SPECIAL REPORT

Re-Identification of the Many-World Background of Special Relativity as Four-World Background. Part II.

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The re-identification of the many-world background of the special theory of relativity (SR) as four-world background in the first part of this paper (instead of two-wold background isolated in the initial papers), is concluded in this second part. The flat two-dimensional intrinsic spacetime, which underlies the flat four-dimensional spacetime in each universe, introduced as *ansatz* in the initial paper, is derived formally within the four-world picture. The identical magnitudes of masses, identical sizes and identical shapes of the four members of every quartet of symmetry-partner particles or objects in the four universes are shown. The immutability of Lorentz invariance on flat spacetime of SR in each of the four universes is shown to arise as a consequence of the perfect symmetry of relative motion at all times among the four members of every quartet of symmetry-partner particles and objects in the four universes. The perfect symmetry of relative motions at all times, coupled with the identical magnitudes of masses, identical sizes and identical shapes, of the members of every quartet of symmetry-partner particles and objects in the four universes, guarantee perfect symmetry of state among the universes.

1 Isolating the two-dimensional intrinsic spacetime that underlies four-dimensional spacetime

1.1 Indispensability of the flat 2-dimensional intrinsic spacetime underlying flat 4-dimensional spacetime

The flat two-dimensional proper intrinsic metric spacetimes denoted by $(\phi\rho', \phi c\phi t')$ and $(-\phi\rho'^{*}, -\phi c\phi t'^{*})$, which underlies the flat four-dimensional proper metric spacetimes (Σ', ct') and $(-\Sigma'^{*}, -ct'^{*})$ of the positive and negative universes respectively, were introduced as *ansatz* in sub-section 4.4 of [1]. They have proved very useful and indispensable since their introduction. For instance, the new spacetime/intrinsic spacetime diagrams for the derivation of Lorentz transformation/intrinsic Lorentz transformation and their inverses in the four-world picture, (referred to as two-world picture in [1]), derived and presented as Figs. 8a and 8b of [1] (or Figs. 10a and 11a of part one of this paper [3]) and their inverses namely, Figs. 9a and 9b of [1], involve relative rotations of intrinsic affine spacetime coordinates, without any need for relative rotations of affine spacetime coordinates.

Once the intrinsic Lorentz transformation (ϕLT) and its inverse have been derived graphically as transformation of the primed intrinsic affine spacetime coordinates $\phi\tilde{x}'$ and $\phi c\phi\tilde{t}'$ of the intrinsic particle's frame into the unprimed intrinsic affine spacetime coordinates $\phi\tilde{x}$ and $\phi c\phi\tilde{t}$ of the intrinsic observer's frame and its inverse, then Lorentz transformation (LT) and its inverse in terms of primed affine spacetime coordinates $\tilde{x}', \tilde{y}', \tilde{z}'$ and $c\tilde{t}'$ of the particle's frame and the unprimed affine spacetime coordinates $\tilde{x}, \tilde{y}, \tilde{z}$ and $c\tilde{t}$ of the observer's frame can be written straight away, as the outward manifestations on flat four-dimensional spacetime of the intrinsic Lorentz transformation (ϕLT) and its inverse on flat two-dimensional intrinsic spacetime, as demonstrated in sub-section 4.4 of [1].

The indispensability of the flat two-dimensional proper intrinsic metric spacetime $(\phi\rho', \phi c\phi t')$ underlying flat four-dimensional proper metric spacetime (Σ', ct'), arises from the fact that it is possible for the intrinsic affine spacetime coordinates $\phi\tilde{x}'$ and $\phi c\phi\tilde{t}'$ of the intrinsic particle's frame $(\phi\tilde{x}', \phi c\phi\tilde{t}')$ that contains the one-dimensional intrinsic rest mass ϕm_0 of the particle in the intrinsic affine space coordinate $\phi\tilde{x}'$, to rotate anti-clockwise by an intrinsic angle $\phi\psi$ relative to the horizontal and vertical respectively and thereby project the intrinsic affine spacetime coordinates $\phi\tilde{x}$ and $\phi c\phi\tilde{t}$ of the intrinsic observer's frame $(\phi\tilde{x}, \phi c\phi\tilde{t})$ along the horizontal and vertical respectively, where the projective intrinsic affine space coordinate $\phi\tilde{x}$ of the observer's frame along the horizontal contains the one-dimensional intrinsic relativistic mass, $\phi m = \gamma\phi m_0$, of the particle, as happens in the first and second quadrants in Fig. 8a of [1], although the intrinsic rest mass ϕm_0 in the inclined $\phi\tilde{x}'$ and intrinsic relativistic mass ϕm in the projective $\phi\tilde{x}$ along the horizontal are not shown in that diagram.

The projective unprimed intrinsic affine coordinates $\phi\tilde{x}$ and $\phi c\phi\tilde{t}$ that constitute the observer's intrinsic frame, containing one-dimensional intrinsic relativistic mass ϕm of the particle in $\phi\tilde{x}$, are then made manifest outwardly in the unprimed affine spacetime coordinates $\tilde{x}$, $\tilde{y}$, $\tilde{z}$ and $c\tilde{t}$ of the observer's fame on flat four-dimensional spacetime, containing the three-dimensional relativistic mass, $m = \gamma m_0$, of the particle in affine 3-space $\tilde{\Sigma}(\tilde{x}, \tilde{y}, \tilde{z})$ of the observer's frame.

On the other hand, diagrams obtained by replacing the inclined primed intrinsic affine coordinates $\phi\tilde{x}', \phi c\phi\tilde{t}', -\phi\tilde{x}'^*$ and $-\phi c\phi\tilde{t}'^*$ of the symmetry-partner intrinsic particles' frames $(\phi\tilde{x}', \phi c\phi\tilde{t}')$ and $(-\phi\tilde{x}'^*, -\phi c\phi\tilde{t}'^*)$ by inclined primed affine spacetime coordinates $\tilde{x}', c\tilde{t}', -\tilde{x}'^*$ and $-c\tilde{t}'^*$ respectively of the symmetry-partner particles' frames $(\tilde{x}', \tilde{y}', \tilde{z}', c\tilde{t}')$ and $(-\tilde{x}'^*, -\tilde{y}'^*, -\tilde{z}'^*, -c\tilde{t}'^*)$ in the positive and negative universes in Figs. 8a and 8b of [1], that is, by letting $\phi\tilde{x}' \to \tilde{x}'$; $\phi c\phi\tilde{t}' \to c\tilde{t}'$; $-\phi\tilde{x}'^* \to -\tilde{x}'^*$; $-\phi c\phi\tilde{t}'^* \to -c\tilde{t}'^*$; $\phi\tilde{x} \to \tilde{x}$; $\phi c\phi\tilde{t} \to c\tilde{t}$; $-\phi\tilde{x}^* \to -\tilde{x}^*$ and $-\phi c\phi\tilde{t}^* \to -c\tilde{t}^*$ in those diagrams, as would be done in the four-world picture in the absence of the intrinsic spacetime coordinates, are invalid or will not work.

The end of the foregoing paragraph is so since the affine space coordinates $\tilde{y}'$ and $\tilde{z}'$ of the particle's frame are not rotated along with the affine space coordinate $\tilde{x}'$ from affine 3-space $\tilde{\Sigma}'(\tilde{x}', \tilde{y}', \tilde{z}')$ of the particle's frame (as a hyper-surface) along the horizontal towards the time dimension $c\tilde{t}$ along the vertical. And the only rotated coordinate $\tilde{x}'$, which is inclined at angle ψ to the horizontal, cannot contain the three-dimensional rest mass m_0 of the particle, which can then be "projected" as three-dimensional relativistic mass, $m = \gamma m_0$, into the projective affine 3-space $\tilde{\Sigma}(\tilde{x}, \tilde{y}, \tilde{z})$ of the observer's frame (as a hyper-surface) along the horizontal. It then follows that the observational fact of the evolution of the rest mass m_0 of the particle into relativistic mass, $m = \gamma m_0$, in SR, is impossible in the context of diagrams involving rotations of the affine spacetime coordinates $\tilde{x}'$ and $c\tilde{t}'$ of the particle's frame relative to the affine spacetime coordinates $\tilde{x}$ and $c\tilde{t}$ of the observer's frame, which are in relative motion along their collinear $\tilde{x}'-$ and $\tilde{x}-$axes in the four-world picture. This rules out the possibility (or validity) of such diagrams in the four-world picture. As noted in [1], if such diagrams are drawn, it must be understood that they are hypothetical or intrinsic (i.e. non-observable).

Further more, it is possible for the intrinsic affine spacetime coordinates $\phi\tilde{x}'$ and $\phi c\phi\tilde{t}'$ of the particle's intrinsic frame $(\phi\tilde{x}', \phi c\phi\tilde{t}')$, containing the one-dimensional intrinsic rest mass ϕm_0 of the particle in the intrinsic affine space coordinate $\phi\tilde{x}'$, to rotate relative to their projective affine intrinsic spacetime coordinates $\phi\tilde{x}$ and $\phi c\phi\tilde{t}$ of the observer's intrinsic frame $(\phi\tilde{x}, \phi c\phi\tilde{t})$, that contains the 'projective' one-dimensional intrinsic relativistic mass, $\phi m = \gamma\phi m_0$, of the particle in the projective intrinsic affine space coordinate $\phi\tilde{x}$, by intrinsic angles $\phi\psi$ larger that $\frac{\pi}{2}$, that is, in the range $\frac{\pi}{2} < \phi\psi \le \pi$, (assuming rotation by $\phi\psi = \frac{\pi}{2}$ can be avoided), in Fig. 8a of [1]. This will make the particle's intrinsic frame $(\phi\tilde{x}', \phi c\phi\tilde{t}')$ containing the positive intrinsic rest mass ϕm_0 of the particle in the inclined affine intrinsic coordinate $\phi\tilde{x}'$ in the positive universe to make transition into the negative universe through the second quadrant to become particle's intrinsic frame $(-\phi\tilde{x}'^*, -\phi c\phi\tilde{t}'^*)$ containing negative intrinsic rest mass $-\phi m_0^*$ of the particle in the negative intrinsic affine space coordinate $-\phi\tilde{x}'^*$, as explained in section 2 of [2].

The negative intrinsic affine spacetime coordinates $-\phi\tilde{x}'^*$ and $-\phi c\phi\tilde{t}'^*$ of the intrinsic particle's frame, into which the positive intrinsic affine coordinates $\phi\tilde{x}'$ and $\phi c\phi\tilde{t}'$ of the particle's intrinsic frame in the positive universe transform upon making transition into the negative universe through the second quadrant, will be inclined intrinsic affine coordinates in the second quadrant and the third quadrant respectively. They will project intrinsic affine coordinates $-\phi\tilde{x}^*$ and $-\phi c\phi\tilde{t}^*$ of the observer's intrinsic frame along the horizontal and vertical respectively in the third quadrant. Thus the observer's intrinsic frame $(-\phi\tilde{x}^*, -\phi c\phi\tilde{t}^*)$ containing negative intrinsic relativistic mass, $-\phi m^* = -\gamma\phi m_0^*$, in the intrinsic affine space coordinate $-\phi\tilde{x}^*$, will automatically appear in the negative universe, upon the particle's intrinsic frame $(\phi\tilde{x}', \phi c\phi\tilde{t}')$ containing positive intrinsic rest mass ϕm_0 of the particle in the first quadrant making transition into the second quadrant. The observer's intrinsic frame $(-\phi\tilde{x}^*, -\phi c\phi\tilde{t}^*)$ containing relativistic intrinsic mass $-\phi m^* = -\gamma\phi m_0^*$ in $-\phi x^*$ will then be made manifest in observer's frame $(-\tilde{x}^*, -\tilde{y}^*, -\tilde{z}^*, -c\tilde{t}^*)$ on flat spacetime of the negative universe, containing negative three-dimensional relativistic mass, $-m^* = -\gamma m_0^*$, of the particle.

It is therefore possible for a particle in relative motion in the positive universe to make transition into the negative universe in the context of the geometrical representation of ϕLT/LT in the two-world picture (now re-identified as four-world picture) in Figs. 8a and 8b of [1], assuming rotation of intrinsic affine spacetime coordinates $\phi\tilde{x}'$ and $\phi c\phi\tilde{t}'$ of the particle's intrinsic frame relative to the intrinsic affine spacetime coordinates $\phi\tilde{x}$ and $\phi c\phi\tilde{t}$ of the observer's intrinsic frame by intrinsic angle $\phi\psi = \frac{\pi}{2}$, corresponding to intrinsic speed $\phi v = \phi c$ of relative intrinsic motion, can be avoided in the process of rotation by $\phi\psi > \frac{\pi}{2}$.

On the other hand, letting the affine spacetime coordinates $\tilde{x}'$ and $c\tilde{t}'$ of the particle's frame $(\tilde{x}', \tilde{y}', \tilde{z}', c\tilde{t}')$ to rotate relative to the affine spacetime coordinates $\tilde{x}$ and $c\tilde{t}$ respectively of the observer's frame $(\tilde{x}, \tilde{y}, \tilde{z}, c\tilde{t})$ in the positive universe by angle ψ larger than $\frac{\pi}{2}$, that is in the range $\frac{\pi}{2} < \psi \le \pi$, (assuming $\psi = \frac{\pi}{2}$ can be avoided), will cause the affine spacetime coordinates $\tilde{x}'$ and $c\tilde{t}'$ to make transition into the negative universe through the second quadrant to become inclined affine coordinates $-\tilde{x}'^*$ and $-c\tilde{t}'^*$ in the second and third quadrants respectively. However the non-rotated affine space coordinates $\tilde{y}'$ and $\tilde{z}'$ of the particle's frame will remain along the horizontal in the first quadrant in the positive universe. This situation in which only two of four coordinates of a frame make transition from the positive universe into the negative universe is impossible.

Moreover since the three-dimensional rest mass m_0 of the particle cannot be contained in the only rotated affine space coordinate $\tilde{x}'$, the rest mass of the particle will be unable to make transition into the negative universe with the rotated coordinates $\tilde{x}'$ and $c\tilde{t}'$. It is therefore impossible for a particle in relative motion in the positive universe to make transition into the negative universe in the context of diagrams involving rotation of affine spacetime coordinates $\tilde{x}'$ and $c\tilde{t}'$ of the particle's frame relative to affine spacetime coordinates $\tilde{x}$ and

$c\tilde{t}$ of the observer's frame, where the two frames are in motion along their collinear $\tilde{x}'-$ and $\tilde{x}-$axes, in the two-world picture (now re-identified as four-world picture). This further renders such diagrams ineffective and impossible.

Relative rotations of intrinsic affine spacetime coordinates in the spacetime/intrinsic spacetime diagrams for deriving intrinsic Lorentz transformation/Lorentz transformation are unavoidable in the present many-world picture. This makes the flat two-dimensional intrinsic metric spacetime underlying flat four-dimensional metric spacetime indispensable in the context of the present theory.

1.2 Origin of the intrinsic space and intrinsic time dimensions

It has been shown that the quartet of Euclidean 3-spaces and underlying one-dimensional intrinsic spaces in Fig. 2 of part one of this paper [3], simplifies naturally as Figs. 6a and 6b of that paper, where Fig. 6a is valid with respect to 3-observers in our proper Euclidean 3-space Σ' and 3-observer* in the proper Euclidean 3-space $-\Sigma'^*$ of the negative universe and Fig. 6b is valid with respect to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe and 3-observer* in the proper Euclidean 3-space $-\Sigma^{0\prime*}$ of the negative time-universe, as indicated in those diagrams. Figs. 6a and 6b of [3] ultimately transform into Figs. 8a and 8b respectively of that paper naturally with respect to the same 3-observers in the proper Euclidean 3-spaces with respect to whom Figs. 6a and 6b are valid.

The one-dimensional proper intrinsic spaces underlying the proper Euclidean 3-spaces have been introduced without deriving them in the first part of this paper [3]. Now let us assume that the underlying one-dimensional proper intrinsic spaces have not been known in Figs. 6a and 6b of [3]. Then let us reproduce the first quadrant of those figures without the intrinsic spaces as Figs. 1a and 1b respectively here.

The one-dimensional proper (or classical) space $\rho^{0\prime}$ along the vertical in Fig. 1a (to which the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe naturally contracts with respect to 3-observers in our proper Euclidean 3-space Σ'), projects a component to be denoted by ρ' into our proper Euclidean 3-space Σ' (considered as a hyper-surface along the horizontal), which is given as follows:

$$\rho' = \rho^{0\prime} \cos\psi_0 = \rho^{0\prime} \cos\frac{\pi}{2} = 0 \qquad (1)$$

where the fact that $\rho^{0\prime}$ is naturally inclined at absolute angle $\psi_0 = \frac{\pi}{2}$ to the horizontal, corresponding to absolute speed $V_0 = c$ of every point along $\rho^{0\prime}$ relative to 3-observers in Σ' (discussed extensively in sub-section 1.1 of [3]) has been used in (1).

Equation (1) states that the one-dimensional space $\rho^{0\prime}$ along the vertical projects zero component (or nothing) into the Euclidean 3-space Σ' (as a hyper-surface) along the horizontal. However we shall not ascribe absolute nothingness

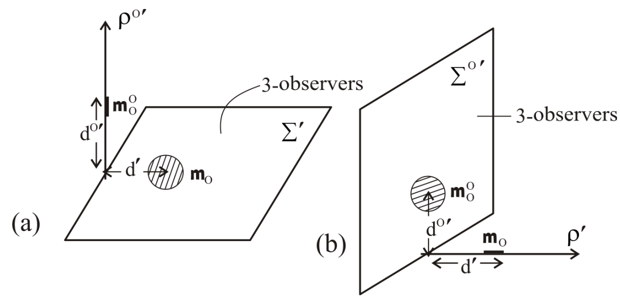


Fig. 1: (a) The proper Euclidean 3-space of our universe Σ' (as a hyper-surface along the horizontal), containing the rest mass m_0 of an object and the one-dimensional proper space $\rho^{0\prime}$ containing the one-dimensional rest mass m_0^0 of the symmetry-partner object in the positive time-universe relative to 3-observers in Σ'; $\rho^{0\prime}$ containing one-dimensional m_0^0 being the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe containing three-dimensional rest mass m_0^0 with respect to 3-observers in $\Sigma^{0\prime}$. (b) The proper Euclidean 3-space of the positive time-universe $\Sigma^{0\prime}$ (as a hyper-surface along the vertical), containing the rest mass m_0^0 of an object and the one-dimensional proper space ρ' containing the one-dimensional rest mass m_0 of the symmetry-partner object in our universe relative to 3-observers in $\Sigma^{0\prime}$; ρ' containing one-dimensional m_0 being the proper Euclidean 3-space Σ' of the positive (or our) universe containing three-dimensional rest mass m_0 with respect to 3-observers in Σ'.

to the projection of the physical one-dimensional space $\rho^{0\prime}$ along the vertical into the Euclidean 3-space Σ' along the horizontal in Fig. 1a. The one-dimensional space $\rho^{0\prime}$ certainly "casts a shadow" into Σ'.

Actually, it is the factor $\cos\frac{\pi}{2}$ that vanishes in (1) and not $\rho^{0\prime}$ multiplying it. Thus let us re-write (1) as follows:

$$\rho' = \rho^{0\prime} \cos\frac{\pi}{2} = 0 \times \rho^{0\prime} \equiv \phi\rho' \qquad (2)$$

where $\phi\rho'$ is without the superscript "0" label because it lies in (or underneath) our Euclidean 3-space Σ' (without superscript "0" label) along the horizontal.

Thus instead of associating absolute nothingness to the projection of $\rho^{0\prime}$ along the vertical into the Euclidean 3-space Σ' along the horizontal, as done in (1), a dimension $\phi\rho'$ of intrinsic (that is, non-observable and non-detectable) quality, has been attributed to it in (2). Hence $\phi\rho'$ shall be referred to as intrinsic space. It is proper (or classical) intrinsic space by virtue of its prime label.

Any interval of the one-dimensional intrinsic space (or intrinsic space dimension) $\phi\rho'$ is equivalent to zero interval of the one-dimensional physical space $\rho^{0\prime}$, (as follows from $\phi\rho' \equiv 0 \times \rho^{0\prime}$ in (2)). It then follows that any interval of the proper intrinsic space $\phi\rho'$ is equivalent to zero distance of the physical proper Euclidean 3-space Σ'. Or any interval of $\phi\rho'$ is no interval of space. The name nospace shall be coined for $\phi\rho'$ from the last statement, as an alternative to intrinsic space, where $\phi\rho'$ is proper (or classical) nospace by virtue of the prime label on it.

As derived in sub-section 1.2 of the first part of this paper [3], the Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe is geometrically contracted to the one-dimensional space $\rho^{0\prime}$ with respect to 3-observers in our Euclidean 3-space Σ' between Fig. 3 and Fig. 6a of [3], where $\rho^{0\prime}$ can be considered to be along any direction of the Euclidean 3-space $\Sigma^{0\prime}$ that contracts to it, with respect to 3-observers in Σ'. Thus $\rho^{0\prime}$ is an isotropic one-dimensional space with no unique orientation in the Euclidean 3-space $\Sigma^{0\prime}$ that contracts to it with respect to 3-observers in Σ'. The one-dimensional intrinsic space (or one-dimensional nospace) $\phi\rho'$, which $\rho^{0\prime}$ projects into the Euclidean 3-space Σ', is consequently an isotropic intrinsic space dimension with no unique orientation in Σ' with respect to 3-observers in Σ'.

The one-dimensional proper (or classical) space ρ' along the horizontal in Fig. 1b, to which our proper Euclidean 3-space Σ' geometrically contracts with respect to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe, as explained between Fig. 4 and Fig. 6b in sub-section 1.2 of [3], likewise projects one-dimensional proper intrinsic space (or proper nospace) $\phi\rho^{0\prime}$ into the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe along the vertical in Fig. 1b (not yet shown in Fig. 1b), where $\phi\rho^{0\prime}$ is an isotropic one-dimensional intrinsic space dimension (with no unique orientation) in $\Sigma^{0\prime}$ with respect to 3-observers in $\Sigma^{0\prime}$.

As follows from all the foregoing, Fig. 1a must be replaced with Fig. 2a, where the one-dimensional proper intrinsic space $\phi\rho'$ projected into the proper Euclidean 3-space Σ' by the one-dimensional proper space $\rho^{0\prime}$ with respect to 3-observers in Σ' has been shown. Fig. 1b must likewise be replaced with Fig 2b, where the one-dimensional proper intrinsic space (or proper nospace) $\phi\rho^{0\prime}$ projected into the proper Euclidean 3-space $\Sigma^{0\prime}$ by the one-dimensional proper space ρ' with respect to 3-observers in $\Sigma^{0\prime}$ has been shown.

The one-dimensional isotropic proper (or classical) intrinsic space $\phi\rho'$ underlying the proper (or classical) Euclidean 3-space Σ' of the positive (or our) universe with respect to 3-observers in Σ' and the one-dimensional isotropic proper (or classical) intrinsic space $\phi\rho^{0\prime}$ underlying the proper (or classical) Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$, have thus been derived. The derivations of the proper intrinsic space $-\phi\rho'^{*}$ underlying the proper Euclidean 3-space $-\Sigma'^{*}$ of the negative universe with respect to 3-observers in $-\Sigma'^{*}$ and of $-\phi\rho^{0\prime *}$ underlying the proper Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe with respect to 3-observers* in $-\Sigma'^{0*}$, follow directly from the derivations of $\phi\rho'$ underlying Σ' and $\phi\rho^{0\prime}$ underlying $\Sigma^{0\prime}$ above.

Following the introduction of the flat 2-dimensional proper intrinsic spacetimes $(\phi\rho', \phi c\phi t')$ and $(-\phi\rho'^{*}, -\phi c\phi t'^{*})$ that underlie the flat four-dimensional proper spacetimes (Σ', ct') and $(-\Sigma'^{*}, -ct'^{*})$ of the positive (or our) universe and the negative universe respectively as *ansatz* in sub-section 4.4 of [1], the one-dimensional proper intrinsic spaces $\phi\rho'$ and $-\phi\rho'^{*}$ underlying the proper Euclidean 3-spaces Σ' and $-\Sigma'^{*}$ of the positive and negative universes and the proper intrinsic spaces $\phi\rho^{0\prime}$ and $-\phi\rho^{0\prime *}$ underlying the proper Euclidean 3-spaces $\Sigma^{0\prime}$ and $-\Sigma^{0\prime *}$ of the positive and negative time-universes were introduced without deriving them in Figs. 2, 3 and 4 and Figs. 6a and 6b of the first part of this paper [3]. The existence in nature of the one-dimensional isotropic intrinsic spaces underlying the physical Euclidean 3-spaces has now been validated.

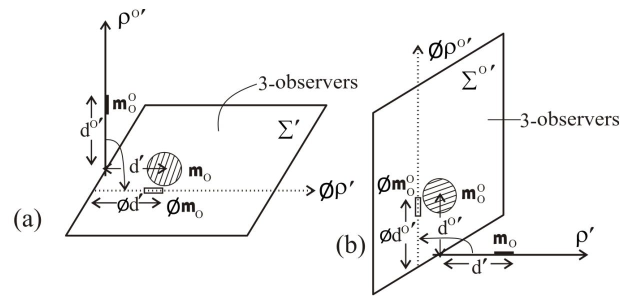


Fig. 2: (a) The one-dimensional proper space $\rho^{0\prime}$ containing one-dimensional rest mass m_0^0 along the vertical, projects one-dimensional proper intrinsic space $\phi\rho'$ containing one-dimensional intrinsic rest mass ϕm_0 into the proper Euclidean 3-space Σ' (as a hyper-surface) containing the rest mass m_0 along the horizontal, with respect to 3-observers in Σ'. (b) The one-dimensional proper space ρ' containing one-dimensional rest mass m_0 along the horizontal, projects one-dimensional proper intrinsic space $\phi\rho^{0\prime}$ containing one-dimensional intrinsic rest mass ϕm_0^0 into the proper Euclidean 3-space $\Sigma^{0\prime}$ (as a hyper-surface) containing rest mass m_0^0 along the vertical, with respect to 3-observers in $\Sigma^{0\prime}$

1.3 Origin of one-dimensional intrinsic rest mass in one-dimensional proper intrinsic space underlying rest mass in proper Euclidean 3-space

The one-dimensional proper space $\rho^{0\prime}$, being orthogonal to the proper Euclidean 3-space Σ' (as a hyper-surface) along the horizontal, possesses absolute speed $V_0 = c$ at every point along its length with respect to 3-observers in Σ', as has been well discussed in sub-section 1.1 of [3]. Consequently, the one-dimensional rest mass m_0^0 of a particle or object in $\rho^{0\prime}$ acquires the absolute speed $V_0 = c$ of $\rho^{0\prime}$ with respect to 3-observers in Σ' in Figs. 1a and 2a.

On the other hand, the Euclidean 3-space Σ' being along the horizontal (as a hyper-surface), possesses zero absolute speed ($V_0 = 0$) at every point of it with respect to 3-observers in Σ'. The projective intrinsic space (or nospace) $\phi\rho'$, being along the horizontal, likewise possesses zero absolute intrinsic speed ($\phi V_0 = 0$) at every point along its length with respect to 3-observers in Σ' in Fig. 2a.

The one-dimensional rest mass m_0^0 in the one-dimensional proper space $\rho^{0\prime}$ along the vertical in Figs. 1a or 2a, can be said to be in non-detectable absolute motion at constant absolute speed $V_0 = c$ along $\rho^{0\prime}$ with respect to 3-observers in the proper Euclidean 3-space Σ' in that figure. There is a mass relation in the context of absolute motion that can be applied for the non-detectable absolute motion at absolute speed $V_0 = c$ of m_0^0 along $\rho^{0\prime}$, which shall be derived elsewhere in the systematic development of the present theory. It shall be temporarily written hereunder because of the need to use it at this point.

Let us revisit Fig. 7 of part one of this paper [3], drawn to illustrate the concept of time and intrinsic time induction only. It is assumed that the proper intrinsic metric space $\phi\rho^{0\prime}$ possesses absolute intrinsic speed $\phi V_0 < \phi c$ at every point along its length, thereby causing $\phi\rho^{0\prime}$ to be inclined at a constant absolute intrinsic angle, $\phi\psi_0 < \frac{\pi}{2}$, relative to its projection $\phi\rho'$ along the horizontal in that figure. This is so since the uniform absolute intrinsic speed ϕV_0 along the length of $\phi\rho^{0\prime}$ is related to the constant absolute intrinsic angle $\phi\psi_0$ of inclination to the horizontal of $\phi\rho^{0\prime}$ as, $\sin\phi\psi_0 = \phi V_0/\phi c$, (see Eq. (1) of [3]). It follows from this relation that when the inclined $\phi\rho^{0\prime}$ lies along the horizontal, thereby being the same as its projection $\phi\rho'$ along the horizontal, it possesses constant zero absolute intrinsic speed ($\phi V_0 = 0$) at every point along its length along the horizontal with respect to the 3-observer in Σ' in that figure, just as it has been said that the projective $\phi\rho'$ along the horizontal possesses absolute intrinsic speed $V_0 = 0$ at every point along its length with respect to 3-observers Σ' in Fig. 2a earlier. And for $\phi\rho^{0\prime}$ to lie along the vertical in Fig. 7 of [3], it possesses constant absolute intrinsic speed $\phi V_0 = \phi c$ at every point along its length with respect to the 3-observer in Σ'.

Now let a one-dimensional intrinsic rest mass ϕm_0^0 be located at any point along the inclined proper intrinsic metric space $\phi\rho^{0\prime}$ in Fig. 7 of [3]. Then ϕm_0^0 will acquire absolute intrinsic speed $\phi V_0 < \phi c$ along the inclined $\phi\rho^{0\prime}$. It will project another intrinsic rest mass ϕm_0 (since it is not in relative motion) into the proper intrinsic space $\phi\rho'$, which the inclined $\phi\rho^{0\prime}$ projects along the horizontal. The relation between the 'projective' intrinsic rest mass ϕm_0 in the projective proper intrinsic space $\phi\rho'$ along the horizontal and the intrinsic rest mass ϕm_0^0 along the inclined proper intrinsic space $\phi\rho^{0\prime}$ (not shown in Fig. 7 of [3]), is the intrinsic mass relation in the context of absolute intrinsic motion to be derived formally elsewhere. It is given as follows:

$$\phi m_0 = \phi m_0^0 \cos^2\phi\psi_0 = \phi m_0^0\left(1 - \frac{\phi V_0^2}{\phi c^2}\right) \qquad (3)$$

The outward manifestation in the proper 3-dimensional Euclidean space Σ' (in Fig. 7 of [3]) of Eq. (3), obtained by simply removing the symbol ϕ, is the following

$$m_0 = m_0^0 \cos^2\psi_0 = m_0^0\left(1 - \frac{V_0^2}{c^2}\right) \qquad (4)$$

Corresponding to relations (3) and (4) in the contexts of absolute intrinsic motion and absolute motion, there are the intrinsic mass relation in the context of relative intrinsic motion (or in the context of intrinsic special theory of relativity (ϕSR)) and mass relation in the context of relative motion (or in the context of SR). The generalized forms involving intrinsic angle $\phi\psi$ and angle ψ of intrinsic mass relation in the context of ϕSR and mass relation in the context of SR, derived and presented as Eqs. (15) and (16) in section 3 of [2] are the following

$$\phi m = \phi m_0 \sec\phi\psi = \phi m_0\left(1 - \frac{\phi v^2}{\phi c^2}\right)^{-1/2} \qquad (5)$$

and

$$m = m_0 \sec\psi = m_0\left(1 - \frac{v^2}{c^2}\right)^{-1/2} \qquad (6)$$

One finds that relations (3) and (4) in the context of absolute intrinsic motion and absolute motion differ grossly from the corresponding relations (5) and (6) in relative intrinsic motion (or in the context of ϕSR) and in relative motion (or in the context of SR).

Since the one-dimensional rest mass m_0^0 possesses absolute speed $V_0 = c$ of non-detectable absolute motion along $\rho^{0\prime}$ with respect to 3-observers in Σ' in Fig. 2a, relation (4) can be applied for the "projection" of m_0^0 into the Euclidean 3-space Σ' with respect to 3-observers in Σ' in that figure. We must simply let $\psi_0 = \frac{\pi}{2}$ and $V_0 = c$ in Eq. (4) to have

$$m_0 = m_0^0 \cos^2\frac{\pi}{2} = m_0^0\left(1 - \frac{c^2}{c^2}\right) = 0 \qquad (7)$$

Equation (7) states that the one-dimensional rest mass m_0^0 in the one-dimensional space $\rho^{0\prime}$ along the vertical in Fig. 2a, (to which the three-dimensional rest mass m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$ contracts relative to 3-observers in our Euclidean 3-space Σ'), projects zero rest mass (or nothing) into our Euclidean 3-space Σ' along the horizontal. However the one-dimensional rest mass m_0^0 in $\rho^{0\prime}$ along the vertical certainly 'casts a shadow' into the Euclidean 3-space Σ' considered as a hyper-surface along the horizontal in Fig. 2a.

It is the factor $\cos^2\frac{\pi}{2}$ or $(1 - c^2/c^2)$ that vanishes and not the rest mass m_0^0 multiplying it in Eq. (7). Thus let us re-write Eq. (7) as follows:

$$m_0 = m_0^0 \cos^2\frac{\pi}{2} = 0 \times m_0^0 \equiv \phi m_0 \qquad (8)$$

Instead of ascribing absolute nothingness to the "projection" of the one-dimensional rest mass m_0^0 in the one-dimensional space $\rho^{0\prime}$ along the vertical into our proper Euclidean 3-space as a hyper-surface Σ' along the horizontal in Fig. 2a in Eq. (7), a one-dimensional quantity ϕm_0 of intrinsic (that is, nonobservable and non-detectable) quality has been ascribed to it in Eq. (8). Hence ϕm_0 shall be referred to as intrinsic rest mass.

Any quantity of the one-dimensional intrinsic rest mass ϕm_0 is equivalent to zero quantity of the one-dimensional rest

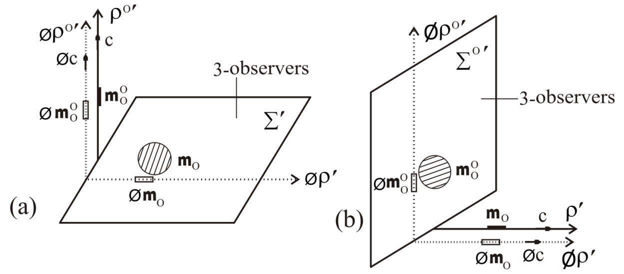


Fig. 3: (a) The proper intrinsic space $\phi\rho^{0\prime}$ containing intrinsic rest mass ϕm_0^0, projected into the proper Euclidean 3-space $\Sigma^{0\prime}$ along the vertical by one-dimensional proper space ρ' containing one-dimensional rest mass m_0 along the horizontal in Fig. 2b, is added to Fig. 2a, where it lies parallel to $\rho^{0\prime}$ along the vertical, giving rise to a flat four-dimensional proper space $(\Sigma', \rho^{0\prime})$ underlied by flat two-dimensional proper intrinsic space $(\phi\rho', \phi\rho^{0\prime})$ with respect to 3-observers in Σ'. (b) The proper intrinsic space $\phi\rho'$ containing intrinsic rest mass ϕm_0, projected into the proper Euclidean 3-space Σ' along the horizontal by one-dimensional proper space $\rho^{0\prime}$ containing one-dimensional rest mass m_0^0 along the vertical in Fig. 2a, is added to Fig. 2b, where it lies parallel to ρ' along the horizontal, giving rise to a flat four-dimensional proper space $(\Sigma^{0\prime}, \rho')$ underlied by flat two-dimensional proper intrinsic space $(\phi\rho^{0\prime}, \phi\rho')$ with respect to 3-observers in $\Sigma^{0\prime}$.

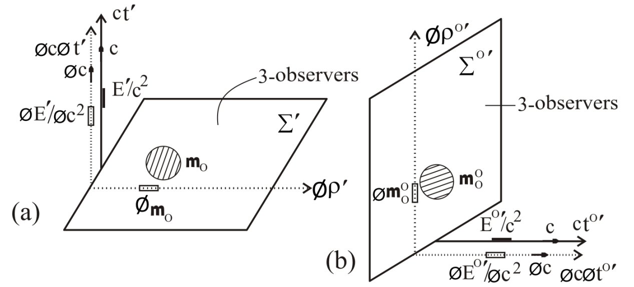


Fig. 4: (a) The one-dimensional proper space $\rho^{0\prime}$ and the proper intrinsic space $\phi\rho^{0\prime}$ along the vertical with respect to 3-observers in Σ' in Fig. 3a, transform into the proper time dimension ct' and proper intrinsic time dimension $\phi c\phi t'$ respectively, giving rise to a flat four-dimensional proper spacetime (Σ', ct') underlied by flat two-dimensional proper intrinsic spacetime $(\phi\rho', \phi c\phi t')$ with respect to 3-observers in Σ'. (b) The one-dimensional proper space ρ' and the proper intrinsic space $\phi\rho'$ along the horizontal with respect to 3-observers in $\Sigma^{0\prime}$ in Fig. 3b, transform into the proper time dimension $ct^{0\prime}$ and proper intrinsic time dimension $\phi c\phi t^{0\prime}$ respectively, giving rise to a flat four-dimensional proper spacetime $(\Sigma^{0\prime}, ct^{0\prime})$ underlied by flat two-dimensional proper intrinsic spacetime $(\phi\rho^{0\prime}, \phi c\phi t^{0\prime})$ with respect to 3-observers in $\Sigma^{0\prime}$.

mass m_0^0 in the one-dimensional space $\rho^{0\prime}$, as follows from $\phi m_0 \equiv 0 \times m_0^0$ in Eq. (8). It then follows that any quantity of the intrinsic rest mass ϕm_0 is equivalent to zero quantity of three-dimensional rest mass m_0 in Σ'. Or any quantity of intrinsic rest mass is no rest mass. An alternative name coined from the preceding statement namely, nomass, shall be given to the intrinsic rest mass ϕm_0. The intrinsic rest mass ϕm_0 in the proper (or classical) intrinsic space is the proper (or classical) nomass.

The 'projective' intrinsic rest mass (or proper nomass) ϕm_0 in the projective proper intrinsic space $\phi\rho'$, lies directly underneath the rest mass m_0 in the proper Euclidean 3-space Σ', as already shown in Fig. 2a. The one-dimensional rest mass m_0 in the one-dimensional proper (or classical) space ρ' along the horizontal in Fig. 2b, likewise "projects" intrinsic rest mass (or proper nomass) ϕm_0^0 into the projective proper (or classical) intrinsic space $\phi\rho^{0\prime}$, which lies directly underneath the rest mass m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$, as already shown in Fig. 2b.

Now the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in it in Fig. 2b, is what appears as one-dimensional proper space $\rho^{0\prime}$ along the vertical with respect to 3-observers in our proper Euclidean 3-space Σ' in Fig. 2a. The one-dimensional proper intrinsic space $\phi\rho^{0\prime}$ projected into (or underneath) $\Sigma^{0\prime}$ by ρ' along the horizontal in Fig. 2b, must be added to Fig. 2a, where it must lie parallel to $\rho^{0\prime}$ along the vertical, thereby converting Fig. 2a to Fig. 3a with respect to 3-observers in Σ'. The one-dimensional proper intrinsic space $\phi\rho'$ projected into (or underneath) our proper Euclidean 3-space Σ' by $\rho^{0\prime}$ along the vertical in Fig. 2a, must likewise be added to Fig. 2b, where it must lie parallel to ρ' along the horizontal, thereby converting Fig. 2b to Fig. 3b with respect to 3-observers in $\Sigma^{0\prime}$.

Finally, as explained for the transformations of Figs. 6a and 6b into Figs. 8a and 8b respectively in sub-section 1.3 of part one of this paper [3], the one-dimensional proper (or classical) space $\rho^{0\prime}$ and the one-dimensional proper (or classical) intrinsic space $\phi\rho^{0\prime}$ lying parallel to it along the vertical in Fig. 3a, transform into the proper time dimension ct' and the proper intrinsic time dimension $\phi c\phi t'$ of the positive (or our) universe with respect to 3-observers in our proper Euclidean 3-space Σ', thereby converting Fig. 3a to the final Fig. 4a.

The one-dimensional proper (or classical) space ρ' and the one-dimensional proper (or classical) intrinsic space $\phi\rho'$ lying parallel to it along the horizontal in Fig. 3b, likewise transform into the proper time dimension $ct^{0\prime}$ and the proper intrinsic time dimension $\phi c\phi t^{0\prime}$ of the positive time-universe with respect to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe, thereby converting Fig. 3b to the final Fig. 4b.

As also explained in drawing Figs. 9a and 9b of [3], the one-dimensional rest mass m_0^0 in the one-dimensional proper (or classical) space $\rho^{0\prime}$ and the one-dimensional intrinsic rest mass ϕm_0^0 in the proper (or classical) intrinsic space $\phi\rho^{0\prime}$ in Fig. 3a must be replaced by one-dimensional equivalent rest mass E'/c^2, where $E' = m_0^0 c^2$, in the proper time-dimension ct' and one-dimensional equivalent intrinsic rest mass $\phi E'/\phi c^2$, where $\phi E' = \phi m_0^0 \phi c^2$, in the proper intrinsic time dimension $\phi c\phi t'$ respectively, as done in Fig. 4a. The one-dimensional rest mass m_0 in ρ' and the intrinsic rest mass ϕm_0 in $\phi\rho'$ along the horizontal in Fig. 3b must likewise be replaced by $E^{0\prime}/c^2$; $E^{0\prime} = m_0c^2$, in $ct^{0\prime}$ and $\phi E^{0\prime}/\phi c^2$; $\phi E^{0\prime} = \phi m_0\phi c^2$, in $\phi c\phi t^{0\prime}$ respectively, as done in Fig. 4b.

Fig. 4a now has flat two-dimensional proper intrinsic spacetime (or proper nospace-notime) $(\phi\rho', \phi c\phi t')$, containing intrinsic rest mass (or proper nomass) ϕm_0 (in $\phi\rho'$) and equivalent intrinsic rest mass $\phi E'/\phi c^2$ (in $\phi c\phi t'$), underlying flat four-dimensional proper spacetime (Σ', ct'), containing rest mass m_0 (in Σ') and equivalent rest mass E'/c^2 (in ct'), of the positive (or our) universe. Fig. 4b likewise now has flat two-dimensional proper intrinsic spacetime $(\phi\rho^{0\prime}, \phi c\phi t^{0\prime})$, containing intrinsic rest mass ϕm_0^0 (in $\phi\rho^{0\prime}$) and equivalent intrinsic rest mass $\phi E^{0\prime}/\phi c^2$ (in $\phi c\phi t^{0\prime}$), underlying flat proper spacetime $(\Sigma^{0\prime}, ct^{0\prime})$, containing rest mass m_0^0 (in $\Sigma^{0\prime}$) and equivalent rest mass $E^{0\prime}/c^2$ (in $ct^{0\prime}$), of the positive time-universe.

In tracing the origin of the proper intrinsic space $\phi\rho'$ and the intrinsic rest mass ϕm_0 contained in it in Fig. 4a, we find that the one-dimensional proper space $\rho^{0\prime}$ containing one-dimensional rest mass m_0^0 along the vertical with respect to 3-observers in the proper Euclidean 3-space Σ' of the positive (or our) universe in Fig. 2a or 3a, projects proper intrinsic space $\phi\rho'$ containing intrinsic rest mass ϕm_0 into the proper Euclidean 3-space Σ'. Then as $\rho^{0\prime}$ containing m_0^0 along the vertical in Fig. 2a or 3a (being along the vertical) naturally transforms into proper time dimension ct' containing equivalent rest mass E'/c^2 with respect to 3-observers in Σ' in Fig. 4a, its projection $\phi\rho'$ containing ϕm_0 into Σ' along the horizontal (being along the horizontal) remains unchanged with respect to 3-observers in Σ'.

The conclusion then is that the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$, (which is one-dimensional space $\rho^{0\prime}$ with respect to 3-observers in our proper Euclidean 3-space Σ'), is ultimately the origin of the one-dimensional proper intrinsic space $\phi\rho'$ underlying the proper Euclidean 3-space Σ' of our universe and the three-dimensional rest mass m_0^0 of a particle of object in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$ is the origin of the one-dimensional intrinsic rest mass ϕm_0 in the proper intrinsic space $\phi\rho'$ lying directly underneath the rest mass m_0 of the symmetry-partner particle or object in the proper Euclidean 3-space Σ' of our universe. In other words, the proper Euclidean 3-space $\Sigma^{0\prime}$ containing the three-dimensional rest mass m_0^0 of a particle or object in the positive time-universe, "casts a shadow" of one-dimensional isotropic proper intrinsic space $\phi\rho'$ containing one-dimensional intrinsic rest mass ϕm_0 into the proper Euclidean 3-space Σ' containing the rest mass m_0 of the symmetry-partner particle or object in our universe, where ϕm_0 in $\phi\rho'$ lies directly underneath m_0 in Σ'.

And in tracing the origin of the proper intrinsic time dimension $\phi c\phi t'$ that contains the equivalent intrinsic rest mass $\phi E'/\phi c^2$, lying parallel to the proper time dimension ct' containing the equivalent rest mass E'/c^2 in Fig. 4a, we find that the one-dimensional proper space ρ' containing one-dimensional rest mass m_0 along the horizontal with respect to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe in Fig. 2b or 3b, where ρ' is the Euclidean 3-space Σ' of our universe with respect to 3-observers in Σ', as derived between Fig. 4 and Fig. 6b in sub-section 1.2 of [3], projects one-dimensional proper intrinsic space $\phi\rho^{0\prime}$ containing intrinsic rest mass ϕm_0^0 underneath the proper Euclidean 3-space $\Sigma^{0\prime}$ containing rest mass m_0^0 of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$ in Fig. 2b or 3b. The proper Euclidean 3-space $\Sigma^{0\prime}$ containing the rest mass m_0^0 and its underlying proper intrinsic space $\phi\rho^{0\prime}$ containing intrinsic rest mass ϕm_0^0 with respect to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe in Fig. 3b, are the proper time dimension ct' of our universe containing equivalent rest mass E'/c^2 and its underlying proper intrinsic time dimension $\phi c\phi t'$ of our universe containing equivalent intrinsic rest mass $\phi E'/\phi c^2$ with respect to 3-observers in Σ' in Fig. 4a.

The conclusion then is that the proper Euclidean 3-space Σ' of the positive (or our) universe is the origin of the proper intrinsic time dimension $\phi c\phi t'$ that lies parallel to the proper time dimension ct' of the positive (or our) universe in Fig. 4a. The three-dimensional rest mass m_0 of a particle or object in the proper Euclidean 3-space Σ' of our universe is the origin of the one-dimensional equivalent intrinsic rest mass $\phi E'/\phi c^2$ in the proper intrinsic time dimension $\phi c\phi t'$ that lies besides the one-dimensional equivalent rest mass E'/c^2 in the proper time dimension ct' of our universe in Fig. 4a.

The two-dimensional proper intrinsic metric spacetime (or proper metric nospace-notime) $(\phi\rho', \phi c\phi t')$, containing intrinsic rest mass ϕm_0 in $\phi\rho'$ and equivalent intrinsic rest mass $\phi E/\phi c^2$ in $\phi c\phi t'$, which underlies the flat proper metric spacetime (Σ', ct'), containing rest mass m_0 in Σ' and equivalent rest mass E'/c^2 in ct', has thus been derived within the four-world picture. The intrinsic special theory of relativity (ϕSR) operates on the flat proper intrinsic metric spacetime $(\phi\rho', \phi c\phi t')$ and the special theory of relativity (SR) operates on the flat proper metric spacetime (Σ', ct') in the absence of relativistic gravitational field. The flat two-dimensional proper intrinsic spacetime was introduced as *ansatz* in section 4.4 of [1] and it has proved indispensable in the present theory since then, as discussed fully earlier in sub-section 1.1 of this paper.

The derivations of the flat two-dimensional proper intrinsic spacetime $(\phi\rho', \phi c\phi t')$ containing intrinsic rest masses $(\phi m_0, \phi E'/\phi c^2)$ of particles and bodies, which underlies the flat four-dimensional proper spacetime (Σ', ct') containing the rest masses $(m_0, E'/c^2)$ of particles and bodies in our universe and in the other three universes, as presented in this sub-section, is the best that can be done at the present level of the present evolving theory. The derivations certainly demystify the concepts of intrinsic spacetime and intrinsic mass introduced as *ansatz* in section 4 of [1]. There are, however, more formal and more complete derivations of these concepts along with the concepts of absolute intrinsic spacetime containing absolute intrinsic rest mass, which underlies absolute spacetime containing absolute rest mass and relativistic intrinsic spacetime containing relativistic intrinsic mass, which underlies relativistic spacetime containing relativistic mass, to be presented elsewhere with further development.

2 Validating perfect symmetry of state among the four universes isolated

Perfect symmetry of natural laws among the four universes namely, the positive universe, the negative universe, the positive time-universe and the negative time-universe, whose metric spacetimes and underlying intrinsic metric spacetimes are depicted in Figs. 8a and 8b of the first part of this paper [3], has been demonstrated in section 2 of that paper. Perfect symmetry of state among the universes shall now be demonstrated in this section. Perfect symmetry of state exists among the four universes if the masses of the four members of every quartet of symmetry-partner particles or objects in the four universes have identical magnitudes, shapes and sizes and if they perform identical relative motions in their universes at all times. These conditions shall be shown to be met in this section.

2.1 Identical magnitudes of masses and of shapes and sizes of the members of every quartet of symmetry-partner particles or objects in the four universes

As illustrated in Fig. 2a or 3a, the one-dimensional intrinsic rest mass (or proper nomass) ϕm_0 "projected" into the projective isotropic one-dimensional proper (or classical) intrinsic space (or proper nospace) $\phi\rho'$, lies directly underneath the three-dimensional rest mass m_0 in the proper (or classical) Euclidean 3-space Σ' of the positive (or our) universe with respect to 3-observers in Σ'. Likewise the "projective" one-dimensional intrinsic rest mass ϕm_0^0 in the projective one-dimensional isotropic proper intrinsic space $\phi\rho^{0\prime}$ lies directly underneath the three-dimensional rest mass m_0^0 in the proper (or classical) Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$ in Fig. 2b or 3b.

Now the rest mass m_0 is the outward (or physical) manifestation in the proper (or classical) physical Euclidean 3-space Σ' of the one-dimensional intrinsic rest mass ϕm_0 in the one-dimensional proper (or classical) intrinsic space $\phi\rho'$ lying underneath m_0 in Σ' in Fig. 2a or 3a. It then follows that m_0 and ϕm_0 are equal in magnitude, that is, $m_0 = |\phi m_0|$.

But the one-dimensional intrinsic rest mass ϕm_0 in $\phi\rho'$ along the horizontal is equal in magnitude to the one-dimensional rest mass m_0^0 in the one-dimensional space $\rho^{0\prime}$ along the vertical that 'projects' ϕm_0 contained in $\phi\rho'$ along the horizontal in Fig. 2a or 3a. That is, $m_0^0 = |\phi m_0|$. By combining this with $m_0 = |\phi m_0|$ derived in the preceding paragraph, we have the equality in magnitude of the three-dimensional rest mass m_0 of a particle or object in our proper Euclidean 3-space Σ' and the one-dimensional rest mass m_0^0 of the symmetry-partner particle or object in the one-dimensional proper (or classical) space $\rho^{0\prime}$ (with respect to 3-observers in Σ') in Fig. 2a or 3a. That is, $m_0 = m_0^0$.

Finally the one-dimensional rest mass m_0^0 of a particle or object in the one-dimensional proper space $\rho^{0\prime}$ along the vertical with respect to 3-observers in our proper Euclidean 3-space Σ' in Fig. 2a or 3a, is what 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe observe as three-dimensional rest mass m_0^0 of the particle or object in $\Sigma^{0\prime}$. Consequently the one-dimensional rest mass m_0^0 of the particle or object in $\rho^{0\prime}$ in Fig. 2a or 3a is equal in magnitude to the three-dimensional rest mass m_0^0 of the particle or object in the proper Euclidean 3-space $\Sigma^{0\prime}$. This is certainly so since the geometrical contraction of the Euclidean 3-space $\Sigma^{0\prime}$ to one-dimensional space $\rho^{0\prime}$ and the consequent geometrical contraction of the three-dimensional rest mass m_0^0 in $\Sigma^{0\prime}$ to one-dimensional rest mass m_0^0 in $\rho^{0\prime}$ with respect to 3-observers in our Euclidean 3-space Σ', does not alter the magnitude of the rest mass m_0^0.

In summary, we have derived the simultaneous relations $m_0 = |\phi m_0|$ and $m_0^0 = |\phi m_0|$, from which we have, $m_0 = m_0^0$ in the above. Also since m_0^0 in $\Sigma^{0\prime}$ is the outward manifestation of ϕm_0^0 in $\phi\rho^{0\prime}$ in Fig. 2b or 3b, we have the equality in magnitude of m_0^0 and ϕm_0^0, that is, $m_0^0 = |\phi m_0^0|$, which, along with $m_0^0 = |\phi m_0|$ derived above, gives $\phi m_0^0 = \phi m_0$. The conclusion then is that the rest mass m_0 of a particle or object in the proper Euclidean 3-space Σ' of our (or positive) universe with respect to 3-observers in Σ', is equal in magnitude to the rest mass m_0^0 of the symmetry-partner particle or object in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$. The one-dimensional intrinsic rest mass ϕm_0 of the particle or object in our proper intrinsic space $\phi\rho'$ underlying m_0 in Σ' in Fig. 2a, 3a or 4a is equal in magnitude to the intrinsic rest mass ϕm_0^0 of the symmetry-partner particle or object in the proper intrinsic space $\phi\rho^{0\prime}$ underlying m_0^0 in $\Sigma^{0\prime}$ in Fig. 2b, 3b or 4b.

By repeating the derivations done between the positive (or our) universe and the positive time-universe, which lead to the conclusion reached in the foregoing paragraph, between the negative universe and the negative time-universe, (which shall not be done here in order to conserve space), we are also led to the conclusion that the rest mass $-m_0^*$ of a particle or object in the proper Euclidean 3-space $-\Sigma'^*$ of the negative universe with respect to 3-observers in $-\Sigma'^*$, is equal in magnitude to the rest mass $-m_0^{0*}$ of the symmetry-partner particle or object in the proper Euclidean 3-space $-\Sigma^{0\prime*}$ of the negative time-universe with respect to 3-observers in $-\Sigma^{0\prime*}$. The one-dimensional intrinsic rest mass $-\phi m_0^*$ of the particle or object in the proper intrinsic space $-\phi\rho'^*$ of the negative universe underlying $-m_0^*$ in $-\Sigma'^*$, is equal in magnitude to the intrinsic rest mass $-\phi m_0^{0*}$ of the symmetry-partner particle or object in the proper intrinsic space $-\phi\rho^{0\prime *}$ underlying $-m_0^{0*}$ in $-\Sigma^{0\prime *}$ in the negative time-universe.

The perfect symmetry of state between the positive (or our) universe and the negative universe prescribed in [1], remains a prescription so far. It implies that the rest mass m_0 of a particle or object in the proper Euclidean 3-space Σ' of the positive (or our) universe, is identical in magnitude to the rest mass $-m_0^*$ of the symmetry-partner particle or object in the proper Euclidean 3-space $-\Sigma'^*$ of the negative universe, that is, $m_0 = |-m_0^*|$. The corresponding (prescribed) perfect symmetry of state between positive time-universe and the negative time-universe likewise implies that the rest mass m_0^0 of a particle or object in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe is identical in magnitude to the rest mass$-m_0^{0*}$ of its symmetry-partner in the proper Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe, that is, $m_0^0 = |-m_0^{0*}|$.

The equality of magnitudes of symmetry-partner rest masses, $m_0 = |-m_0^*|$, that follows from the prescribed perfect symmetry of state between the positive (or our) universe and the negative universe and $m_0^0 = |-m_0^{0*}|$ that follows from the prescribed symmetry of state between the positive time-universe and the negative time-universe, discussed in the foregoing paragraph, are possible of formal proof, as shall be presented elsewhere. By combining these with $m_0 = m_0^0$ and $-m_0^* = -m_0^{0*}$ derived from Figs. 2a and 2b above, we obtain the equality of magnitudes of the rest masses of the four symmetry-partner particles or objects in the four universes, that is, $m_0 = |-m_0^*| = m_0^0 = |-m_0^{0*}|$. Consequently there is equality of magnitudes of the intrinsic rest masses in the one-dimensional intrinsic spaces of the quartet of symmetry-partner particles or objects in the four universes, that is, $|\phi m_0| = |-\phi m_0^*| = |\phi m_0^0| = |-\phi m_0^{0*}|$.

Having demonstrated the equality of magnitudes of the rest masses of the members of every quartet of symmetry-partner particles or objects in the four universes, (to the extent that $m_0 = |-m_0^*|$ between the positive (or our) universe and the negative universe and $m_0^0 = |-m_0^{0*}|$ between the positive and negative time-universes are valid), let us also show their identical shapes and sizes.

Now the rest mass m_0 being the outward manifestation in our proper Euclidean 3-space Σ' of the intrinsic rest mass ϕm_0 of intrinsic length $\Delta\phi\rho'$ in the one-dimensional proper intrinsic space $\phi\rho'$ and the three-dimensional rest mass m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ with respect to 3-observers in $\Sigma^{0\prime}$, being what geometrically contracts to the one-dimensional rest mass m_0^0 of length $\Delta\rho^{0\prime}$ in $\rho^{0\prime}$ with respect to 3-observers in our Euclidean 3-space Σ' and since $\Delta\rho^{0\prime}$ along the vertical projects $\Delta\phi\rho'$ into Σ' along the horizontal, then the length $\Delta\rho^{0\prime}$ of the one-dimensional rest mass m_0^0 in $\rho^{0\prime}$ has the same magnitude as the intrinsic length $\Delta\phi\rho'$ of the intrinsic rest mass ϕm_0 in $\phi\rho'$, that is, $\Delta\rho^{0\prime} = |\Delta\phi\rho'|$. Consequently the volume $\Delta\Sigma^{0\prime}$ of the Euclidean 3-space $\Sigma^{0\prime}$ occupied by the three-dimensional rest mass m_0^0 with respect to 3-observers in $\Sigma^{0\prime}$ has the same magnitude as the volume $\Delta\Sigma'$ of the Euclidean 3-space Σ' occupied by the rest mass m_0 with respect to 3-observers in Σ'; $\Delta\Sigma'$ occupied by m_0 being the outward manifestation of $\Delta\phi\rho'$ occupied by ϕm_0. In other words, the rest mass m_0 in Σ' has the same size as its symmetry-partner m_0^0 in $\Sigma^{0\prime}$.

Further more, the shape of the outward manifestation of ϕm_0 in the proper Euclidean 3-space Σ', that is, the shape of m_0 in Σ', with respect to 3-observers in Σ', is the same as the shape of the three-dimensional rest mass m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ with respect to 3-observers in $\Sigma^{0\prime}$. In providing justification for this, let us recall the discussion leading to Fig. 6a and 6b of [1], that the intrinsic rest masses ϕm_0 of particles and objects, which appear as lines of intrinsic rest masses along the one-dimensional isotropic proper intrinsic space $\phi\rho'$ relative to 3-observers in the proper Euclidean 3-space Σ', as illustrated for a few objects in Fig. 6a of [1], are actually three-dimensional intrinsic rest masses ϕm_0 in three-dimensional proper intrinsic space $\phi\Sigma'$ with respect to three-dimensional intrinsic-rest-mass-observers (or 3-intrinsic-observers) in $\phi\Sigma'$, as also illustrated for a few objects in Fig. 6b of [1]. The shape of the three-dimensional intrinsic rest mass ϕm_0 of an object or particle in the three-dimensional intrinsic space $\phi\Sigma'$ with respect to 3-intrinsic-observers in $\phi\Sigma'$, is the same as the shape of its outward manifestation in the proper Euclidean 3-space Σ', that is, the same as the shape of the rest mass m_0 in Σ', with respect to 3-observers in Σ'.

Since the line of intrinsic rest mass ϕm_0 in one-dimensional proper intrinsic space $\phi\rho'$ relative to 3-observers in Σ', (which is a three-dimensional intrinsic rest mass ϕm_0 in three-dimensional proper intrinsic space $\phi\Sigma'$ with respect to 3-intrinsic-observers in $\phi\Sigma'$), is the projection along the horizontal of the line of rest mass m_0^0 in the one-dimensional proper space $\rho^{0\prime}$ along the vertical relative to 3-observers in our proper Euclidean 3-space Σ', (which is a 3-dimensional rest mass m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in $\Sigma^{0\prime}$), the shape of the three-dimensional intrinsic rest mass ϕm_0 in $\phi\Sigma'$ with respect to 3-intrinsic-observers in $\phi\Sigma'$ is the same as the shape of the three-dimensional rest mass m_0^0 in $\Sigma^{0\prime}$ with respect to 3-observers in $\Sigma^{0\prime}$. It then follows from this and the conclusion (that the shape of ϕm_0 in $\phi\Sigma'$ is the same as the shape of m_0 in Σ') reached in the preceding two paragraphs, that the shapes of the rest masses m_0 in our proper Euclidean 3-space Σ' and m_0^0 in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe are the same, as stated earlier.

The identical sizes and shapes of the the rest mass m_0 of a particle or object in the proper Euclidean 3-space Σ' of our universe and of the rest mass m_0^0 of its symmetry-partner in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe, concluded from the foregoing, is equally true between the rest mass $-m_0^*$ in the Euclidean 3-space $-\Sigma'^*$ of the negative universe and its symmetry-partner $-m_0^{0*}$ in the

Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe.

When the preceding paragraph is combined with the identical shapes and sizes of the rest mass m_0 of a particle or object in the proper Euclidean 3-space Σ' of the positive (or our) universe and of the rest mass $-m_0^*$ of its symmetry-partner in the proper Euclidean 3-space $-\Sigma'^*$ of the negative universe, which the so far prescribed perfect symmetry of state between our universe and the negative universe implies, as well as the identical shapes and sizes of the rest mass m_0^0 of a particle or object in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe and of the rest mass $-m_0^{0*}$ of its symmetry-partner in the proper Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe, which the so far prescribed perfect symmetry of state between positive time-universe and the negative time-universe implies, we have the identical shapes and sizes of the four members of the quartet of symmetry-partner particles or objects in the four universes, and this is true for every such quartet of symmetry-partner particles or objects.

2.2 Perfect symmetry of relative motions always among the members of every quartet of symmetry-partner particles or objects in the four universes

As mentioned at the beginning of this section, the second condition that must be met for symmetry of state to obtain among the four universes isolated in part one of this paper [3] and illustrated in Figs. 8a and 8b of that paper namely, the positive (or our) universe, the negative universe, the positive time-universe and the negative time-universe, is that the members of every quartet of symmetry-partner particles or objects in the universes, now shown to have identical magnitudes of masses, identical sizes and identical shapes, are involved in identical motions relative to identical symmetry-partner observers or frames of reference in the universes at all times. The *reductio ad absurdum* method of proof shall be applied to show that this second condition is also met. We shall assume that the quartet of symmetry-partner particles or objects in the four universes are not involved in identical relative motions and show that this leads to a violation of Lorentz invariance.

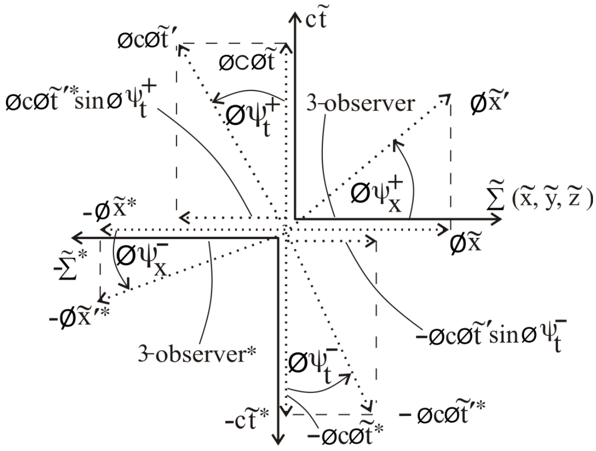
Let us start with the assumption that the members of a quartet of symmetry-partner particles or objects in the four universes are in arbitrary motions at different speeds relative to the symmetry-partner observers of frames of reference in their respective universes at every given moment. This assumption implies that given an object on earth in our universe in motion at a speed v_{x^+} along the north pole of the earth, say, relative to our earth at a given instant, then its symmetry-partner on earth in the negative universe is in motion at a speed v_{x^-} along the north pole relative to the earth of the negative universe at the same instant; the symmetry-partner object on earth in the positive time-universe is motion at a speed $v_{x^{0+}}$ along the north pole relative to the earth of the positive time-universe at the same instant and the symmetry-partner object on earth in the negative time-universe is in motion at a speed $v_{x^{0-}}$ along the north pole relative to the earth of the negative time-universe at the same instant, where it is being assumed that the speeds v_{x^+}, v_{x^-}, $v_{x^{0+}}$ and $v_{x^{0-}}$ have different magnitudes and each could take on arbitrary values lower than c, including zero. They may as well be assumed to be moving along arbitrary directions on earths in their respective universes.

The geometrical implication of the assumption made in the foregoing paragraph is that the equal intrinsic angle $\phi\psi$ of relative rotations of intrinsic affine space and intrinsic affine time coordinates in the four quadrants, drawn upon the proper (or classical) metric spacetimes/intrinsic spacetimes of the positive (or our) universe and the negative universe in Fig. 8a of [3], as Fig. 10a of that paper, and upon the proper (or classical) metric spacetimes/intrinsic spacetimes of the positive time-universe and negative time-universe in Fig. 8b of [3], as Fig. 10b of that paper, will take on different values $\phi\psi_x^+$, $\phi\psi_x^-$, $\phi\psi_t^+$, $\phi\psi_t^-$, $\phi\psi_{x^0}^+$, $\phi\psi_{x^0}^-$, $\phi\psi_{t^0}^+$ and $\phi\psi_{t^0}^-$ as depicted in Figs. 5a and 5b.

The rotations of $\phi\tilde{x}'$ by intrinsic angle $\phi\psi_x^+$ relative to $\phi\tilde{x}$ along the horizontal in the first quadrant and the rotation of $\phi c\phi\tilde{t}'$ by intrinsic angle $\phi\psi_t^+$ relative to $\phi c\phi\tilde{t}$ along the vertical in the second quadrant are valid with respect to the 3-observer in $\tilde{\Sigma}$ in Fig. 5a, where $\sin\phi\psi_x^+ = \phi v_{x^+}/\phi c$ and $\sin\phi\psi_t^+ = \phi v_{t^+}/\phi c$. On the other hand, the rotation of $-\phi\tilde{x}'^*$ at intrinsic angle $\phi\psi_x^-$ relative to $-\phi\tilde{x}^*$ along the horizontal in the third quadrant and the rotation of $-\phi c\phi\tilde{t}'^*$ by intrinsic angle $\phi\psi_t^-$ relative to $-\phi c\phi\tilde{t}^*$ along the vertical in the fourth quadrant in Fig. 5a are valid with respect to the 3-observer* in $-\tilde{\Sigma}^*$, where $\sin\phi\psi_x^- = \phi v_{x^-}/\phi c$ and $\sin\phi\psi_t^- = \phi v_{t^-}/\phi c$.

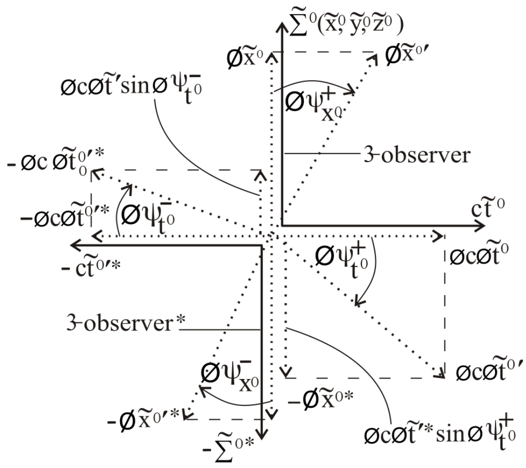
The rotations of $\phi\tilde{x}^{0\prime}$ by intrinsic angle $\phi\psi_{x^{0+}}$ relative to $\phi\tilde{x}^0$ along the vertical in the first quadrant and the rotation of $\phi c\phi\tilde{t}^{0\prime}$ by intrinsic angle $\phi\psi_{t^{0+}}$ relative to $\phi c\phi\tilde{t}^0$ along the horizontal in the fourth quadrant are valid with respect to the 3-observer in $\tilde{\Sigma}^0$ in Fig. 5b, where $\sin\phi\psi_{x^0}^+ = \phi v_{x^{0+}}/\phi c$ and $\sin\phi\psi_{t^0}^+ = \phi v_{t^{0+}}/\phi c$. On the other hand, the rotation of $-\phi\tilde{x}^{0\prime *}$ at intrinsic angle $\phi\psi_{x^0}^-$ relative to $-\phi\tilde{x}^{0*}$ along the vertical in the third quadrant and the rotation of $-\phi c\phi\tilde{t}^{0\prime *}$ by intrinsic angle $\phi\psi_{t^0}^-$ relative to $-\phi c\phi\tilde{t}^{0*}$ along the vertical in the second quadrant in Fig. 5b are valid with respect to the 3-observer* in $-\tilde{\Sigma}^{0*}$, where $\sin\phi\psi_{x^0}^- = \phi v_{x^{0-}}/\phi c$ and $\sin\phi\psi_{t^0}^- = \phi v_{t^{0-}}/\phi c$.

Although the intrinsic angles $\phi\psi_x^+$, $\phi\psi_x^-$, $\phi\psi_t^+$ and $\phi\psi_t^-$, which are related to the intrinsic speeds ϕv_{x^+}, ϕv_{x^-}, ϕv_{t^+} and ϕv_{t^-}, as $\sin\phi\psi_x^+ = \phi v_{x^+}/\phi c$; $\sin\phi\psi_x^- = \phi v_{x^-}/\phi c$; $\sin\phi\psi_t^+ = \phi v_{t^+}/\phi c$; and $\sin\phi\psi_t^- = \phi v_{t^-}/\phi c$ respectively in Fig. 5a, are different in magnitude as being assumed and although the intrinsic angles $\phi\psi_{x^0}^+$, $\phi\psi_{x^0}^-$, $\phi\psi_{t^0}^+$, $\phi\psi_{t^0}^-$, which are related to intrinsic speeds $\phi v_{x^{0+}}$, $\phi v_{x^{0-}}$, $\phi v_{t^{0+}}$ and $\phi v_{t^{0-}}$ as $\sin\phi\psi_{x^0}^+ = \phi v_{x^{0+}}/\phi c$; $\sin\phi\psi_{x^0}^- = \phi v_{x^{0-}}/\phi c$; $\sin\phi\psi_{t^0}^+ = \phi v_{t^{0+}}/\phi c$; and $\sin\phi\psi_{t^0}^- = \phi v_{t^{0-}}/\phi c$ respectively in Fig. 5b, are different in magnitude as being assumed, it must be remembered that the intrinsic angles $\phi\psi_x^+$, $\phi\psi_x^-$, $\phi\psi_{t^+}$, $\phi\psi_t^-$ in Fig. 5a are equal to the intrin-



(a)

Fig. 5: (a) Rotations of intrinsic affine spacetime coordinates of intrinsic particle's frame relative to intrinsic observer's frame due to assumed non-symmetrical motions of symmetry-partner particles relative to symmetry-partner observers in the four universes, with respect to 3-observers in the Euclidean 3-spaces in the positive (or our) universe and the negative universe.



(b)

Fig. 5: (b) Rotations of intrinsic affine spacetime coordinates of intrinsic particle's frame relative to intrinsic observer's frame due to assumed non-symmetrical motions of symmetry-partner particles relative to symmetry-partner observers in the four universes, with respect to 3-observers in the Euclidean 3-spaces in the positive time-universe and the negative time-universe.

sic angles $\phi\psi^+_{t0}$, $\phi\psi^-_{t0}$, $\phi\psi^+_{x0}$, $\phi\psi^-_{x0}$ respectively in Fig. 5b.

That is, $\phi\psi^+_x = \phi\psi^+_{t0}$; $\phi\psi^-_x = \phi\psi^-_{t0}$; $\phi\psi^+_t = \phi\psi^+_{x0}$ and $\phi\psi^-_t = \phi\psi^-_{x0}$ in Figs. 5a and 5b. Consequently the intrinsic speeds ϕv_{x^+}, ϕv_{x^-}, ϕv_{t^+} and ϕv_{t^-} in Fig. 5a are equal to ϕv_{t0^+}, ϕv_{t0^-}, ϕv_{x0^+} and ϕv_{x0^-} respectively in Fig. 5b. That is, $\phi v_{x^+} = \phi v_{t0^+}$; $\phi v_{x^-} = \phi v_{t0^-}$; $\phi v_{t^+} = \phi v_{x0^+}$ and $\phi v_{t^-} = \phi v_{x0^+}$ in Figs. 5a and 5b.

By following the procedure used to derive partial intrinsic Lorentz transformation with respect to the 3-observer in $\tilde{\Sigma}$ from Fig. 8a of [1], the unprimed intrinsic affine coordinate $\phi\tilde{x}$ along the horizontal is the projection of the inclined $\phi\tilde{x}'$ in the first quadrant in Fig. 5a. That is, $\phi\tilde{x} = \phi\tilde{x}' \cos\phi\psi^+_x$. Hence we can write

$$\phi\tilde{x}' = \phi\tilde{x} \sec\phi\psi^+_x$$

This is all the intrinsic coordinate transformation that could have been possible with respect to the 3-observer in $\tilde{\Sigma}$ along the horizontal in the first quadrant in Fig. 5a, but for the fact that the inclined negative intrinsic coordinate $-\phi c\phi\tilde{t}'^*$ of the negative universe in the fourth quadrant also projects a component $-\phi c\phi\tilde{t}' \sin\phi\psi^-_t$ along the horizontal, which must be added to the right-hand side of the last displayed equation to have

$$\phi\tilde{x}' = \phi\tilde{x} \sec\phi\psi^+_x - \phi c\phi\tilde{t}' \sin\phi\psi^-_t; \qquad (*)$$

w.r.t 3 – observer in $\tilde{\Sigma}$.

As mentioned in the derivation of $(*)$, but for $\phi\psi^+_x = \phi\psi^-_x = \phi\psi$ with Fig. 8a in [1], the dummy star label on the component $-\phi c\phi\tilde{t}'^* \sin\phi\psi^-_t$ projected along the horizontal has been removed, since the projected component is now an intrinsic coordinate in the positive universe.

But $\phi c\phi\tilde{t} = \phi c\phi\tilde{t}' \cos\phi\psi^+_t$ or $\phi c\phi\tilde{t}' = \phi c\phi\tilde{t} \sec\phi\psi^+_t$ along the vertical in the second quadrant in the same Fig. 5a. By replacing $\phi c\phi\tilde{t}'$ by $\phi c\phi\tilde{t} \sec\phi\psi^+_t$ at the right-hand side of $(*)$ we have

$$\phi\tilde{x}' = \phi\tilde{x} \sec\phi\psi^+_x - \phi c\phi\tilde{t} \sec\phi\psi^+_t \sin\phi\psi^-_t; \qquad (9)$$

w.r.t 3 – observer in $\tilde{\Sigma}$. Eq. (9) is the final form of the partial intrinsic Lorentz transformation that the 3-observer in $\tilde{\Sigma}$ in our universe could derive along the horizontal in the first quadrant from Fig. 5a.

By applying the same procedure used to derive Eq. (9) from the first and fourth quadrants of Fig. 5a to the first and second quadrants of Fig. 5b, the counterpart of Eq. (9) that is valid with respect to the 3-observer in $\tilde{\Sigma}^0$ in that figure is the following:

$$\phi\tilde{x}^{0\prime} = \phi\tilde{x}^0 \sec\phi\psi^+_{x0} - \phi c\phi\tilde{t}^0 \sec\phi\psi^+_{t0} \sin\phi\psi^-_{t0}; \qquad (10)$$

w.r.t 3 – observer in $\tilde{\Sigma}^0$. Again Eq. (10) is the final form of the partial intrinsic Lorentz transformation that the 3-observer in $\tilde{\Sigma}^0$ in the positive time-universe could derive along the vertical in the first quadrant from Fig. 5b. By collecting Eqs. (9) and (10) we have

$$\left.\begin{aligned} \phi\tilde{x}' &= \phi\tilde{x} \sec\phi\psi^+_x - \phi c\phi\tilde{t} \sec\phi\psi^+_t \sin\phi\psi^-_t; \\ &\quad (\text{w.r.t } 3 - \text{observer in } \tilde{\Sigma}); \\ \phi\tilde{x}^{0\prime} &= \phi\tilde{x}^0 \sec\phi\psi^+_{x0} - \phi c\phi\tilde{t}^0 \sec\phi\psi^+_{t0} \sin\phi\psi^-_{t0}; \\ &\quad (\text{w.r.t } 3 - \text{observer in } \tilde{\Sigma}^0) \end{aligned}\right\}. \qquad (11)$$

However system (11) is useless because it is neither the full intrinsic Lorentz transformation in our (or positive) universe nor in the the positive time-universe. This is so because the second equation of system (11) contains intrinsic coordinates of the positive time-universe, which are elusive to observers in our universe or which cannot appear in physics in our universe. On the other hand, the first equation contains the intrinsic spacetime coordinates of our universe, which cannot appear in physics in the positive time-universe.

In order to make system (11) a valid full intrinsic spacetime coordinate transformation (i.e. to make it full intrinsic Lorentz transformation) in our universe, we must transform the intrinsic spacetime coordinates of the positive time-universe in the second equation into the intrinsic spacetime coordinates of our universe. As derived in part one of this paper [3], we must let $\phi\tilde{x}^{0\prime} \to \phi c\phi\tilde{t}'$, $\phi\tilde{x}^0 \to \phi c\phi\tilde{t}$ and $\phi c\phi\tilde{t}^0 \to \phi\tilde{x}$ in the second equation of system (11), thereby converting system (11) to the following

$$\left.\begin{aligned} \phi\tilde{x}' &= \phi\tilde{x} \sec\phi\psi^+_x - \phi c\phi\tilde{t} \sec\phi\psi^+_t \sin\phi\psi^-_t; \\ &\quad (\text{w.r.t } 3 - \text{observer in } \tilde{\Sigma}); \\ \phi c\phi\tilde{t}' &= \phi c\phi\tilde{t} \sec\phi\psi^+_t - \sec\phi\psi^+_x \sin\phi\psi^-_x; \\ &\quad (\text{w.r.t } 1 - \text{observer in } c\tilde{t}) \end{aligned}\right\}. \qquad (12)$$

Fig. 5b cannot serve the role of a complementary diagram to Fig. 5a because it contains spacetime and intrinsic spacetime coordinates of the positive time-universe and negative time-universe that are elusive to observers in our universe and negative universe. This has been discussed for Figs. 10a and 10b of [3]. In order to make Fig. 5b a valid complementary diagram to Fig. 5a, the spacetime/intrinsic spacetime coordinates of the positive and negative time-universes in it must be transformed into those of our universe and the negative universe, as done between Fig. 10b and Fig. 11a of [3], to have Fig. 5c.

Fig. 5c containing spacetime/intrinsic spacetime coordinates of the positive (or our) universe and negative universe (obtained from Fig. 5b) is now a valid complementary diagram to Fig. 5a for the purpose of deriving the ϕLT/LT in our universe and negative universe. Observe that the 3-observers in the Euclidean 3-spaces $\tilde{\Sigma}^0$ and $-\tilde{\Sigma}^{0*}$ of the positive and negative time-universes in Fig. 5b have transformed into 1-observers in the time dimensions $c\tilde{t}$ and $-c\tilde{t}^*$ of our universe and the negative universe in Fig. 5c.

The second equation of system (12) has been derived from Fig. 5c with respect to the 1-observer in the time dimension $c\tilde{t}$

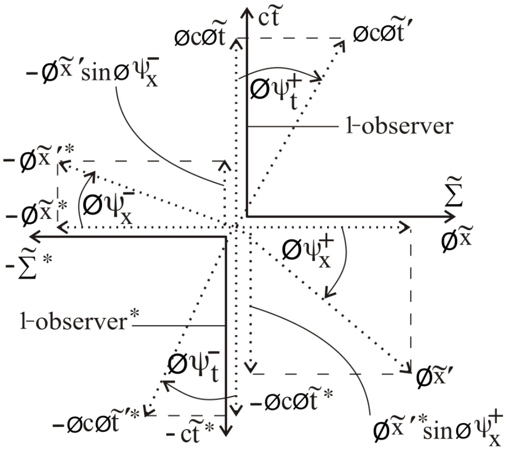


Fig. 5: (c) Complementary diagram to Fig. 5a obtained by transforming the spacetime/intrinsic spacetime coordinates of the positive time-universe and the negative time-universe in Fig. 5b into the spacetime/intrinsic spacetime coordinates of our universe and the negative universe.

in that diagram. It is a valid complementary partial intrinsic spacetime transformation to the first equation of system (12) or to Eq. (10) derived with respect to 3-observer in the Euclidean 3-space $\tilde{\Sigma}$ from Fig. 5a. Thus system (12) is the complete intrinsic Lorentz transformation derivable from Figs. 5a and 5c with respect to 3-observer in $\tilde{\Sigma}$ and 1-observer in $c\tilde{t}$.

By using the definitions given earlier namely,

$$\begin{aligned}
\sin\phi\psi_x^+ &= \sin\phi\psi_{t^0}^+ = \phi v_{x^+}/\phi c;\\
\sin\phi\psi_x^- &= \sin\phi\psi_{t^0}^- = \phi v_{x^-}/\phi c;\\
\sin\phi\psi_{x^0}^+ &= \sin\phi\psi_t^+ = \phi v_{t^+}/\phi c \ \text{ and}\\
\sin\phi\psi_{x^0}^- &= \sin\phi\psi_t^- = \phi v_{t^-}/\phi c;
\end{aligned}$$

system (12) is given explicitly in terms of intrinsic speeds as follows:

$$\left.\begin{aligned}
\phi\tilde{x}' &= \left(1-\frac{\phi v_{x^+}^2}{\phi c^2}\right)^{-\frac{1}{2}}\phi\tilde{x}-\\
&\quad -\left(1-\frac{\phi v_{t^+}^2}{\phi c^2}\right)^{-\frac{1}{2}}(\phi v_{t^-})\phi\tilde{t};\\
&\quad (\text{w.r.t. } 3-\text{observer in } \tilde{\Sigma})\\
\phi\tilde{t}' &= \left(1-\frac{\phi v_{t^+}^2}{\phi c^2}\right)^{-\frac{1}{2}}\phi\tilde{t}-\\
&\quad -\left(1-\frac{\phi v_{x^+}^2}{\phi c^2}\right)^{-\frac{1}{2}}\frac{\phi v_{x^-}}{\phi c^2}\phi\tilde{x};\\
&\quad (\text{w.r.t. } 1-\text{observer in } c\tilde{t})
\end{aligned}\right\} \quad (13)$$

The outward manifestation on the flat four-dimensional spacetime of systems (12) and (13) are given respectively as follows:

$$\left.\begin{aligned}
\tilde{x}' &= \tilde{x}\sec\psi_x^+ - c\tilde{t}\sec\psi_t^+\sin\psi_t^-;\\
&\quad \tilde{y}'=\tilde{y};\ \tilde{z}'=\tilde{z};\\
&\quad (\text{w.r.t } 3-\text{observer in } \tilde{\Sigma});\\
c\tilde{t}' &= c\tilde{t}\sec\psi_t^+ - \tilde{x}\sec\psi_x^+\sin\psi_x^-;\\
&\quad (\text{w.r.t } 1-\text{observer in } c\tilde{t})
\end{aligned}\right\} \quad (14)$$

and

$$\left.\begin{aligned}
\tilde{x}' &= \left(1-\frac{v_{x^+}^2}{c^2}\right)^{-\frac{1}{2}}\tilde{x} - \left(1-\frac{v_{t^+}^2}{c^2}\right)^{-\frac{1}{2}}(v_{t^-})\tilde{t};\\
&\quad \tilde{y}'=\tilde{y};\ \tilde{z}'=\tilde{z};\\
&\quad (\text{w.r.t. } 3-\text{observer in } \tilde{\Sigma})\\
\tilde{t}' &= \left(1-\frac{v_{t^+}^2}{c^2}\right)^{-\frac{1}{2}}\tilde{t} - \left(1-\frac{v_{x^+}^2}{c^2}\right)^{-\frac{1}{2}}\frac{v_{x^-}}{c^2}\tilde{x};\\
&\quad (\text{w.r.t. } 1-\text{observer in } c\tilde{t})
\end{aligned}\right\}. \quad (15)$$

As can be easily shown, system (12) or (13) contradicts (or does not lead to) intrinsic Lorentz invariance (ϕLI) for $\phi\psi_x^+ \neq \phi\psi_x^- \neq \phi\psi_t^+ \neq \phi\psi_t^-$ (or for $\phi v_{x^+} \neq \phi v_{x^-} \neq \phi v_{t^+} \neq \phi v_{t^-}$). System (14) or (15) likewise does not lead to Lorentz invariance (LI) for $\psi_x^+ \neq \psi_x^- \neq \psi_t^+ \neq \psi_t^-$ (or $v_{x^+} \neq v_{x^-} \neq v_{t^+} \neq v_{t^-}$). Even if only one of the four intrinsic angles $\phi\psi_x^+$, $\phi\psi_x^-$, $\phi\psi_t^+$ and $\phi\psi_t^-$ is different from the rest (or if only one of the four intrinsic speeds ϕv_{x^+}, ϕv_{x^-}, ϕv_{t^+} and ϕv_{t^-} is different from the rest), system (12) or (13) still contradicts ϕLI. And even if only one of the four angles ψ_x^+, ψ_x^-, ψ_t^+ and ψ_t^- is different from the rest (or if only one of the four speeds v_{x^+}, v_{x^-}, v_{t^+} and v_{t^-} is different from the rest), system (14) or (15) still contradicts the LI.

The assumption made initially that members of a quartet of symmetry-partner particles or objects in the four universes are in non-symmetrical relative motions in their universes, which gives rise to Fig. 5a-c, has led to the non-validity of intrinsic Lorentz invariance in intrinsic special relativity (ϕSR) and of Lorentz invariance in special relativity (SR) in our universe and indeed in the four universes. This invalidates the initial assumption, since Lorentz invariance is immutable on the flat four-dimensional spacetime of the special theory of relativity. The conclusion then is that all the four members of every quartet of symmetry-partner particles or objects in the four universes are in identical (or symmetrical) relative motions at all times.

Having shown that the members of every quartet of symmetry-partner particles or objects in the four universes have identical magnitudes of masses, identical shapes and identical sizes, (in so far as the prescribed identical magnitudes of masses, identical shapes and identical sizes of symmetry-partner particles or objets in the positive (or our) universe and the negative universe is valid), in the preceding sub-section and that they are involved in identical relative motions at all times in this sub-section, the perfect symmetry of state among the four universes has been demonstrated. Although gravity is being assumed to be absent in this and the previous papers [1-3], it is interesting to note that gravitational field sources of identical magnitudes of masses, identical sizes and identical shapes, which hence give rise to identical gravitational fields, are located at symmetry-partner positions in spacetimes in the four universes.

3 Summary and conclusion

This section is for the two parts of the initial paper [1] and [2], this paper and its first part [3]. The co-existence in nature of four symmetrical universes identified as positive (or our) universe, negative universe, positive time-universe and negative time-universe in different spacetime/intrinsic spacetime domains, have been exposed in these papers. The four universes exhibit perfect symmetry of natural laws and perfect symmetry of state. This implies that natural laws take on identical forms in the four universes and that all members of every quartet of symmetry-partner particles or objects in the four universes have identical magnitudes of masses, identical shapes and identical sizes and that they are involved in identical relative motions in their universes at all times, as demonstrated. The four universes constitute a four-world background to the special theory of relativity in each universe.

The flat two-dimensional intrinsic spacetime of the intrinsic special theory of relativity (ϕSR), containing one-dimensional intrinsic masses of particles and objects in one-dimensional intrinsic space, which underlies the flat four-dimensional spacetime of the special theory of relativity (SR) containing three-dimensional masses of particles and objects in Euclidean 3-space in each universe, introduced (as *ansatz* in the first paper [1], is isolated in this fourth paper. The two-dimensional intrinsic spacetime is indispensable in special relativity/intrinsic special relativity (SR/ϕSR) in the four-world picture, because the new set of spacetime/intrinsic spacetime diagrams for deriving Lorentz transformation/intrinsic Lorentz transformation (LT/ϕLT) and their inverses in the four-world picture, involve relative rotations of intrinsic spacetime coordinates of two frames in relative motion.

The LT/ϕLT and their inverses are derived from a new set of spacetime/intrinsic spacetime diagrams on the combined spacetimes/intrinsic spacetimes of the positive (or our) universe and the negative universe as one pair of universes and on combined spacetimes/intrinsic spacetimes of the positive time-universe and the negative time-universe as another pair of universes. The two pairs of spacetimes/intrinsic spacetimes co-exist in nature, consequently the spacetime/intrinsic spacetime diagram drawn on one pair co-exists with and must complement the spacetime/intrinsic spacetime diagram drawn on the other pair in deriving the LT/ϕLT and their inverses (with a set of four diagrams in all) in each universe, as done in the first paper [1] and validated formally in the third paper [3].

The proper (or classical) Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe with respect to 3-observers in it, is what appears as the proper time dimension ct' of the positive (or our) universe relative to 3-observers in the proper Euclidean 3-space Σ' of our universe and the proper Euclidean 3-space Σ' of the positive (or our) universe with respect to 3-observers in it, is what appears as the proper time dimension $ct^{0\prime}$ of the positive time-universe relative to 3-observers in the proper Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe. The proper Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe is likewise the proper time dimension $-ct'^{*}$ of the negative universe and the proper Euclidean 3-space $-\Sigma'^{*}$ of the negative universe is the proper time dimension $-ct^{0\prime *}$ of the negative time-universe. The important revelation in this is that time is not a fundamental (or "created") concept, but a secondary concept that evolved from the concept of space. Time dimension does not exist in an absolute sense, as does 3-space, but in a relative sense.

The positive time-universe cannot be perceived better than the time dimension ct' of the positive (or our) universe by 3-observers in the Euclidean 3-space Σ' of our universe and the negative time-universe cannot be perceived better than the time dimension $-ct'^{*}$ of the negative universe by 3-observers in the Euclidean 3-space $-\Sigma'^{*}$ of the negative universe. Conversely, the positive (or our) universe cannot be perceived better than the time dimension $ct^{0\prime}$ of the positive time-universe by 3-observers in the Euclidean 3-space $\Sigma^{0\prime}$ of the positive time-universe and the negative universe cannot be perceived better than the time dimension $-ct^{0\prime *}$ of the negative time-universe by 3-observers in the Euclidean 3-space $-\Sigma^{0\prime *}$ of the negative time-universe. It can thus be said that the positive time-universe and the negative time-universe are imperceptibly hidden in the time dimensions of the positive (or our) universe and the negative universe respectively relative to 3-observers in the Euclidean 3-spaces in our universe and the negative universe and conversely.

Physicists in our (or positive) universe and negative universe can formulate special relativity and special-relativistic physics in general in terms of the spacetime/intrinsic spacetime dimensions (or coordinates) and physical parameters/intrinsic parameters of our universe and the negative universe only. Physicists in the positive time-universe and the negative time-universe can likewise formulate special relativity and special-relativistic physics in general in terms of the spacetime/intrinsic spacetime dimensions (or coordinates) and parameters/intrinsic parameters of the positive and the negative time-universes only. It is to this extent that it can still be said that special relativity and special-relativistic physics in general, pertain to a two-world background, knowing that the two-world picture actually encompasses four universes; two of them being imperceptibly hidden in the time dimensions.

Experimental validation ultimately of the co-existence in nature of four symmetrical universes will give a second testimony to their isolation theoretically in these papers. The next natural step is to investigate the possibility of subsuming the theory of relativistic gravity into the four-world picture.

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