, but

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<sup>4</sup>  $\gamma = [1 - (v/c)^2]^{-1/2}$

this result does not support first opinion. Also, if we fix the perpendicular path with a filter; this time, probably the length of light's way does not increase like the total of steps' heights for a stairs; i.e. the length of the photon's way does never change. Whereas these options have transparency according to concept of LCS; it does not cause confusions.

The logic of STR has an interesting theme: Fitzgerald contraction is a prophecy to save the concept of ether. Some people followed and considered this prophecy. STR (especially in Einstein's book at 1916) starts by accepting the Maxwell's electro-magnetic cycles (i.e. STR disowns the concept of ether); but, the following analysis results by presenting a theoretical/technical base for ether concept. Intrinsically the STR supports the old ether concept by verifying the Fitzgerald contraction. This point is interesting.

We human look to universe from a place within universe; we want to define all phenomenons by relativity method according to familiar things and naturally we prefer to assign the tangible/concrete things for reference role. The labeling the light as relative characteristic according to its source or local place is our natural and local habit; because the light is already radiated by its source; we may be captured by this perception. If we would locate on LCS and measure the velocity of light, determined value would be defined as direct relative speed according to out of universe (LCS) by our similar habit; and so, this decision would be really accurate.

In this study, it is indicated that all experiments and postulates (that they are supporting the STR) can support another thesis too. The identical measurements on everywhere will give the same universal value, if the device can measure just the velocity according to LCS.

Is a paradox mentioned for the top limit concept "2c"? In direct relativity the top limit for the increasing/decreasing speed of distance (between two moving objects) is c; but, it is 2c for notional relativity (each one of objects gets its speed independently from other). But even in this case, an observer can see the events (which happen by bigger speed than c) due to single value of "c" (an observer who is on an object sees the other -like a cinema film- by fast or slow playing in accordance with their approaching or becoming distant status; this result is not an inference of STR that is about time dilation):

The objects' speed can have separately high portion of c. So, the increasing/decreasing speed of the distance between two moving objects is bigger than c, in approaching option of the objects, three observers (that each one is located on an object and the third one is located on the collision point) will perceive the collision on the same moment. The simultaneous perceiving the collision is indicative / determinative about the indirect relative speed of each one (according to other one) requires to be arithmetical total of their speeds, and this value can be bigger than c (but; < 2 c). For the state of moving away, if the objects travel even with the velocity c; the observer (who is located on an object) will remain to see the other object on starting point which is marked on LCS. Eventually, to see the older times than the starting time is impossible; the causality is kept. And the nature never cares about what an organism will see.

In light kinematics and special relativity, the presence of the observer and his perceiving capability must be eliminated or well managed to exclude negative and wrong/confusing perceptions. A photon travels with the value c in space after the emitting moment ( $T_0$ ). Also, its source travels to any different direction after  $T_0$ . At a moment of the following times ( $T_1$ ), the distance ( $L_1$ ) between new positions of the source and this photon is not defined by that expression:  $c (T_1 - T_0)$ ; but, the STR claims that  $L_1 = c (T_1 - T_0)$ . To distinguish and consider the positions that the observer/experimenter is an actor of the experiment/analysis or he is outside of the experiment.

## CONCLUSION

We queried the equivalency and partnership of the light and its source and found the clues for asymmetric matching or inconsistency; especially the light is a kind of energy; but the source or moving body is a material. And we perceived that we will not be allowed to can use their parameters in the same formula easily/ unreservedly; because the measured velocity of light may not be light's local speed (or relative value according to local objects). Eventually,

we internalized (by the arguments) that the considering the values of all parameters according to most external frame is a better solution. This method eliminates suspicions and confusions.

To label the light's velocity as "direct relative" -with habits like in mechanic and without any discussion- causes exciting inferences and but it could obstruct the cosmological analyses because the simultaneity is not guaranteed. The concept LCS allows cosmological analyses and will may cause new inferences; also it has a potential to clarify for the confusions of STR.

Energy and light are genuine realities which have highest universal qualities and they are most appropriate candidates for reference role to define everything. The light itself or entire space (LCS) is deserving of co-reference frame for the analyses of light kinematics. The LCS concept requires using universal values of the parameters and this method guarantees equivalency.

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