Article 18:

Incorporating the absolute-absolute spacetime and its underlying absolute-absolute intrinsic-intrinsic spacetime into physics. Part I.

A. O. Adekugbe Joseph
adekugbe@alum.mit.edu

We show that the third layer of space-time-mass namely, the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime containing the 'two-dimensional' absolute-absolute intrinsic-intrinsic rest masses of particles and bodies, in the derived space-time/intrinsic spacetime diagrams in the gravitational field in the previous papers, is made manifest outwardly in flat 'two-dimensional' absolute-absolute spacetime containing the 'two-dimensional' absolute-absolute rest masses of particles and bodies, with respect to observers in the flat four-dimensional physical spacetime of the theory of gravitational relativity (TGR); that the flat 'two-dimensional' absolute-absolute spacetime containing the absolute rest masses of particles and bodies is imperceptibly embedded in the flat four-dimensional spacetime containing the inertial masses of particles and bodies and that the 'one-dimensional' absolute-absolute space is an isotropic 'dimension' (with no unique orientation in the physical Euclidean 3-space, with respect to observers in the physical spacetime. We develop the Newtonian theory of absolute-absolute gravity (NAAG) and Newtonian theory of absolute-absolute motion (NAAM) on the flat absolute-absolute spacetime with respect to observers in the physical spacetime and show that these are the only theories that qualify to be described as Newton's mechanics in a Newtonian absolute space, which Leibnitz pointed out. We therefore identify the flat 'two-dimensional' absolute-absolute spacetime as the Newtonian absolute spacetime (of classical mechanics); the 'one-dimensional' isotropic absolute-absolute space being the controversial Newtonian absolute space, the absolute-absolute time 'dimension' being the universal synchronous time coordinate that appears in the Gaussian line element and the absolute-absolute time being the universal absolute time parameter of classical mechanics. We conclude with a brief history of the controversies that the Newtonian absolute space concept has generated since Newton's time and the definite resolution of the controversies in the present theory.

1 Three stages of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe revisited

Let us revisit [1] and reproduce the flat 'four-dimensional' absolute-absolute spacetime $(\hat{\hat{\Sigma}}, \hat{\hat{c}}\hat{\hat{t}})$ and its underlying absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$, with respect to hypothetical 3-observers in the absolute-absolute space $\hat{\hat{\Sigma}}$ in Fig. 13a of that paper, which existed at the *ab initio* State 1 of a universe as Fig. 1 here. The 'four-dimensional' absolute-absolute rest masses $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$

and ($\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2$) in flat ($\hat{\hat{\Sigma}}, \hat{\hat{c}}\hat{\hat{t}}$) and the 'two-dimensional' absolute-absolute intrinsic-intrinsic rest masses ($\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2$) of a gravitational field source and ($\phi\phi\hat{\hat{m}}_0$, $\phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2$) of a test particle in flat ($\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$), assumed to be present in the universe at that epoch are shown in Fig. 1.

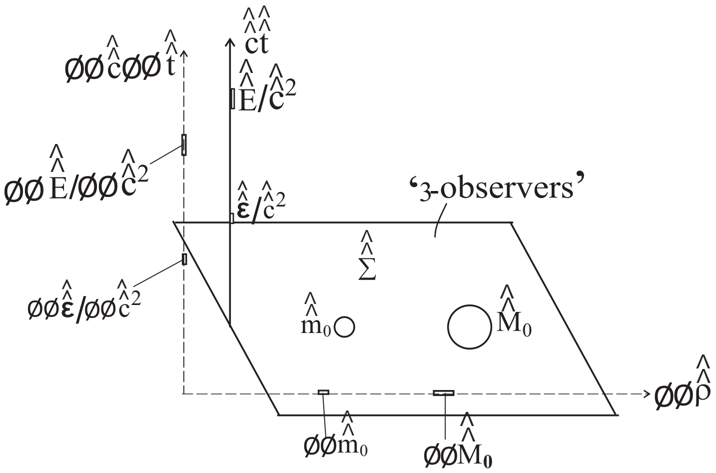

Figure 1: The flat 'four-dimensional' absolute-absolute spacetime assumed to contain the absolute-absolute rest masses of a gravitational field source and a test particle and its underlying flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime containing the absolute-absolute intrinsic-intrinsic rest masses of the gravitational field source and test particle, with respect to hypothetical '3-observers' in the absolute-absolute space, at the *ab initio* absolutely immaterial state one of a universe.

Let us also revisit the three stages of evolutions of spacetime/intrinsic spacetime-and parameters/inrinsic parameters in a universe in section 3 of [1]. As explained in that paper, the flat universal absolute-absolute spacetime ($\hat{\hat{\Sigma}}, \hat{\hat{c}}\hat{\hat{t}}$), assumed to contain absolute-absolute rest masses ($\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2$), ($\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2$) of gravitational field sources and particles and its underlying flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime ($\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$), containing the absolute-absolute intrinsic-intrinsic rest masses ($\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2$), ($\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2$) of gravitational field sources and particles, at the *ab initio* State 1 of a universe in Fig. 1, evolved into flat 'four-dimensional' absolute spacetime ($\hat{\Sigma}, \hat{c}\hat{t}$) containing absolute rest masses ($\hat{M}_0, \hat{E}/\hat{c}^2$), ($\hat{m}_0, \hat{\varepsilon}/\hat{c}^2$) of gravitational field sources and test particles, which is underlied by flat ‘two-dimensional’ absolute intrinsic spacetime ($\phi\hat{\rho}, \phi\hat{c}\phi\hat{t}$) containing absolute intrinsic rest masses ($\phi\hat{M}_0, \phi\hat{E}/\phi\hat{c}^2$), ($\phi\hat{m}_0, \phi\hat{\varepsilon}/\phi\hat{c}^2$) of gravitational field sources and test particles, which, in turn, is underlies by flat ‘two-dimensional’ absolute-absolute intrinsic-intrinsic spacetime ($\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$) containing the absolute-absolute intrinsic-intrinsic rest masses ($\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2$), ($\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2$) of gravitational field sources and test particles. In other words, Fig. 1 evolved into Fig. 2a at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

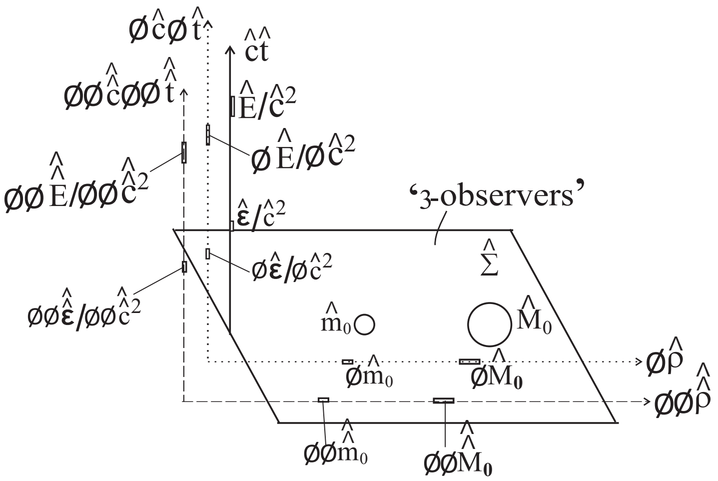

Figure 2: **a** The flat ‘four-dimensional’ absolute spacetime containing the absolute rest masses of a gravitational field source and a test particle and its underlying flat ‘two-dimensional’ absolute intrinsic spacetime containing the absolute intrinsic rest masses of the gravitational field source and test particle, with respect to hypothetical ‘3-observers’ in the absolute space, which evolves from Fig. 1 at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

At the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, the universal flat ‘four-dimensional’ absolute spacetime ($\hat{\Sigma}, \hat{c}\hat{t}$) containing the absolute rest masses ($\hat{M}_0, \hat{E}/\hat{c}^2$), ($\hat{m}_0, \hat{\varepsilon}/\hat{c}^2$) of gravitational field sources and test particles, which is underlied by universal flat ‘two-dimensional’ absolute intrinsic spacetime ($\phi\hat{\rho}, \phi\hat{c}\phi\hat{t}$) containing the absolute intrinsic rest masses ($\phi\hat{M}_0, \phi\hat{E}/\phi\hat{c}^2$), ($\phi\hat{m}_0, \phi\hat{\varepsilon}/\phi\hat{c}^2$) of gravitational field sources and test particles, that evolves at the first stage in Fig. 2a, evolves into universal flat four-dimensional proper spacetime (Σ', ct') containing the rest masses $(M_0, E'/c^2)$, $(m_0, \varepsilon'/c^2)$ of gravitational field sources and test particles, and its underlying universal flat two-dimensional proper intrinsic spacetime $(\phi\rho', \phi c\phi t')$ containing the intrinsic rest masses $(\phi M_0, \phi E'/\phi c^2)$, $(\phi m_0, \phi\varepsilon'/c^2)$ of gravitational field sources and test particles, which, in turn, is underlied by universal flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$, containing the absolute-absolute intrinsic-intrinsic rest masses $(\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2)$, $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$ of gravitational field sources and test particles. Thus Fig. 2a evolves into Fig. 2b at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

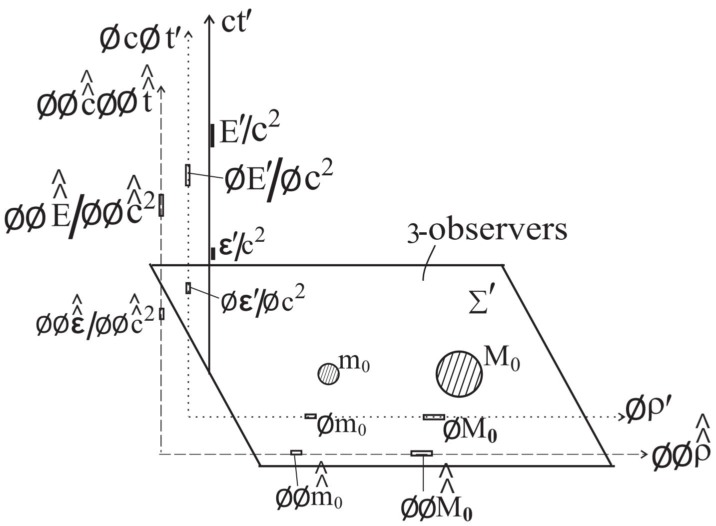

Figure 2: **b** The flat four-dimensional proper spacetime containing the rest masses of a gravitational field source and a test particle and its underlying flat two-dimensional proper intrinsic spacetime containing the intrinsic rest masses of the gravitational field source and test particle, with respect to 3-observers in the proper Euclidean 3-space, which evolves from Fig. 2a at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

And at the third (and final) stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, the universal flat four-dimensional proper spacetime (Σ', ct') containing the rest masses $(M_0, E'/c^2)$, $(m_0, \varepsilon'/c^2)$ of gravitational field sources and test particles, and its underlying universal flat two-dimensional proper intrinsic spacetime ($\phi\rho'$, $\phi c\phi t'$) containing the intrinsic rest masses ($\phi M_0, \phi E'/\phi c^2$), ($\phi m_0, \phi\varepsilon'/c^2$) of gravitational field sources and test particles, which evolves at the second stage in Fig. 2b, evolves into universal flat four-dimensional relativistic spacetime (Σ, ct), containing the inertial masses ($M, E/c^2$), ($m, /c^2$) of gravitational field sources and test particles and its underlying universal flat two-dimensional relativistic intrinsic spacetime ($\phi\rho$, $\phi c\phi t$) containing the intrinsic inertial masses ($\phi M, \phi E/\phi c^2$), ($\phi m, \phi\varepsilon/c^2$) of gravitational field sources and test particles, which, in turn, is underlied by flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime ($\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$) containing the absolute-absolute intrinsic-intrinsic rest masses ($\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2$), ($\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2$) of gravitational field sources and test particles. In other word, Fig. 2b evolves into Fig. 2c at the third stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

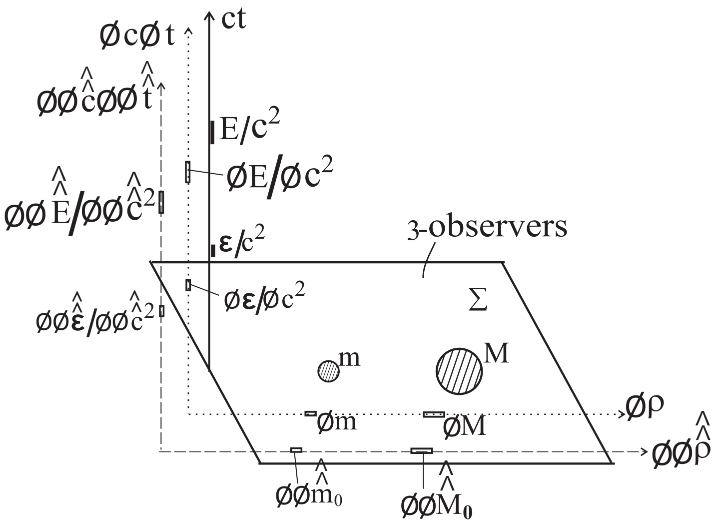

Figure 2: **c** The flat four-dimensional relativistic spacetime containing the inertial masses of a gravitational field source and a test particle and its underlying flat two-dimensional relativistic intrinsic spacetime containing the intrinsic inertial masses of the gravitational field source and test particle, with respect to 3-observers in the relativistic Euclidean 3-space, which evolves from Fig. 2b at the third stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe.

It must be recalled that the geometries of Figs. 2a – 2c are not their complete forms. The complete form of the geometry of the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, which transforms Fig. 1 to Fig. 2a, has no corresponding geometry in a gravitational field. Its complete form shall not be presented until the present theory has propagated to black hole physics and cosmological model. On the other hand, Fig. 2b at the second stage in a universe corresponds to the geometry at the first stage in a gravitational field, presented fully as Fig. 5 of [2] and Fig. 13a of [1]. Fig. 2c at the third stage in a universe corresponds to the geometry at the second stage in a gravitational field, presented fully as Figs. 7 and 8 and their inverses Figs. 9 and 10 of [2] and as Fig. 13b of [1].

The evolution of the geometry of Fig. 2a to the geometry of Fig. 2b at the second sage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, which corresponds to the first stage in a gravitational field, takes place within every gravitational field in the universe, as has been well described in [3] – [4]. The evolution of the geometry of Fig. 2b to that of Fig. 2c at the third stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, which corresponds to the second stage in a gravitational field, likewise takes place within every gravitational field in the universe, as has been well described in [2] and [5] – [6]. Further more the evolution of Fig. 2a to Fig. 2b and the evolution of Fig. 2b to Fig. 2c, occur simultaneously, as explained in sub-section 1.1 of [2] and section 3 of [4]. Consequently the extended geometries of Figs. 2a and 2b were not formed (or never existed) within the universe, but the final and enduring geometry of Fig. 2c.

Now the flat 'four-dimensional' absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ containing absolute rest masses $(\hat{m}_0, \hat{\varepsilon}/\hat{c}^2)$, $(\hat{M}_0, \hat{E}/\hat{c}^2)$ is the outward manifestation of the flat 'two-dimensional' absolute absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ containing absolute intrinsic rest masses $(\phi\hat{m}_0, \phi\hat{\varepsilon}/\phi\hat{c}^2)$, $(\phi\hat{M}_0, \phi\hat{E}/\phi\hat{c}^2)$ in Fig. 2a. Although this has not been mentioned in the previous articles, the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\rho}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ containing absolute-absolute intrinsic-intrinsic rest masses $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$, $(\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2)$, is also made manifest outwardly in flat 'four-dimensional' absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ containing absolute rest masses $(\hat{m}_0, \hat{\varepsilon}/\hat{c}^2)$, $(\hat{M}_0, \hat{E}/\hat{c}^2)$, where the absolute-absolute spacetime $(\hat{\hat{\Sigma}}, \hat{\hat{c}}\hat{\hat{t}})$ is embedded in the absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ and the absolute-absolute rest masses $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$, $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$ are embedded in the absolute rest masses $(\hat{m}_0, \hat{\varepsilon}/\hat{c}^2)$, $(\hat{M}_0, \hat{E}/\hat{c}^2)$.

The more complete form of Fig. 2a at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, which follows from the foregoing paragraph is depicted in Fig. 3a with respect to '3-

observers' in the absolute space $\hat{\Sigma}$. The 'three-dimensional' absolute-absolute space $\hat{\hat{\Sigma}}$ with respect to hypothetical observers in it, is a 'one-dimensional' isotropic absolute-absolute space $\hat{\hat{\rho}}$ with respect to '3-observers' in the absolute space $\hat{\Sigma}$. The absolute-absolute space $\hat{\hat{\Sigma}}$ is isotropic with respect to '3-observers' in the absolute space $\hat{\Sigma}$, consequently it naturally contracts to 'one-dimensional' space $\hat{\hat{\rho}}$ with no unique orientation in $\hat{\Sigma}$, with respect to '3-observers' in $\hat{\Sigma}$, as shall be explained in the second part of this paper. The explanation takes the form of the explanation of the natural contraction of the 'three-dimensional' absolute space $\hat{\Sigma}$ into an isotropic 'one-dimensional' absolute space $\hat{\rho}$ with respect to 3-observers in the relative 3-space Σ' or Σ in sub-section 4.7 of [3].

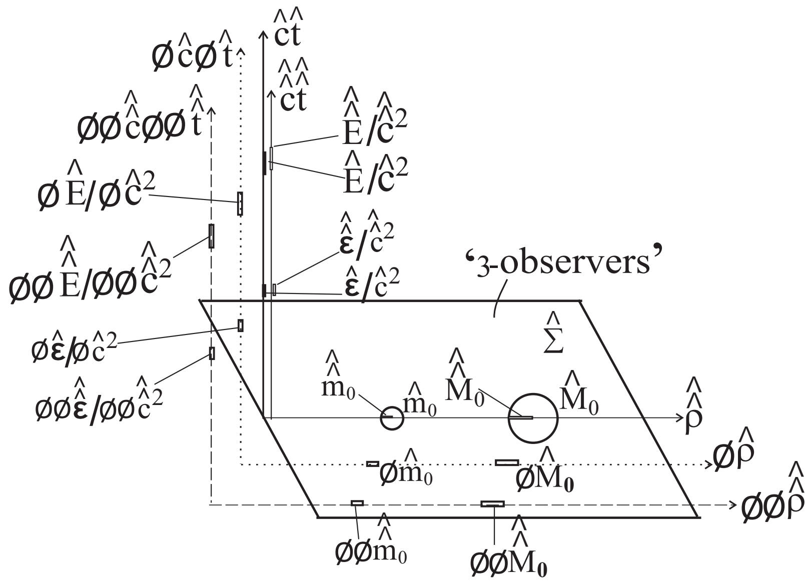

Figure 3: **a** A more complete form of Fig. 2a, in which the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime containing absolute-absolute intrinsic-intrinsic rest masses of particles and bodies, is made manifest outwardly in flat 'two-dimensional' absolute-absolute spacetime containing the absolute-absolute rest masses of particles and bodies, which is embedded in flat 'four-dimensional' absolute spacetime containing the absolute rest masses of particles and bodies, with respect to '3-observers' in the absolute space.

The lines of absolute-absolute rest masses $\hat{\hat{M}}_0$, $\hat{\hat{m}}_0$ in the isotropic 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ are embedded in the 'three-dimensional' absolute rest masses $\hat{M}_0$, $\hat{m}_0$ respectively in $\hat{\Sigma}$. Of course the '3-observers' in $\hat{\Sigma}$ cannot perceive the 'dimensions' $\hat{\hat{\rho}}$ and $\hat{\hat{c}}\hat{\hat{t}}$ embedded in $\hat{\Sigma}$ and $\hat{c}\hat{t}$ respectively nor the absolute-absolute rest masses $\hat{\hat{M}}_0$, $\hat{\hat{m}}_0$ embedded in $\hat{M}_0$, $\hat{m}_0$ in $\hat{\Sigma}$.

The corresponding more complete form of Fig. 2b at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, corresponding to the first stage in a gravitational field, is depicted in Fig. 3b .

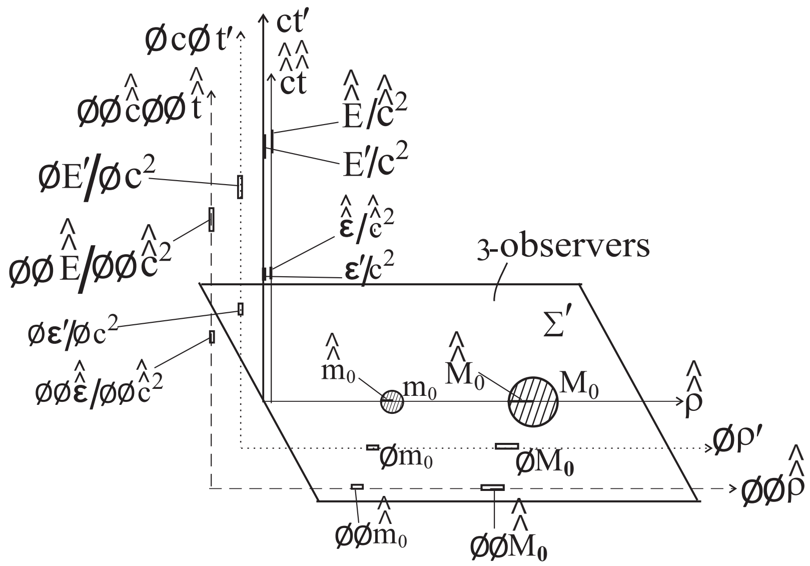

Figure 3: **b** A more complete form of Fig. 2b, in which the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime containing absolute-absolute intrinsic-intrinsic rest masses of particles and bodies, is made manifest outwardly in flat 'two-dimensional' absolute-absolute spacetime containing the absolute-absolute rest masses of particles and bodies, which is embedded in flat four-dimensional proper spacetime containing the rest masses of particles and bodies, with respect to 3-observers in the proper Euclidean 3-space.

The lines of absolute-absolute rest masses $\hat{\hat{M}}_0$, $\hat{\hat{m}}_0$ in the isotropic 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ are embedded in the three-dimensional rest masses M_0, m_0 in the proper Euclidean 3-space Σ'. Again the 3-observers in Σ' cannot perceive the 'dimensions' $\hat{\hat{\rho}}$ and $\hat{\hat{c}}\hat{\hat{t}}$ embedded in Σ' and ct' respectively, nor the absolute-

absolute rest masses $\hat{\hat{M}}_0$. $\hat{\hat{m}}_0$ embedded in M_0, m_0 in Σ'.

Finally the corresponding more complete form of Fig. 2c at the third stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, corresponding to the second stage in a gravitational field, is depicted in Fig. 3c. Again the lines of absolute-absolute rest masses $\hat{\hat{M}}_0$, $\hat{\hat{m}}_0$ in the isotropic

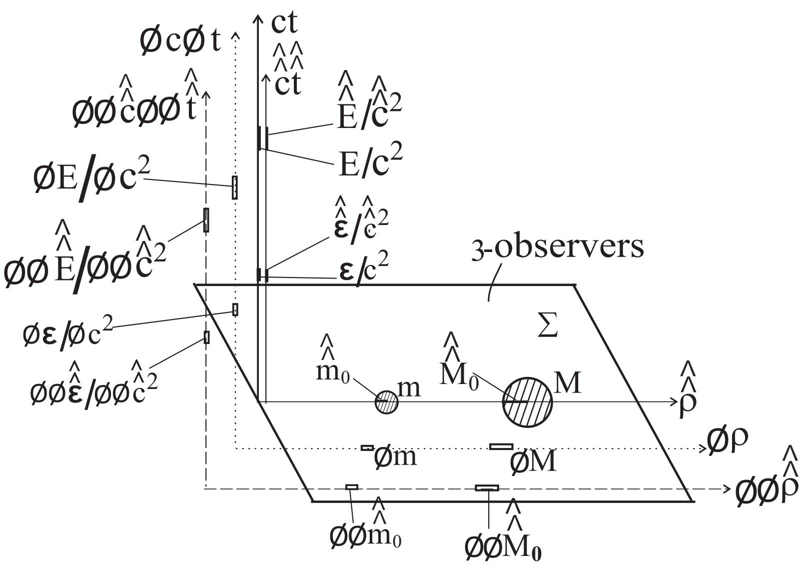

Figure 3: **c** A more complete form of Fig. 2c, in which the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime containing absolute-absolute intrinsic-intrinsic rest masses of particles and bodies, is made manifest outwardly in flat 'two-dimensional' absolute-absolute spacetime containing the absolute-absolute rest masses of particles and bodies, which is embedded in flat four-dimensional relativistic spacetime containing the inertial masses of particles and bodies with respect to 3-observers in the relativistic Euclidean 3-space.

'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ are embedded in the 'three-dimensional' inertial masses M, m in the relativistic Euclidean 3-space Σ. Of course the 3-observers in Σ cannot perceive the 'dimensions' $\hat{\hat{\rho}}$ and $\hat{\hat{c}}\hat{\hat{t}}$ embedded in Σ and ct respectively, nor the $\hat{\hat{M}}_0$, $\hat{\hat{m}}_0$ embedded in M, m in Σ.

The 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ and the absolute-absolute rest masses $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$, $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$ contained in it in the more complete diagrams of Figs. 3a – 3c, have not been shown in the diagrams until now. Only the three layers of space-time-mass in the diagrams of Figs. 2a – 2c have been drawn since the flat absolute-absolute space-time-mass $(\hat{\hat{\Sigma}}, \hat{\hat{c}}\hat{\hat{t}}; \hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$ was isolated along with its underlying flat absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}; \phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$ in [1].

It has been possible to keep away the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the absolute-absolute rest masses $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$, $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$ embedded in the proper spacetime (Σ', ct') containing rest masses $(M_0, E'/c^2)$, $(m_0, \varepsilon'/c^2)$ or embedded in the relativistic spacetime (Σ, ct) containing inertial masses $(M, E/c^2)$, $(m, \varepsilon/c^2)$, from the spacetime/intrinsic spacetime diagrams of the theories of gravity and motion at the first and second stages of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in every gravitational field in the previous articles [3]– [8], because the absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ and the absolute-absolute rest mass $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$, $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$ contained in it, and its underlying $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ containing $(\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2)$, $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$, do not participate in the theories of gravity and motion. Consequently the 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ containing absolute-absolute intrinsic-intrinsic rest masses $(\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2)$, $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$, shown as the third layer in the diagrams has been redundant until now.

Thus the absolute-absolute spacetime 'dimensions' $\hat{\hat{\rho}}$ and $\hat{\hat{c}}\hat{\hat{t}}$, the absolute-absolute intrinsic-intrinsic spacetime 'dimensions' $\phi\phi\hat{\hat{\rho}}$ and $\phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$ and the absolute-absolute rest masses/absolute-absolute intrinsic-intrinsic rest masses contained in them, can be relegated in the contexts of the theories of gravity and motion, as done until now. They nevertheless have important roles to play in physics, as shall be found with further development of the present theory, and must be incorporated into the diagrams and physics ultimately as now started with the diagrams of Figs. 3a – 3c.

Again the evolution of the geometry of Fig. 3a into the geometry of Fig. 3b at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a universe, corresponding to the first stage in a gravitational field, and the evolution of the geometry of Fig. 3b into that of Fig. 3c at the third stage in a universe, corresponding to the second stage in a gravitational field, occur simultaneously. Consequently the geometries of Fig. 3a and 3b were never formed in a gravitational field or in the universe, but only the enduring final geometry of Fig. 3c. We shall therefore be concerned with the geometry of Fig. 3c that exists in every gravitational field and hence within the universe in the rest of this article.

Figure 3c must be drawn in the complete form within the four-world picture, presented as the global diagram of Fig. 7 and its complementary diagram of Fig. 8, and their inverses Figs. 9 and 10 of [2], reproduced as Figs. 1 and 2 and their undrawn inverses in [5]. That is Figs. 7 – 10 of [2] or Figs. 1 and 2 of [5], must be made complete by embedding the flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the absolute-absolute rest masses $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{c}^2)$ and $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{c}^2)$ of the gravitational field source and test particle into the flat relativistic spacetime (Σ, ct) containing the inertial masses $(M, E/c^2)$ and $(m, \varepsilon/c^2)$ of the gravitational field source and test particle in the positive (or our) universe and by embedding $(-\hat{\hat{\rho}}*, -\hat{\hat{c}}\hat{\hat{t}}^*)$ containing the absolute-absolute rest masses $(-\hat{\hat{M}}_0^*, -\hat{\hat{E}}^*/\hat{c}^2)$ and $(-\hat{\hat{m}}_0^*, -\hat{\hat{\varepsilon}}^*/\hat{c}^2)$ of the symmetry-partner gravitational field source and test particle into the flat relativistic spacetime $(-\Sigma^*, -ct^*)$ containing the inertial masses $(-M^*, -E^*/c^2)$ and $(-m^*, -\varepsilon^*/c^2)$ of the symmetry-partner gravitational field source and test particle in the negative universe, as illustrated in Fig. 4. Fig. 4 is the complete form of Fig. 7 of [2] or Fig. 1 of [5], except that the details shown in that figure in [2] or [5] are not shown in Fig. 4 here for clarity.

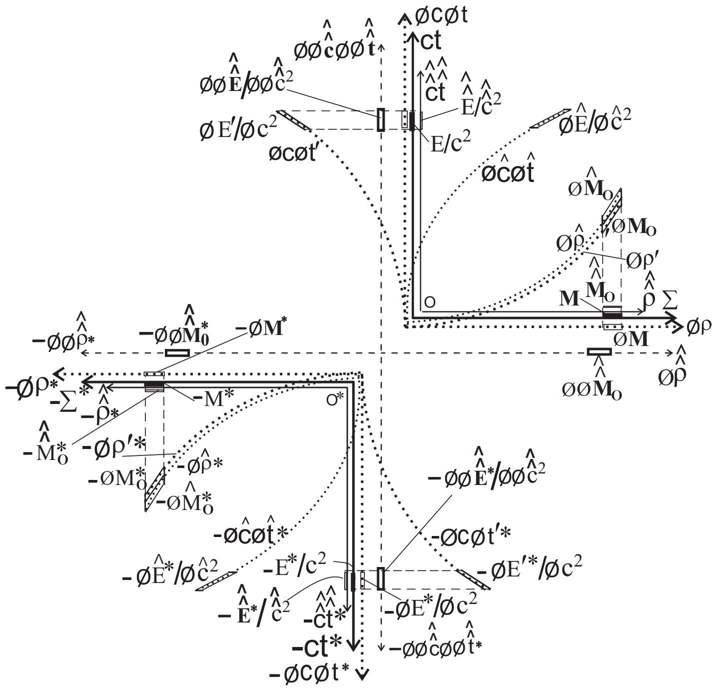

Figure 4:

Having established the fact that the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing absolute-absolute rest masses $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$, $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$ of particles and bodies is imperceptibly embedded in the flat four-dimensional relativistic spacetime (Σ, ct) containing the inertial masses $(m, \varepsilon/c^2)$, $(M, E/c^2)$ of particles and bodies, as illustrated in our universe and the negative universe in Fig. 4, the flat absolute-absolute spacetime and the absolute-absolute rest masses contained in it shall not be shown in the diagrams, as done in the previous papers, in order to avoid too complicated diagrams, except when the need to show them arises.

The theories/intrinsic theories of gravity and combined gravity and motion at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field of arbitrary strength, which Figs. 3c and 4 and their undrawn complementary diagrams and inverses encompass, have been developed in [3]– [7] and summarized in section 4 of [7]. They are ϕNAG* and ϕNAG* $\cup$ ϕNAM* on the curved absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$; ϕNAG and ϕNAG $\cup$ ϕNAM, which ϕNAG* and ϕNAG* $\cup$ ϕNAM* on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ project into the flat relativistic intrinsic spacetime $(\phi\rho, \phi c\phi t)$ and NAG and NAG $\cup$ NAM, which are the outward manifestations on flat (Σ, ct) of ϕNAG and $\phi \cup \phi$NAM on flat $(\phi\rho, \phi c\phi t)$. The others are the gravitational-relativistic Newton's law of universal gravity, that is, the Newton's law of universal gravity modified in the context of the theory of gravitational relativity (TGR), denoted by RNLG, on flat relativistic spacetime (Σ, ct) and its underlying ϕRNLG on the flat relativistic intrinsic spacetime $(\phi\rho, \phi c\phi t)$.

Apart from the theories listed in the foregoing paragraph, which have been developed in the previous articles, Figs. 4 (or more clearly in Fig. 3c) encompasses other theories/intrinsic theories of gravity and motion that are worthy of investigation. These are theories of absolute-absolute gravity (AAG) and absolute-absolute motion (AAM) on flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, due to the lines of absolute-absolute rest masses $\hat{\hat{M}}_0$ and $\hat{\hat{m}}_0$ of the gravitational field source and test particle embedded in the inertial masses M and m in Σ respectively, and the theories of absolute-absolute intrinsic-intrinsic gravity ($\phi\phi$AAG) and absolute-absolute intrinsic-intrinsic motion ($\phi\phi$AAM) on flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$, due to the absolute-absolute intrinsic-intrinsic rest masses $\phi\phi\hat{\hat{M}}_0$ and $\phi\phi\hat{\hat{m}}_0$ of the gravitational field source and test particle in $\phi\phi\hat{\hat{\rho}}$. The theories of absolute-absolute gravity and absolute-absolute motion on flat $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ and the theories of absolute-absolute intrinsic-intrinsic gravity and absolute-absolute intrinsic-intrinsic motion in on flat $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$, shall be developed in the next section, and their fate, that is, whether they are possible of existence with respect to observers in spacetime or not, shall be determined in the second part of this paper.

2 Formulating the Newtonian theories of absolute-absolute gravity and absolute-absolute motion and Newtonian theories of absolute-absolute intrinsic-intrinsic gravity and absolute-absolute intrinsic-intrinsic motion with respect to 3-observers in the relativistic Euclidean 3-space

While the theory of gravitational relativity (TGR) and the gravitational-relativistic Newton's law of universal gravity (RNLG), are established in all finite neighborhood of the inertial mass ($M, E/c^2$) of the gravitational field source on the flat relativistic spacetime (Σ, ct), which are the outward manifestations of ϕTGR and ϕRNLG established on flat relativistic intrinsic spacetime ($\phi\rho, \phi c\phi t$), in all finite neighborhood of the intrinsic inertial mass ($\phi M, \phi E/\phi c^2$) of the gravitational field source, with respect to 3-observers in Σ, the absolute-absolute rest mass ($\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2$) in the flat 'two-dimensional' absolute-absolute spacetime ($\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}}$), establishes 'one-dimensional' Newtonian theory of absolute-absolute gravity (NAAG) on the flat ($\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}}$), with respect to 3-observers in Σ, which is mere outward manifestation of the Newtonian theory of absolute-absolute intrinsic-intrinsic gravity ($\phi\phi$NAAG) on flat absolute-absolute intrinsic-intrinsic spacetime ($\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$).

The essential equations of the 'one-dimensional' NAAG in ($\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}}$) with respect to 3-observers in Σ in Fig. 3c or Fig. 4, which follows from the equations of primed classical gravitation (CG′) on flat proper spacetime (Σ', ct') are the following

$$\hat{\hat{\Phi}}(\hat{\hat{r}}) = -\frac{1}{2}\hat{\hat{V}}_g(\hat{\hat{r}})^2 = -\frac{G\hat{\hat{M}}_{0a}}{\hat{\hat{r}}} \tag{1}$$

$$\hat{\hat{g}}(\hat{\hat{r}}) = \frac{1}{2}\frac{\mathrm{d}}{\mathrm{d}\hat{\hat{r}}}(\hat{\hat{V}}_g(\hat{\hat{r}})^2) = -\frac{G\hat{\hat{M}}_{0a}}{\hat{\hat{r}}^2} \tag{2}$$

$$\hat{\hat{U}}(\hat{\hat{r}}) = \hat{\hat{m}}_0\hat{\hat{\Phi}}(\hat{\hat{r}}) = -\frac{G\hat{\hat{M}}_{0a}\hat{\hat{m}}_0}{\hat{\hat{r}}} \tag{3}$$

$$\hat{\hat{F}}_g(\hat{\hat{r}}) = \hat{\hat{m}}_0\hat{\hat{g}}(\hat{\hat{r}}) = -\frac{G\hat{\hat{M}}_{0a}\hat{\hat{m}}_0}{\hat{\hat{r}}^2} \quad \text{and} \tag{4}$$

$$\frac{\mathrm{d}^2\hat{\hat{r}}}{\mathrm{d}\hat{\hat{t}}^2} = \hat{\hat{g}}(\hat{\hat{r}}) = -\frac{G\hat{\hat{M}}_{0a}}{\hat{\hat{r}}^2} \tag{5}$$

Equations (1) – (5) of the 'one-dimensional' NAAG in the absolute-absolute Galileo space ($\hat{\hat{\rho}}$; $\hat{\hat{t}}$) with respect to 3-observers in Σ, are the outward manifestations of the 'one-dimensional' $\phi\phi$NAAG in the absolute-absolute intrinsic-intrinsic Galileo space ($\phi\phi\hat{\hat{\rho}}$; $\phi\phi\hat{\hat{t}}$), with respect to 3-observers in Σ in Fig. 3c or Fig. 4. The essential equations of $\phi\phi$NAAG are the following

$$\phi\phi\hat{\hat{\Phi}}(\phi\phi\hat{\hat{r}}) = -\frac{1}{2}\phi\phi\hat{\hat{V}}_g(\phi\phi\hat{\hat{r}})^2 = -\frac{G\phi\phi\hat{\hat{M}}_{0\mathrm{a}}}{\phi\phi\hat{\hat{r}}} \quad (6)$$

$$\phi\phi\hat{\hat{g}}(\phi\phi\hat{\hat{r}}) = \frac{1}{2}\frac{\mathrm{d}}{\mathrm{d}\phi\phi\hat{\hat{r}}}(\phi\phi\hat{\hat{V}}_g(\phi\phi\hat{\hat{r}})^2) = -\frac{G\phi\phi\hat{\hat{M}}_{0\mathrm{a}}}{\phi\phi\hat{\hat{r}}^2} \quad (7)$$

$$\phi\phi\hat{\hat{U}}(\phi\phi\hat{\hat{r}}) = \phi\phi\hat{\hat{m}}_0\,\phi\phi\hat{\hat{\Phi}}(\phi\phi\hat{\hat{r}}) = -\frac{G\phi\phi\hat{\hat{M}}_{0\mathrm{a}}\phi\phi\hat{\hat{m}}_0}{\phi\phi\hat{\hat{r}}} \quad (8)$$

$$\phi\phi\hat{\hat{F}}_g(\phi\phi\hat{\hat{r}}) = \phi\phi\hat{\hat{m}}_0\,\phi\phi\hat{\hat{g}}(\phi\phi\hat{\hat{r}}) = -\frac{G\phi\phi\hat{\hat{M}}_{0\mathrm{a}}\phi\phi\hat{\hat{m}}_0}{\phi\phi\hat{\hat{r}}^2} \text{ and} \quad (9)$$

$$\frac{\mathrm{d}^2\phi\phi\hat{\hat{r}}}{\mathrm{d}\phi\phi\hat{\hat{t}}^2} = \phi\phi\hat{\hat{g}}(\phi\phi\hat{\hat{r}}) = -\frac{G\phi\phi\hat{\hat{M}}_{0\mathrm{a}}}{\phi\phi\hat{\hat{r}}^2} \quad (10)$$

Likewise while the relative motion at a velocity $\vec{v}$ of the inertial mass $(m, \varepsilon/c^2)$ of the test particle on the flat relativistic spacetime (Σ, ct) must be described in the context of the unprimed special theory of relativity (SR) and the unprimed special-relativistic mechanics (CM ∪ SR) in the flat (Σ, ct) with respect to 3-observers in Σ, which are outward manifestations of ϕSR and ϕCM ∪ ϕSR, involving the relative intrinsic motion at intrinsic dynamical speed ϕv of ϕm on the flat relativistic intrinsic spacetime $(\phi\rho, \phi c\phi t)$, with respect to 3-observers in Σ in Fig. 3c or Fig. 4, the absolute-absolute motion at an absolute-absolute dynamical speed $\hat{\hat{V}}_d$ in $(\hat{\hat{\rho}}; \hat{\hat{t}})$ of the test particle, must be described in the context of 'one-dimensional' Newtonian theory of absolute-absolute motion (NAAM) with respect to 3-observers in Σ, which is mere outward manifestation of $\phi\phi$NAAM that describes the absolute-absolute intrinsic-intrinsic motion at absolute-absolute intrinsic-intrinsic dynamical speed $\phi\phi\hat{\hat{V}}_d$ of $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$ in $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ in Fig. 3c or Fig. 4.

The essential equations of the 'one-dimensional' NAAM in $(\hat{\hat{\rho}}; \hat{\hat{t}})$ with respect to 3-observers in Σ, which follow from the equations of primed classical mechanics (CM′) on flat proper spacetime (Σ', ct'), are the following

$$\hat{\hat{p}} = \hat{\hat{m}}_0\hat{\hat{V}}_d \quad (11)$$

$$\hat{\hat{E}}_{kin} = \frac{1}{2}\hat{\hat{m}}_0\hat{\hat{V}}_d^2 \quad (12)$$

$$\frac{\mathrm{d}^2\hat{\hat{x}}}{\mathrm{d}\hat{\hat{t}}^2} = \hat{\hat{a}} \text{ and} \quad (13)$$

$$\hat{\hat{F}} = \frac{\mathrm{d}\hat{\hat{p}}}{\mathrm{d}\hat{\hat{t}}} = \hat{\hat{m}}_0\frac{\mathrm{d}^2\hat{\hat{x}}}{\mathrm{d}\hat{\hat{t}}^2} \quad (14)$$

Equations (11) – (14) of the 'one-dimensional' NAAM in the 'one-dimensional' absolute-absolute Galileo space $(\hat{\hat{\rho}};\hat{\hat{t}})$, with respect to 3-observers in Σ, are the outward manifestations of the essential equations of the 'one-dimensional' Newtonian theory of absolute-absolute intrinsic-intrinsic motion ($\phi\phi$NAAM) in the 'one-dimensional' absolute-absolute intrinsic-intrinsic Galileo space $(\phi\phi\hat{\hat{\rho}};\phi\phi\hat{\hat{t}})$, with respect to 3-observers in Σ in Fig. 3c or Fig. 4. The essential equations of $\phi\phi$NAAM are the following

$$\phi\phi\hat{\hat{p}} = \phi\phi\hat{\hat{m}}_0\,\phi\phi\hat{\hat{V}}_d \tag{15}$$

$$\phi\phi\hat{\hat{E}}_{kin} = \frac{1}{2}\phi\phi\hat{\hat{m}}_0\phi\phi\hat{\hat{V}}_d^2 \tag{16}$$

$$\frac{\mathrm{d}^2\phi\phi\hat{\hat{x}}}{\mathrm{d}\phi\phi\hat{\hat{t}}^2} = \phi\phi\hat{\hat{a}} \ \text{ and} \tag{17}$$

$$\phi\phi\hat{\hat{F}} = \frac{\mathrm{d}\phi\phi\hat{\hat{p}}}{\mathrm{d}\phi\phi\hat{\hat{t}}} = \phi\phi\hat{\hat{m}}_0\frac{\mathrm{d}^2\phi\phi\hat{\hat{x}}}{\mathrm{d}\phi\phi\hat{\hat{t}}^2} \tag{18}$$

2.1 Infinite ranges of absolute-absolute gravitational speeds and absolute-absolute dynamical speeds in the contexts of NAAG and NAAM

The common space of $\phi\phi$NAAG and $\phi\phi$NAAM namely, the flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}},\phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ in Fig. 3c or Fig. 4, remains flat and unchanged, that is, $\phi\phi\hat{\hat{\rho}}$ and $\phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}}$ remain not inclined or curved from their horizontal and vertical positions respectively, for all magnitudes of $\phi\phi\hat{\hat{V}}_g(\phi\phi\hat{\hat{r}})$ (or $\phi\phi\hat{\hat{\Phi}}(\phi\phi\hat{\hat{r}})$) and $\phi\phi\hat{\hat{V}}_d$. That is, for the ranges $0 \le \phi\phi\hat{\hat{V}}_g(\phi\phi\hat{\hat{r}}) \le \infty$ (or $0 \le \phi\phi\hat{\hat{\Phi}}(\phi\phi\hat{\hat{r}}) \le \infty$) and $0 \le \phi\phi\hat{\hat{V}}_d \le \infty$, with respect to 3-observers in Σ. The explanations of these shall be given shortly. Consequently the common space of NAAG and NAAM namely, the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}},\hat{\hat{c}}\hat{\hat{t}})$, likewise remains flat and unchanged for all magnitudes of $\hat{\hat{V}}_g(\hat{\hat{r}})$ (or $\hat{\hat{\Phi}}(\hat{\hat{r}})$) and all magnitudes of $\hat{\hat{V}}_d$. That is, for the ranges $0 \le \hat{\hat{V}}_g(\hat{\hat{r}}) \le \infty$ (or $0 \le \hat{\hat{\Phi}}(\hat{\hat{r}}) \le \infty$) and $0 \le \hat{\hat{V}}_d \le \infty$, with respect to 3-observers in Σ.

In a nutshell, the foregoing paragraph says that the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}},\hat{\hat{c}}\hat{\hat{t}})$ of NAAG and NAAM and the underlying flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}},\phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ of $\phi\phi$NAAG and $\phi\phi$NAAM, remain unchanged, that is, do not evolve into higher levels in the hierarchy of spacetimes/intrinsic spacetimes for any magnitudes, including infinite magnitudes, of $\phi\phi\hat{\hat{V}}_g(\phi\phi\hat{\hat{r}})$ and $\phi\phi\hat{\hat{V}}_d$ that may be established on $(\phi\phi\hat{\hat{\rho}},\phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ and any magnitudes, including infinite magnitudes, of $\hat{\hat{V}}_g(\hat{\hat{r}})$ and $\hat{\hat{V}}_d$ that may be established on $(\hat{\hat{\rho}},\hat{\hat{c}}\hat{\hat{t}})$.

The infinite ranges of gravitational potentials (or gravitational speeds) and dynamical speeds that are known to be implied by the equations of primed classical gravitation (CG′) and primed classical mechanics (CM′) on the flat proper spacetime (Σ', ct'), are meaningless in the context of the general theory of relativity (GR) on proposed curved spacetime (x^0, x^1, x^2, x^3) and in the context of the special theory of relativity (SR) on flat spacetime. This is so because gravitational potential has maximum value of $\Phi(r) = -c^2/2$ in the exterior Schwarzschild line element, for instance, in GR and dynamical speed has maximum value of c in the Lorentz transformation in SR.

Infinite ranges of gravitational potential (or gravitational speed) and dynamical speed known to be implied by the equations of primed classical gravitation (CG′) and primed classical mechanics (CM′) on the flat proper spacetime (Σ', ct'), are likewise meaningless on the flat proper spacetime (Σ', ct') and flat relativistic spacetime (Σ, ct), and infinite ranges of intrinsic gravitational potential (or intrinsic gravitational speed) and intrinsic dynamical speed are meaningless on the flat proper intrinsic spacetime $(\phi\rho', \phi c\phi t')$ underlying (Σ', ct') and flat relativistic intrinsic spacetime $(\phi\rho, \phi c\phi t)$ underlying (Σ, ct), isolated in the present theory.

The facts stated at the end of the foregoing paragraph are so because, as well discussed in sub-section 5.3 of [7], dynamical speed has a maximum magnitude of $c_\gamma = 3\times10^8\,\mathrm{m\,s^{-1}}$ in the contexts of SR′ on flat (Σ', ct') and SR on flat (Σ, ct) and gravitational speed has maximum magnitude of $c_g = 3\times10^8\,\mathrm{m\,s^{-1}}$ on flat (Σ, ct) in the context of the theory of gravitational relativity (TGR). Intrinsic dynamical speed likewise has maximum magnitude of $\phi c_\gamma = 3\times10^8\,\mathrm{m\,s^{-1}}$ in the context of ϕSR′ on flat $(\phi\rho', \phi c\phi t')$ and in the context of ϕSR on flat $(\phi\rho, \phi c\phi t)$, and intrinsic gravitational speed has maximum magnitude of $\phi c_g = 3\times10^8\,\mathrm{m\,s^{-1}}$ on the flat $(\phi\rho, \phi c\phi t)$ in the context of ϕTGR.

Infinite ranges of gravitational potential (or gravitational speed) and dynamical speed, known to be implied by the equations of primed classical gravitation (CG′) and primed classical mechanics (CM′) on the flat proper spacetime (Σ', ct'), are likewise meaningless in the context of the starred Newtonian theories of absolute intrinsic gravity (ϕNAG*), starred Newtonian theory of absolute intrinsic motion (ϕNAM*) and their union (ϕNAG* ∪ ϕNAM*) on curved 'two-dimensional' absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, isolated in the present theory and developed in [4], as well as in the contexts of the primed absolute intrinsic Newtonian theories ϕNAG′, ϕNAM′ and (ϕNAG′ ∪ ϕNAM′), which (ϕNAG*), (ϕNAM*) and (ϕNAG* ∪ ϕNAM*) on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ project into the flat proper intrinsic spacetime $(\phi\rho', \phi c\phi t')$ in Figs. 3 and 11 of [3], as well as in the context of the primed absolute theories NAG′, NAM′ and NAG′ ∪ NAM′ on flat proper spacetime (Σ', ct') in those diagrams, at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field.

The facts stated in the foregoing paragraph are so because, as well discussed in sub-section 5.3 of [7], absolute intrinsic gravitational speed lies in the range $0 \le \phi\hat{V}_g(\phi\hat{r}) \le \phi\hat{c}_g$ and absolute intrinsic dynamical speed lies within the range $0 < \phi\hat{V}_d < \phi\hat{c}_\gamma$ in the context of ϕNAG*, ϕNAM*, ϕNAG* ∪ ϕNAM*, ϕNAG′, ϕNAM′ and ϕNAG′ ∪ ϕNAM′. Consequently absolute gravitational speeds lie within the range $0 < \hat{V}_g(\hat{r}) < \hat{c}_g$ and absolute dynamical speeds lie within the range $0 < \hat{V}_d < \hat{c}_\gamma$ in the contexts of NAG′, NAM′ and NAG′ ∪ NAM′ on flat (Σ', ct').

The facts stated in the penultimate paragraph about the Newtonian absolute intrinsic theories of gravity and motion namely, ϕNAG*, ϕNAM*, ϕNAG* ∪ ϕNAM*, ϕNAG′, ϕNAM′ and ϕNAG′ ∪ ϕNAM′ and Newtonian theories of absolute gravity and absolute motion namely, NAG′, NAM′ and NAG′ ∪ NAM′, at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field, are equally valid for the corresponding theories at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field. The corresponding theories at the second stage are ϕNAG*, ϕNAM*, ϕNAG* ∪ ϕNAM* on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, their projective unprimed ϕNAG, ϕNAM and ϕNAG ∪ ϕNAM on flat relativistic intrinsic spacetime $(\phi\rho, \phi c\phi t)$ and the unprimed NAG, NAM and NAG ∪ NAM on flat relativistic spacetime (Σ, ct).

Again absolute intrinsic gravitational speeds lie within the range $0 < \phi\hat{V}_g(\phi\hat{r}) < \phi\hat{c}_g$ and absolute intrinsic dynamical speeds lie within the range $0 < \phi\hat{V}_d < \phi\hat{c}_\gamma$ in the contexts of ϕNAG*, ϕNAM*, ϕNAG* ∪ ϕNAM* on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ and ϕNAG, ϕNAM and ϕNAG ∪ ϕNAM on flat $(\phi\rho, \phi c\phi t)$. And absolute gravitational speeds lie within the range $0 < \hat{V}_g(\hat{r}) < \hat{c}_g$ and absolute dynamical speeds lie within the range $0 < \hat{V}_d < \hat{c}_\gamma$ in the contexts of NAG, NAM and NAG ∪ NAM on flat relativistic spacetime (Σ, ct), at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field.

The infinite ranges of gravitational potentials (or gravitational speeds) and dynamical speeds, known to be implied by primed classical gravitation (CG′) and primed classical mechanics (CM′) on flat proper spacetime (Σ', ct'), are likewise meaningless on the flat absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, in the reference spacetime/intrinsic spacetime geometry of Fig. 3 of [2]. Again, as explained in sub-section 5.3 of [7], this is so because absolute gravitational speed $\hat{V}_g(\hat{r})$ has a mximum magnitude of $\hat{c}_g = 3 \times 10^8\,\mathrm{m\,s^{-1}}$ and absolute dynamical speed $\hat{V}_d$ has maximum magnitude of $\hat{c}_\gamma = 3 \times 10^8\,\mathrm{m\,s^{-1}}$ on flat absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$, and absolute intrinsic gravitational speed $\phi\hat{V}_g(\phi\hat{r})$ has a maximum magnitude of $\phi\hat{c}_g = 3 \times 10^8\,\mathrm{m\,s^{-1}}$ and absolute intrinsic dynamical speed has a maximum magnitude of $\phi\hat{c}_\gamma = 3 \times 10^8\,\mathrm{m^{-1}}$ on flat absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$.

It thus follows that the Newtonian theory of absolute-absolute gravity (NAAG) and Newtonian theory of absolute-absolute motion (NAAM) on the constantly flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ in Fig. 3c or Fig. 4, with essential equations (1) – (5) and (11) – (14), are the only possible forms of Newtonian theories of gravity and motion with infinite ranges of gravitational and dynamical speeds, with respect to 3-observers in Σ. Consequently the $\phi\phi$AAG and $\phi\phi$AAM on constantly flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$, with the essential equations (6) – (10) and (15) – (19), are the only possible forms of the Newtonian theories of intrinsic gravitation and intrinsic motion with infinite ranges of intrinsic gravitational and intrinsic dynamical speeds, with respect to 3-observers in Σ.

3 The constantly flat absolute-absolute spacetime as the controversial Newtonian absolute spacetime

Now let us consider the inertial masses M_1, M_2 and M_3 of three assumed spherical gravitational field sources, which are scattered arbitrarily in the universal relativistic Euclidean 3-space Σ. Let coordinate systems $(ct_1, r_1, r_1\theta_1, r_1 \sin\theta_1\varphi_1)$, $(ct_2, r_2, r_2\theta_2, r_2 \sin\theta_2\varphi_2)$ and $(ct_3, r_3, r_3\theta_3, r_3 \sin\theta_3\varphi_3)$ of the flat relativistic spacetime (Σ, ct) be associated with the inertial masses M_1, M_2 and M_3 respectively. That is, let spherical coordinate systems of the Euclidean 3-space Σ namely, $(r_1, r_1\theta_1, r_1 \sin\theta_1\varphi_1)$, $(r_2, r_2\theta_2, r_2 \sin\theta_2\varphi_2)$ and $(r_3, r_3\theta_3, r_3 \sin\theta_3\varphi_3)$ originate from the centers of M_1, M_2 and M_3 respectively. There are innumerable distinct coordinate systems (of frames) of the universal flat four-dimensional relativistic metric spacetime (Σ, ct), which are associated with the inertial masses of gravitational field sources that are scattered in the relativistic Euclidean 3-space Σ in the universe, with which TGR and unprimed classical gravitation (CG) must be formulated for the different gravitational field sources.

Corresponding to the three-dimensional inertial masses M_1, M_2 and M_3 of the gravitational field sources in Σ, are their 'one-dimensional' absolute-absolute rest masses $\hat{\hat{M}}_{01}$, $\hat{\hat{M}}_{02}$ and $\hat{\hat{M}}_{03}$ in the 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ with respect to 3-observers in Σ, which are embedded in the inertial masses M_1, M_2 and M_3 respectively in Σ, as illustrated for one gravitational field source in Fig. 3c. And corresponding to the spacetime coordinate system of the flat relativistic spacetime (Σ, ct), associated with M_1, M_2 and M_3 namely, $(ct_1, r_1, r_1\theta_1, r_1 \sin\theta_1\varphi_1)$, $(ct_2, r_2, r_2\theta_2, r_2 \sin\theta_2\varphi_2)$ and $(ct_3, r_3, r_3\theta_3, r_3 \sin\theta_3\varphi_3)$, there are coordinate systems $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$, $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$ and $(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$, of the flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, which are associated with the absolute-absolute rest masses $\hat{\hat{M}}_{01}$, $\hat{\hat{M}}_{02}$ and $\hat{\hat{M}}_{03}$ respectively.

The coordinate $\hat{\hat{r}}_1$ of the singular universal isotropic 'one-dimensional' absolute-

absolute space $\hat{\hat{\rho}}$, lying along the coordinate r_1 of Σ from the center of M_1 in Σ, can be along any direction in Σ from the center of M_1 along which r_1 points, with respect to 3-observers in Σ; the coordinate $\hat{\hat{r}}_2$ of the singular universal isotropic 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$, lying along the coordinate r_2 of Σ from the center of M_2 in Σ, can be along any direction in Σ from the center of M_2 along which r_2 points, with respect to 3-observers in Σ; and the coordinate $\hat{\hat{r}}_3$ of the singular universal isotropic 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$, lying along the coordinate r_3 of Σ from the center of M_3 in Σ, can be along any direction in Σ from the center of M_3 along which r_3 points, with respect to 3-observers in Σ, where M_1, M_2 and M_3 are scattered arbitrarily in Σ, as mentioned earlier.

The scenario presented in the foregoing paragraph, in which the singular universal 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ lies along the coordinates r_1, r_2 and r_3 of the Euclidean 3-space Σ, which are orientated along different directions in Σ, is possible because the 'one-dimensional' absolute-absolute space $\hat{\hat{\rho}}$ is an isotropic 'dimension' (i.e. with no unique orientation) in Σ, with respect to 3-observers in Σ. The NAAG must be formulated in terms of the coordinate sets $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$, $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$ and $(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$ for $\hat{\hat{M}}_{01}$, $\hat{\hat{M}}_{02}$ and $\hat{\hat{M}}_{03}$ respectively on the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, with respect to 3-observers in Σ.

Now the coordinate system $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$ associated with the gravitational field source of inertial mass M_1 (i.e. $\hat{\hat{r}}_1$ originates from $\hat{\hat{M}}_{01}$ within M_1), can be described as coordinate system that possesses varying absolute-absolute gravitational speeds $\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1) = -(2G\hat{\hat{M}}_{0a1}/\hat{\hat{r}}_1)^{1/2}$ along $\hat{\hat{\rho}}$ in the context of NAAG. The coordinate system $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$ associated with the gravitational field source of inertial mass M_2 (i.e. $\hat{\hat{r}}_2$ originates from $\hat{\hat{M}}_{02}$ within M_2), can be described as coordinate system that possesses varying absolute-absolute gravitational speeds $\hat{\hat{V}}_{g2}(\hat{\hat{r}}_2) = -(2G\hat{\hat{M}}_{0a2}/\hat{\hat{r}}_2)^{1/2}$ along $\hat{\hat{\rho}}$ in the context of NAAG, and the coordinate system $(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$ associated with the gravitational field source of inertial mass M_3 (i.e. $\hat{\hat{r}}_3$ originates from $\hat{\hat{M}}_{03}$ within M_3), can be described as coordinate system that possesses varying absolute-absolute gravitational speeds $\hat{\hat{V}}_{g3}(\hat{\hat{r}}_3) = -(2G\hat{\hat{M}}_{0a3}/\hat{\hat{r}}_3)^{1/2}$ along $\hat{\hat{\rho}}$ in the context of NAAG.

However any magnitude of absolute-absolute gravitational speed $\hat{\hat{V}}_g(\hat{\hat{r}})$ is equivalent to zero magnitude of absolute gravitational speed ($\hat{V}_g(\hat{r}) = 0$). In other words, any magnitude of absolute-absolute gravitational speed $\hat{\hat{V}}_g(\hat{\hat{r}})$ in absolute-absolute spaetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ is equivalent to zero absolute gravitational speed in the absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ and absolute zero gravitational speed in the relativistic spacetime (Σ, ct). It then follows that the varying absolute-absolute gravitational speeds $\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1)$, $\hat{\hat{V}}_{g2}(\hat{\hat{r}}_2)$ and $\hat{\hat{V}}_{g3}(\hat{\hat{r}}_3)$ associated with the coordinate sets $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$, $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$ and

$(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$, which originate from $\hat{\hat{M}}_{01}$ within M_1, $\hat{\hat{M}}_{02}$ within M_2 and $\hat{\hat{M}}_{03}$ within M_3 respectively, are equivalent with respect to 3-observers in Σ. This is so because we can write,

$$\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1) \equiv \hat{\hat{V}}_{g2}(\hat{\hat{r}}_2) \equiv \hat{\hat{V}}_{g3}(\hat{\hat{r}}_3) \equiv (\hat{V}_g(\hat{r}) = 0), \tag{19}$$

for varying $\hat{\hat{r}}_1$, $\hat{\hat{r}}_2$ and $\hat{\hat{r}}_3$. The equivalence of the coordinate stes $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$, $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$ and $(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$ with respect to 3-observers in Σ then follows. That is,

$$(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1) \equiv (\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2) \equiv (\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3) \tag{20}$$

If we then consider a coordinate system $(\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}})$ in $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, which is associated with constant zero absolute-absolute gravitational speed $(\hat{\hat{V}}_g(\hat{\hat{r}}) = 0)$ along $\hat{\hat{\rho}}$, that is, the coordinate system associated with a gravitational field source with zero absolute-absolute rest mass $(\hat{\hat{M}}_0 = 0)$ in $\hat{\hat{\rho}}$, then the following equivalence of all absolute-absolute gravitational speeds obtains with respect to 3-observers in Σ

$$\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1) \equiv \hat{\hat{V}}_{g2}(\hat{\hat{r}}_2) \equiv \hat{\hat{V}}_{g3}(\hat{\hat{r}}_3) \equiv \ \ldots \ \equiv (\hat{\hat{V}}_g(\hat{\hat{r}}) = 0) \equiv (\hat{V}_g(\hat{r}) = 0), \tag{21}$$

for $0 \le \hat{\hat{V}}_{g1}(\hat{\hat{r}}_1) \le \hat{c}_g$; $0 \le \hat{\hat{V}}_{g2}(\hat{\hat{r}}_2) \le \hat{c}_g$; $0 \le \hat{\hat{V}}_{g3}(\hat{\hat{r}}_3) \le \hat{c}_g$; etc.

The equivalence of all absolute-absolute gravitational speeds with respect to 3-observers in Σ of system (21) is valid for the range $[0, \infty]$ of $\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1)$, $\hat{\hat{V}}_{g2}(\hat{\hat{r}}_2)$, $\hat{\hat{V}}_{g3}(\hat{\hat{r}}_3)$, etc, the range $[0, \hat{c}_g]$ has been chosen however, because gravitational speed has maximum magnitude of c_g in spacetime. This theory is at present being restricted to spacetime and its underlying intrinsic spacetime in which the speeds of signals have maximum magnitudes of c_g and c_γ. The implications of applying the limit $[0, \infty]$ on $\hat{\hat{V}}_{g1}(\hat{\hat{r}}_1)$, $\hat{\hat{V}}_{g2}(\hat{\hat{r}}_2)$, $\hat{\hat{V}}_{g3}(\hat{\hat{r}}_3)$, etc, in system (21), which implies going outside spacetime, shall be investigated elsewhere with further development.

The equivalence with respect to 3-observers in Σ of all coordinate systems $(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1)$, $(\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2)$, $(\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3)$, etc, associated with all gravitational field sources, (whose inertial masses are scattered arbitrarily in the relativistic Euclidean 3-space Σ, so that $\hat{\hat{r}}_1$, $\hat{\hat{r}}_2$, $\hat{\hat{r}}_3$, etc, point along different directions at different locations in Σ), including the coordinate system $(\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}})$ associated with zero absolute-absolute gravitational speed, that is, with a gravitational field source of zero absolute-absolute rest mass $(\hat{\hat{M}}_0 = 0)$, follow from system (21). That is,

$$(\hat{\hat{c}}\hat{\hat{t}}_1, \hat{\hat{r}}_1) \equiv (\hat{\hat{c}}\hat{\hat{t}}_2, \hat{\hat{r}}_2) \equiv (\hat{\hat{c}}\hat{\hat{t}}_3, \hat{\hat{r}}_3) \equiv \ \ldots \ \equiv (\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}}) \tag{22}$$

An implication of system (22) is that the NAAG formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}_1$ and $\hat{\hat{r}}_1$ associated with the gravitational field source of inertial mass M_1

at one location in Σ, can equally be formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}$ and $\hat{\hat{r}}$ associated with a gravitational field source with zero absolute-absolute rest mass, with respect to 3-observers in Σ; the NAAG formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}_2$ and $\hat{\hat{r}}_2$ associated with the gravitational field source of inertial mass M_2 at another location in Σ, can equally be formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}$ and $\hat{\hat{r}}$ associated with the gravitational field source of zero absolute-absolute rest mass, with respect to 3-observers in Σ; the NAAG formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}_3$ and $\hat{\hat{r}}_3$ associated with the gravitational field source of inertial mass M_3 at yet another location in Σ, can equally be formulated in terms of the coordinates $\hat{\hat{c}}\hat{\hat{t}}$ and $\hat{\hat{r}}$ associated with the gravitational field source of zero absolute-absolute rest mass, with respect to 3-observers in Σ; and this is valid for all gravitational field sources n Σ.

We shall distinguish the coordinate system $(\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}})$ in the absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, which is associated with a gravitational field source of zero absolute-absolute rest mass, or which is associated with constant zero absolute-absolute gravitational speed $(\hat{\hat{V}}_g(\hat{\hat{r}}) = 0)$ along $\hat{\hat{\rho}}$ and formulate NAAG in this distinguished coordinate system, that is, with the coordinates $\hat{\hat{r}}$ and $\hat{\hat{c}}\hat{\hat{t}}$, as done in Eqs. (1) – (5), for all gravitational field sources in the universe, with respect to 3-observers in Σ.

Let us also consider the inertial masses m_1, m_2 and m_3 of three material particles or objects for instance, which are scattered arbitrarily in the relativistic Euclidean 3-space Σ, to be in relative motions at different dynamical velocities $\vec{v}_1$, $\vec{v}_2$ and $\vec{v}_3$ respectively along different directions and at different locations in Σ. Let affine coordinate systems $(c_\gamma\tilde{t}_1, \tilde{x}_1, \tilde{y}_1, \tilde{z}_1)$, $(c_\gamma\tilde{t}_2, \tilde{x}_2, \tilde{y}_2, \tilde{z}_2)$ and $(c_\gamma\tilde{t}_3, \tilde{x}_3, \tilde{y}_3, \tilde{z}_3)$ on the flat relativistic spacetime (Σ, ct) be associated with the inertial masses $m_1\, m_2$ and m_3 respectively. Then the special theory of relativity (SR) and special-relativistic mechanics (CM $\cup$ SR), must be formulated in terms of the affine coordinates $c_\gamma\tilde{t}_1, \tilde{x}_1, \tilde{y}_1$ and $\tilde{z}_1$ for m_1; in terms of $c_\gamma\tilde{t}_2, \tilde{x}_2, \tilde{y}_2$ and $\tilde{z}_2$ for m_2 and in terms of the affine coordinates $c_\gamma\tilde{t}_3, \tilde{x}_3, \tilde{y}_3$ and $\tilde{z}_3$ for m_3. There are innumerable distinct affine spacetime coordinate systems (or frames) on the universal flat four-dimensional relativistic spacetime (Σ, ct) of TGR, which are associated with the inertial masses of material particles and objects in relative motions along different directions at different positions in Σ in the universe, with which SR and CM $\cup$ SR must be formulated for the different particles and objects.

Corresponding to the three-dimensional inertial masses m_1, m_2 and m_3 of three material particles or objects in Σ, are their 'one-dimensional' absolute-absolute rest masses $\hat{\hat{m}}_{01}$, $\hat{\hat{m}}_{02}$ and $\hat{\hat{m}}_{03}$ respectively. And corresponding to the affine spacetime coordinate systems $(c_\gamma\tilde{t}_1, \tilde{x}_1, \tilde{y}_1, \tilde{z}_1)$, $(c_\gamma\tilde{t}_2, \tilde{x}_2, \tilde{y}_2, \tilde{z}_2)$ and $(c_\gamma\tilde{t}_3, \tilde{x}_3, \tilde{y}_3, \tilde{z}_3)$, associated with m_1, m_2 and m_3 respectively, on the flat metric spacetime (Σ, ct), there are the affine absolute-absolute spacetime coordinate systems $(\hat{c}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{c}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ and $(\hat{c}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$, on the flat absolute-absolute metric spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, which are associated with $\hat{\hat{m}}_{01}$, $ha\hat{t}m_{02}$ and $\hat{\hat{m}}_{03}$ that are embedded in m_1, m_2 and m_3 respectively.

The affine coordinate $\hat{\hat{x}}_1$ in the singular universal 'one-dimensional' absolute-absolute metric space $\hat{\hat{\rho}}$, lying along the affine coordinate $\tilde{x}_1$ associated with m_1 in Σ, can be along any direction in Σ along which $\tilde{x}_1$ points; the affine absolute-absolute coordinate $\hat{\hat{x}}_2$ in $\hat{\hat{\rho}}$, lying along the affine coordinate $\tilde{x}_2$ associated with m_2 in Σ, can be along any direction in Σ along which $\tilde{x}_2$ points; and the affine absolute-absolute coordinate $\hat{\hat{x}}_3$ in $\hat{\hat{\rho}}$, lying along the affine coordinate $\tilde{x}_3$ associated with m_3 in Σ, can be along any direction in Σ along which $\tilde{x}_3$ points, with respect to 3-observers in Σ, where m_1, m_2 and m_3 are scattered arbitrarily in Σ and are in relative motions at different relative velocities along different directions and at different locations in Σ, as mentioned earlier.

The scenario presented in the foregoing paragraph is possible because $\hat{\hat{\rho}}$ is an isotropic 'one-dimensional' absolute-absolute space (with no unique orientation in Σ) with respect to 3-observers in Σ. The Newtonian theory of absolute-absolute motion (NAAM) must be formulated in terms of the affine coordinate sets (or frames) $(\hat{c}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{c}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ and $(\hat{c}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$ for the absolute-absolute motions of $\hat{\hat{m}}_{01}$, $\hat{\hat{m}}_{02}$ and $\hat{\hat{m}}_{03}$ respectively.

Now the affine coordinate system $(\hat{c}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$ associated with the particle or object of inertial mass m_1 (i.e. with $\hat{\hat{m}}_{01}$ embedded in m_1), is in absolute-absolute motion at absolute-absolute dynamical speed $\hat{\hat{V}}_{d1}$ along the singular 'one-dimensional' universal isotropic absolute-absolute space $\hat{\hat{\rho}}$ in the context of NAAM; the affine coordinate system $(\hat{c}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ associated with the particle or object of inertial mass m_2 (i.e. with $\hat{\hat{m}}_{02}$ embedded in m_2), is in absolute-absolute motion at absolute-absolute dynamical speed $\hat{\hat{V}}_{d2}$ along the singular 'one-dimensional' universal isotropic absolute-absolute space $\hat{\hat{\rho}}$ in the context of NAAM, and the affine coordinate system $(\hat{c}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$ associated with the particle or object of inertial mass m_3 (i.e. with $\hat{\hat{m}}_{03}$ embedded in m_3), is in absolute-absolute motion at absolute-absolute dynamical speed $\hat{\hat{V}}_{d3}$ along the singular 'one-dimensional' universal isotropic absolute-absolute space $\hat{\hat{\rho}}$ in the context of NAAM, with respect to 3-observers in Σ, irrespective of the differing directions along which $\hat{\hat{x}}_1$, $\hat{\hat{x}}_2$ and $\hat{\hat{x}}_3$ actually point in Σ.

However any magnitude of an absolute-absolute dynamical speed $\hat{\hat{V}}_d$ is equivalent to zero magnitude of absolute dynamical speed ($\hat{V}_d = 0$). In other words, an absolute-absolute dynamical speed $\hat{\hat{V}}_d$ of any magnitude in $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ is equivalent to zero absolute dynamical speed in absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ and absolute zero dynamical speed in spacetime (Σ, ct). It then follows that the absolute-absolute dynamical speeds $\hat{\hat{V}}_{d1}$, $\hat{\hat{V}}_{d2}$ and $\hat{\hat{V}}_{d3}$, of absolute-absolute motions of the frames $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ and $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$ respectively, are equivalent with respect to 3-observers in Σ, since we can write as follows

$$\hat{\hat{V}}_{d1} \equiv \hat{\hat{V}}_{d2} \equiv \hat{\hat{V}}_{d3} \equiv (\hat{V}_d = 0) \tag{23}$$

The equivalence with respect to 3-observers in Σ of the absolute-absolute affine frames $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ and $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$, follows from system (23). That is,

$$(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1) \equiv (\hat{\hat{c}}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2) \equiv (\hat{\hat{c}}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3) \tag{24}$$

If we then consider a frame $(\hat{\hat{c}}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ associated with zero absolute-absolute dynamical speed $(\hat{\hat{V}}_d = 0)$ in $(\hat{\rho}, \hat{c}\hat{t})$, then the following equivalence of all absolute-absolute dynamical speeds (including zero absolute-absolute dynamical speed) obtains with respect to 3-observers in Σ

$$\hat{\hat{V}}_{d1} \equiv \hat{\hat{V}}_{d2} \equiv \hat{\hat{V}}_{d3} \equiv \ \ldots \ \equiv (\hat{\hat{V}}_d = 0) \equiv (\hat{V}_d = 0) \tag{25}$$

where $0 \le \hat{\hat{V}}_{d1} \le \hat{\hat{c}}_\gamma$; $0 \le \hat{\hat{V}}_{d2} \le \hat{\hat{c}}_\gamma$; $0 \le \hat{\hat{V}}_{d3} \le \hat{\hat{c}}_\gamma$; etc.

Although the equivalence of all absolute-absolute dynamical speeds with respect to 3-observers in Σ in system (25) is valid for the range $[0, \infty]$ of $\hat{\hat{V}}_{d1}$, $\hat{\hat{V}}_{d2}$, $\hat{\hat{V}}_{d3}$, etc, the range $[0, \hat{\hat{c}}_\gamma]$ has been chosen because dynamical speed has maximum magnitude c_γ in spacetime. This theory is at present being limited to spacetime and its underlying intrinsic spacetime, in which the speeds of 'signals' have magnitudes of c_g and c_γ, as mentioned earlier. The implication of applying the limit $[0, \infty]$ on $\hat{\hat{V}}_{d1}$, $\hat{\hat{V}}_{d2}$, $\hat{\hat{V}}_{d3}$, etc, in system (25), shall be investigated elsewhere with further development.

The equivalence of all absolute-absolute dynamical frames $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$, $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$, etc, associated with different absolute-absolute dynamical speeds of the absolute-absolute rest masses of different particles and objects, including the frame $(\hat{\hat{c}}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ associated with zero absolute-absolute dynamical speed obtains. That is,

$$(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1) \equiv (\hat{\hat{c}}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2) \equiv (\hat{\hat{c}}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3) \equiv \ \ldots \ \equiv (\hat{\hat{c}}_\gamma\hat{\hat{t}}, \hat{\hat{x}}) \tag{26}$$

An implication of system (26) is that NAAM formulated in terms of the coordinates $\hat{\hat{c}}_\gamma\hat{\hat{t}}_1$ and $\hat{\hat{x}}_1$ of the frame $(\hat{\hat{c}}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$ with absolute-absolute dynamical speed $\hat{\hat{V}}_{d1}$ of $\hat{\hat{m}}_{01}$, can be formulated in terms of the coordinates $\hat{\hat{c}}_\gamma\hat{\hat{t}}$ and $\hat{\hat{x}}$ of the frame

$(\hat{c}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ with zero absolute-absolute dynamical speed ($\hat{\hat{V}}_d = 0$), with respect to 3-observers in Σ; NAAM formulated in terms of the coordinates $\hat{c}_\gamma\hat{\hat{t}}_2$ and $\hat{\hat{x}}_2$ of the frame $(\hat{c}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$ with absolute-absolute dynamical speed $\hat{\hat{V}}_{d2}$ of $\hat{\hat{m}}_{02}$, can be formulated in terms of the coordinates $\hat{c}_\gamma\hat{\hat{t}}$ and $\hat{\hat{x}}$ of the frame $(\hat{c}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ with zero absolute-absolute dynamical speed ($\hat{\hat{V}}_d = 0$), with respect to 3-observers in Σ; likewise for the frame $(\hat{c}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$ with absolute-absolute dynamical speed $\hat{\hat{V}}_{d3}$ of $\hat{\hat{m}}_{03}$ and every other absolute-absolute dynamical frame in $(\hat{\rho}, \hat{c}\hat{t})$.

We shall distinguish the frame $(\hat{c}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ with zero absolute-absolute dynamical speed of absolute-absolute motion and formulate NAAM in it, that is, with the coordinates $\hat{c}_\gamma\hat{\hat{t}}$ and $\hat{\hat{x}}$ for all frames $(\hat{c}_\gamma\hat{\hat{t}}_1, \hat{\hat{x}}_1)$, $(\hat{c}_\gamma\hat{\hat{t}}_2, \hat{\hat{x}}_2)$, $(\hat{c}_\gamma\hat{\hat{t}}_3, \hat{\hat{x}}_3)$, etc, in absolute-absolute motions at different absolute-absolute dynamical speeds along different directions at different locations in the relativistic Euclidean 3-space Σ (i.e. $\hat{\hat{x}}_1$, $\hat{\hat{x}}_2$, $\hat{\hat{x}}_3$, etc, are orientated along different directions at different locations in Σ), in the universe. The distinguished absolute-absolute dynamical frame $(\hat{c}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ or the distinguished affine absolute-absolute spacetime coordinates $\hat{c}_\gamma\hat{\hat{t}}$ and $\hat{\hat{x}}$, support NAAM for all particles and objects in the universe with respect to all 3-observers in Σ.

Leibnitz's argument that Newton's mechanics (i.e. Newton's theories of motion and gravity), introduced a distinguished coordinate system (or absolute space) in which it is valid [9, see p. 2] has now been realized. For if we replace Newton's mechanics in Leibnitz's argument with the Newtonian theory of absolute-absolute motion (NAAM) with essential equations (11) – (14) in the distinguished frame $(\hat{c}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ and Newtonian theory of absolute-absolute gravity (NAAG) with essential equations (1) – (5) in the distinguished frame $(\hat{c}\hat{t}, \hat{r})$, then Leibnitz's argument has been realized in NAAM and NAAG on the universal flat 'two-dimensional' absolute-absolute spacetime $(\hat{\rho}, \hat{c}\hat{t})$, embedded in the flat four-dimensional relativistic spacetime (Σ, ct) in Fig. 3c or Fig. 4, with respect to 3-observers in Σ. The conclusion that follows is that the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\rho}, \hat{c}\hat{t})$ isolated originally in [1], is the controversial Newtonian absolute spacetime [10] and [11] and Newtonian mechanics, known to be valid in the Newtonian absolute spacetime, is NAAM and NAAG in $(\hat{\rho}, \hat{c}\hat{t})$.

Indeed of all the Newtonian theories on flat spacetimes isolated in the present theory, only NAAM and NAAG on constantly flat $(\hat{\rho}, \hat{c}\hat{t})$ qualify to be described as Newton's theories of gravity and motion (or Newton's mechanics) in a flat Newtonian absolute spacetime. This is so because the usual Newton's mechanics comprising of the primed classical theory of gravity (CG′) and primed classical theory of motion (CM′) on flat proper spacetime (Σ', ct') and the unprimed classical theory of gravity (CG) and unprimed classical theory of motion (CM) on flat relativistic spacetime (Σ, ct), are not theories of their own, but approximate theories to other exact theories; CG′ on flat (Σ', ct'), which is the same as CG on flat (Σ, ct), is the Newtonian limit approximation to TGR on flat (Σ, ct), while CM′ and CM are approximations and SR′ and SR respectively. Further more, the flat proper spacetime (Σ', ct') of CG′ and CM′ and the flat relativistic spacetime (Σ, ct) of CG and CM are relative spacetime and not absolute spacetime. Definitely the CG′, CG, CM′ and CM cannot be described as Newton's mechanics in a flat Newtonian absolute spacetime (or in a flat Newtonian absolute space).

On the other hand, the primed Newtonian theory of absolute gravity NAG′ and combined primed Newtonian theory of absolute gravity and primed Newtonian absolute motion (NAG′ ∪ NAM′), on the flat proper spacetime (Σ', ct') and the corresponding unprimed theories NAG and NAG ∪ NAM on flat relativistic spacetime (Σ, ct), are exact theories on their own and not approximate theories to other exact theories The NAG′ and NAG′ ∪ NAM′ are exact theories projected into the flat proper spacetime (Σ', ct') by ϕNAG* and ϕNAG* ∪ ϕNAM* on curved absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ at the first stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field of arbitrary strength, as developed in [3] – [4].

The NAG and NAG ∪ NAM are projective theories on flat relativistic spacetime (Σ, ct) of ϕNAG* and ϕNAG* ∪ ϕNAM* on curved absolute intrinsic spacetime $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ at the second stage of evolutions of spacetime/intrinsic spacetime and parameters/intrinsic parameters in a gravitational field of arbitrary strength. As explained in sub-section 5.3 of [7], NAG′ and NAG are valid for the range $0 < \hat{V}_g(\hat{r}) < \hat{c}_g$ of absolute gravitational speeds and NAG′ ∪ NAM′ and NAG ∪ NAM are valid for the range $0 < \hat{V}_g(\hat{r})^2 + \hat{V}_d^2 < \hat{c}^2$ of absolute gravitational speeds and absolute dynamical speeds. Nevertheless the NAG′, NAG′ ∪ NAM′ on flat (Σ', ct') and NAG, NAG ∪ NAM on flat (Σ, ct) cannot be described as Newton's mechanics in a flat absolute spacetime, because the flat spacetimes (Σ', ct') and (Σ, ct) on which they operate are relative spacetimes.

Finally the starred Newtonian theory of absolute gravity NAG* on flat absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ is obtained with the condition $\phi\hat{V}_g(\phi\hat{r})/\phi\hat{c}_g = 2G\phi\hat{M}_{0\mathrm{a}}/\phi\hat{r}\phi\hat{c}^2 = 0$ on the absolute intrinsic line element of the metric theory of absolute intrinsic gravity (ϕMAG) on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$. The condition $2G\phi\hat{M}_{0\mathrm{a}}/\phi\hat{r}\phi\hat{c}^2 = 0$ converts the curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ to flat $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, which is made manifest outwardly in flat absolute spacetime $(\hat{\Sigma}, \hat{c}\hat{t})$ that overlies $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ in all finite neighborhood of the gravitational field source. The ϕNAG* on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ remains unchanged as NAG* on flat $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, which is made manifest in NAG* on flat $(\hat{\Sigma}, \hat{c}\hat{t})$, with the condition $2G\phi\hat{M}_{0\mathrm{a}}/\phi\hat{r}\phi\hat{c}_g^2 = 0$ on ϕNAG* (or ϕMAG) on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$.

However the condition $2G\phi\hat{M}_{0\mathrm{a}}/\phi\hat{r}\phi\hat{c}_g^2 = 0$ implies $\phi\hat{M}_{0\mathrm{a}} = 0$, hence $\phi\hat{M}_0 = 0$, $\phi M_0 = 0$ and $M_0 = 0$. It then means that ϕNAG* on flat $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$ and NAG* on flat $(\hat{\Sigma}, \hat{c}\hat{t})$ created with the condition $2G\phi\hat{M}_{0\mathrm{a}}/\phi\hat{r}\phi\hat{c}_g^2 = 0$ on ϕNAG* (or ϕMAG) on curved $(\phi\hat{\rho}, \phi\hat{c}\phi\hat{t})$, are possible only for a gravitational field source with zero absolute rest mass and consequently zero rest mass, in a strict sense. In other words, NAG* is impossible (or does not exist) as a theory of its own on flat $(\hat{\Sigma}, \hat{c}\hat{t})$. Consequently, although $(\hat{\Sigma}, \hat{c}\hat{t})$ is a flat absolute spacetime, the NAG* (and NAG* $\cup$ NAM*) on it cannot be described as Newton's mechanics in a flat Newtonian absolute spacetime.

The only Newtonian theories of gravity and motion that are exact theories of their own for all magnitudes (including infinite magnitudes) of the parameters (i.e. for all magnitudes of gravitational speeds (or gravitational potential) and dynamical speeds, are the NAAG and NAAM on flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$. The NAAG is exact and valid on the flat $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ for all magnitudes of the absolute-absolute rest mass $\hat{\hat{M}}_0$ of the gravitational field source, unlike NAG* that obtains on flat $(\hat{\Sigma}, \hat{c}\hat{t})$ for $\hat{M}_0 = 0$. Certainly only NAAG and NAAM on flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ qualifies to be described as Newton's mechanics in a Newtonian absolute spacetime (or in Newtonian absolute space), of the hierarchy of Newtonian theories of gravity and motion on a hierarchy of flat spacetimes isolated in the present theory.

It is due to the unknown presence until now of the 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the 'one-dimensional' absolute-absolute rest masses $\hat{\hat{m}}_0$, $\hat{\hat{M}}_0$ of particles and bodies, which is embedded in the flat four-dimensional relativistic spacetime (Σ, ct) containing the inertial masses m, M of particles and bodies, as illustrated in Fig. 3c, that NAAG and NAAM have been formulated as classical theory of gravitation (CG) and classical theory of motion (CM) in terms of the coordinates of (Σ, ct) and inertial masses m, M in Σ until now. In other words, NAAG involving coordinate systems $(\hat{\hat{r}}_1, \hat{\hat{c}}\hat{\hat{t}}_1)$, $(\hat{\hat{r}}_2, \hat{\hat{c}}\hat{\hat{t}}_2)$, $(\hat{\hat{r}}_3, \hat{\hat{c}}\hat{\hat{t}}_3)$, etc, that originate from the absolute-absolute rest masses $\hat{\hat{M}}_{01}$, $\hat{\hat{M}}_{02}$, $\hat{\hat{M}}_{03}$, etc, in $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, has been formulated as classical gravitation (CG) in terms of coordinates $(r_1, r_1\theta_1, r_1 \sin\theta_1\varphi_1; t_1)$, $(r_2, r_2\theta_2, r_2 \sin\theta_2\varphi_2; t_2)$, $(r_3, r_3\theta_3, r_3 \sin\theta_3\varphi_3; t_3)$, etc, of (Σ, ct), which originate from the centers of the inertial masses M_1, M_2, M_3, etc, of gravitational field sources in Σ until now. NAAM involving affine coordinate systems $(\hat{\hat{\tilde{x}}}_1, \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_1)$, $(\hat{\hat{\tilde{x}}}_2, \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_2)$ $(\hat{\hat{\tilde{x}}}_3, \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_3)$, etc, that are attached to the absolute-absolute rest masses $\hat{\hat{m}}_{01}$, $\hat{\hat{m}}_{02}$, $\hat{\hat{m}}_{03}$, etc, in $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, has likewise been formulated as classical theory of motion (or classical mechanics) (CM) in terms of the affine coordinates $(\tilde{x}_1, \tilde{y}_1, \tilde{z}_1; \tilde{t}_1)$, $(\tilde{x}_2, \tilde{y}_2, \tilde{z}_2; \tilde{t}_2)$, $(\tilde{x}_3, \tilde{y}_3, \tilde{z}_3; \tilde{t}_3)$, etc, which are attached to the inertial masses m_1, m_2, m_3, etc, of particles and objects in Σ until now.

3.1 The absolute-absolute time 'dimension' $\hat{\hat{c}}\hat{\hat{t}}$ as the universal synchronous time coordinate and absolute-absolute time $\hat{\hat{t}}$ as universal absolute time parameter of Newtonian mechanics

The constantly flat 'two-dimensional' absolute-absolute spacetime, $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ embedded in the flat relativistic spacetime (Σ, ct) in Figs. 3c and 4, being the Newtonian absolute spacetime, it follows that $\hat{\hat{c}}\hat{\hat{t}}$ is the Newtonian absolute time coordinate or 'dimension' and $\hat{\hat{t}}$ is the absolute time parameter of Newtonian mechanics. The absolute-absolute time 'dimension' $\hat{\hat{c}}\hat{\hat{t}}$ is the universal synchronous time coordinate that appears in the Robertson-Walker line element and the Gaussian coordinates and line elements in general.

The foregoing follows from the equivalence of all absolute-absolute spacetime coordinates sets (or frames) in the universe of system (22) in the context of NAAG and system (26) in the context of NAAM. It follows from system (22) that equivalence of absolute-absolute time coordinates obtains in the context of NAAG,

$$\hat{\hat{c}}\hat{\hat{t}}_1 = \hat{\hat{c}}\hat{\hat{t}}_2 = \hat{\hat{c}}\hat{\hat{t}}_3 = \ \dots \ = \hat{\hat{c}}\hat{\hat{t}}.$$

This means that a distinguished absolute-absolute time coordinate $\hat{\hat{c}}\hat{\hat{t}}$ can be associated with every point in space in every gravitational field, and hence to every point point in space in the universe. Two identical absolute-absolute clocks located at any distinct pair of points in space in the universe will tick at equal rates of absolute-absolute time $\hat{\hat{t}}$ (but not equal rates of relative time t). Thus once the identical clocks are made synchronous in absolute-absolute time, they remain synchronous always. This issue shall be embarked upon and discussed more fully in the second part of this paper.

System (26) in the context of NAAM likewise implies the equivalence of absolute-absolute affine time coordinates,

$$\hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_1 = \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_2 = \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}_3 = \ \dots \ = \hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}.$$

This means that a distinguished absolute-absolute affine time coordinate $\hat{\hat{c}}_\gamma\hat{\hat{\tilde{t}}}$ can be associated with the frame of reference of every material particle or object in relative motion within the universe. Again identical absolute-absolute clocks at rest relative to different frames of reference in relative motions, will tick at equal rates of absolute-absolute time $\hat{\hat{t}}$ (but not at equal rate of relative time t). Thus once the identical clocks are made synchronous in absolute-absolute time, they remain synchronous in absolute-absolute time always.

3.2 Retrospects of the evolution of the Newtonian absolute space concept in physics and the debates it has generated

This section will be incomplete without a brief history of the Newtonian absolute space concept, the controversies it has generated in physics and the resolution of the controversies at last in the present theory. The concept of absolute space entered into mechanics formally in the conceptual scheme of Isaac Newton, as expounded in [12]. Leibnitz, a contemporary of Newton, argued that space should be just a set of possible positions of simultaneously existing bodies — “a ‘mathematical scafolding’ for the identification of material occupants” — without physical significance. Thus, for Leibnitz, space as a set of position markers could not have a physical meaning of its own, and a proper theory of mechanics should be independent of the motion of the observer relative to abstract (or fititious) coordinate system (or frame of reference) used to identify material points. Whereas Newtonian mechanics endowed space with physical significance and introduced a distinguished coordinate system (the absolute space) in which it is valid. Leibnitz contested this fact [9, see p. 2].

However Newton accepted the absolute space concept, arguing that, like an inertial system, absolute space exerts force on material objects. He demonstrated this forcefully with his famous pail experiment.

> Newton filled a pail with water and suspended it from a twisted rope. In unwinding itself, the rope set the pail in rotary motion, and the rotation of the pail continued for a while until it came to rest. The water in the pail was at rest in the first stage of rotation of the pail and had a level surface. The fact that the pail was moving relative to it did not affect it. In the second phase of the rotation of the pail, the friction between the fluid and the wall forced the fluid to participate in the motion. Water and pail then moved as one body, and according to Newton, the surface of the water had the form of a paraboloid of revolution due to centrifugal force on the water. In the third stage, the pail had already come to rest, but the water was still rotating. In a sense the situation was similar to the first stage; water and pail were in the same relative motion. But now the surface the water was parabolic. Newton then concluded that not the relative motion of water and pail were decisive for the phenomenon of the depression of water surface, but the rotation of the body of water relative to absolute space and the consequent centrifugal force.

Newton was considered to have successfully linked the inertia of material objects to absolute space and consequently to have established the existence of the absolute space concept with his pail experiment. The initial objection raised by Leibnitz and by the results of earlier experiments on dynamical relativity, were all considered to be over-ruled by Newton's pail experiment [11].

Subsequently the concept of absolute space was linked with the theological doctrine of the omnipresence of God in the religious front. The Bible says in Psalm 90 verse 1, "Lord you have been our dwelling place in all generations", and in Acts 17 verse 28, it says, "For in Him [God] we live and move and have our being, even as certain of your poets have said" (KJV). This Judeo-Christian heritage prompted some scholars to surmise that space is the sensorium of God [11]. On the other hand, philosophers notably Wolff and Engel, explored the metaphysical implications of Newton's absolute space concept encompassed by the *Principia*. The concept of absolute space bonded religion and metaphysics to physics, and this state of affairs remained for a long time.

During the second half of the nineteenth century, the Austrian physicist, Ernst Mach, investigated the epistemological implications of Newton's *Principia*. He reinterpreted the result of Newton's pail experiment and showed, contrary to the belief of the preceding two hundred years and more, that the result of Newton's pail experiment was not conclusive of motion relative to absolute space. He wrote [10]:

> Newton's experiment with the rotary vessel simply informs us that relative rotation of the water with respect to the sides of the vessel produces no noticeable centrifugal forces, but that such forces are produced by the relative rotation with respect to the mass of the earth and the other celestial bodies. No one is competent to say how the experiment would turn out if the sides of the vessel increased in thickness and mass until they were several leagues thick.

Following his reinterpretation of Newton's pail experiment, Mach advocated for the elimination of what he called 'the conceptual monstrosity of absolute space' from mechanics. Mach related the inertia of a mass-particle not to space as such, but to the center of the masses of all bodies in the universe. The assumption of intrinsic functional dependence between inertia and large-scale distribution of matter in the universe closes for Mach the series of mechanical interactions without resorting to metaphysical and religious entities. Following Mach, the whole physics community, and not only mechanists, was ready to abandon absolute space. For instance Poincare wrote [11]: "whoever speaks of absolute space uses a word devoid of meaning." And this became widely accepted.

Although the intervention of Albert Einstein was on the other controversial concept of the luminiferous ether, he was nevertheless aware of the Newtonian absolute space concept and the arguments it had generated before his time. As a matter of fact, Einstein contributed to the argument in his foreword to [11],

> ... space is not only introduced [in the *Principia*] as an independent thing apart from material objects, but is assigned an absolute role in the whole causal structure of the theory. This role is absolute in the sense that space (as an inertial

system) acts on all objects while these do not in turn exert any reaction on space.

Einstein was aware that the controversy about the Newtonian absolute space had not been resolved. He wrote in 1953, two years before he closed his eyes, in the same foreword to [11],

> It has required no less strenuous exertion subsequently to remove this concept [of absolute space], a process which is by no means as yet complete.

The age-long controversy about the Newtonian absolute space has certainly been resolved in the present theory. This has been achieved by the following steps.

1. Isolating the constantly flat 'two-dimensional' universal absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the absolute-absolute rest masses $(\hat{\hat{m}}_0, \hat{\hat{\varepsilon}}/\hat{\hat{c}}^2)$, $(\hat{\hat{M}}_0, \hat{\hat{E}}/\hat{\hat{c}}^2)$ of particles and bodies and its underlying constantly flat 'two-dimensional' absolute-absolute intrinsic-intrinsic spacetime $(\phi\phi\hat{\hat{\rho}}, \phi\phi\hat{\hat{c}}\phi\phi\hat{\hat{t}})$ containg the absolute-absolute intrinsic-intrinsic rest masses of particles and bodies $(\phi\phi\hat{\hat{m}}_0, \phi\phi\hat{\hat{\varepsilon}}/\phi\phi\hat{\hat{c}}^2)$, $(\phi\phi\hat{\hat{M}}_0, \phi\phi\hat{\hat{E}}/\phi\phi\hat{\hat{c}}^2)$, with respect to 3-observers in the relativistic Euclidean 3-space Σ in [2], and incorporating these into physics formally in this paper, as illustrated in Fig. 3c and Fig. 4 of this paper.
2. Showing that the constantly flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ embedded in the flat four-dimensional relativistic (or physical) spacetime (Σ, ct) is the Newtonian absolute spacetime; the isotropic 'one-dimensional' absolute-absolute space (or 'dimension') $\hat{\hat{\rho}}$ (with no unique orientation in Σ with respect to 3-observers in Σ), being the Newtonian absolute space and $\hat{\hat{t}}$ the Newtonian absolute time parameter.
3. Showing that the only valid form of Newtonian (or classical) theory of gravity as a unique theory of its own (and not an approximate theory to the gravitational-relativistic Newtonian theory of gravity (RNLG) on flat (Σ, ct)), is the Newtonian theory of absolute-absolute gravity (NAAG) on flat $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ and the only valid form of Newtonian (or classical) theory of motion as a unique theory of its own (and not an approximate theory to SR$'$ on flat (Σ', ct') or SR on flat (Σ, ct)), is the Newtonian theory of absolute-absolute motion (NAAM) on flat $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$.

   NAAG and NAAM involve the absolute-absolute rest masses $\hat{\hat{m}}_0$ and $\hat{\hat{M}}_0$ of particles and gravitational field sources and distinguished coordinate sets $(\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}})$ and $(\hat{\hat{c}}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ respectively in the flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, with respect to 3-observers in the relativistic Euclidean 3-space Σ. They involve absolute-absolute gravitational speeds $\hat{\hat{V}}_g(\hat{\hat{r}})$ (or absolute-absolute gravitational potentials $\hat{\hat{\Phi}}(\hat{r})$) in the range $0 \le \hat{\hat{V}}_g(\hat{r}) \le \infty$ (or $0 \le \hat{\hat{\Phi}}(\hat{r}) \le \infty$) and absolute-absolute dynamical speeds $\hat{\hat{V}}_d$ in the range $0 \le \hat{\hat{V}}_d \le \infty$ respectively.

It shall be reiterated that NAAG and NAAM on flat absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ have been unknown in physics until now. What has been known as Newtonian (or classical) theory of gravity on flat spacetime since Newton's time until now is the primed Newtonian (or classical) theory of gravity (CG′), involving the ret masses m_0, M_0 of test particles and gravitational field sources (with equations $\Phi'(r') = -GM_0/r'$; $\vec{g}'(r') = -GM_0\vec{r}'/r'^3$) on flat proper spacetime (Σ', ct'), which is the same as the unprimed Newtonian (or classical) theory of gravity (CG), involving the inertial masses m, M of test particles and gravitational field sources (with equations $\Phi(r) = -GM/r$; $\vec{g}(r) = -GM\vec{r}/r^3$) on flat relativistic spacetime (Σ, ct), in very weak gravitational fields. We know now however that CG′ or CG is not a theory of its own but an approximate theory to the gravitational-relativistic Newton's theory of gravity (RNLG) on flat relativistic spacetime (Σ, ct) in very weak gravitational fields, for which $V_g'(r') << c_g$ (or $\Phi'(r') << -c_g/2$ in RNLG.

Likewise what has been known as Newtonian (or classical) theory of motion on flat spacetime since Newton's time until now is the primed Newtonian (or classical) theory of motion (CM′), involving the ret masses m_0 of particles and objects (with equations $\vec{p}' = m_0\vec{v}$, $d^2\vec{x}'/dt'^2 = d\vec{p}'/dt' = m_0\vec{a}$, $E'_{\text{kin}} = \frac{1}{2}m_0v^2$), on flat proper spacetime (Σ', ct'), and the unprimed Newtonian (or classical) theory motion (CM), involving the inertial masses m of test particles and objects (with equations $\vec{p} = m\vec{v}$, $d^2\vec{x}/dt^2 = d\vec{p}/dt = m\vec{a}$, $E_{\text{kin}} = \frac{1}{2}mv^2$) on flat relativistic spacetime (Σ, ct), at the low relative velocity regime ($v << c_\gamma$). It is known in physics however that CM′ and CM are not theories of their own but approximate theories to SR′ on flat proper spacetime (Σ', ct') and SR on flat relativistic spacetime (Σ, ct) respectively, at the low relative velocity regime ($v << c_\gamma$).

As now established in the present theory, two flat spacetimes co-exists in every gravitational field and hence everywhere in the universe namely, the flat four-dimensional relativistic (physical) spacetime (Σ, ct) containing the inertial masses m, M of particles and bodies and the flat 'two-dimensional' absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the absolute-absolute rest masses $\hat{\hat{m}}_0$, $\hat{\hat{M}}_0$ of particles and bodies, which is embedded in (Σ, ct) containing m, M, as illustrated in Fig. 3c.

Newton performed his pail experiment in the flat relativistic (physical) spacetime (Σ, ct) established in the context of TGR in the gravitational field of the earth. The experiment involved the inertial masses of water and pail in low velocity rotation in (or relative to) the absolutely stationary relativistic (physical) Euclidean 3-space Σ. The relevant theory to Newton's experiment is CM, an approximate theory to SR on flat (Σ, ct). Thus Newton's conclusion that space exerts force on water in the rotating pail, refers to the physical Euclidean 3-space Σ and not to Newtonian absolute space, now identified as the absolute-absolute space $\hat{\hat{\rho}}$, which is non-observable and non-detectable and is hence inaccessible to Newton's experiment. Newton should therefore not have concluded that absolute space exerts force on material objects and that it is the origin of inertia of material objects from his experiment. Rather he should have concluded that the physical (relative) Euclidean 3-space Σ exerts force on material objects and is the origin of the inertia of material objects*; that although absolute space exists, it is inaccessible to his experiment.

Leibnitz's argument that Newton's mechanics endowed space with physical significance and introduced a distinguished coordinate system (the absolute space) in which it is valid, is a valid argument as well from the perspective of the present theory. For it refers to NAAM and NAAG involving the distinguished coordinate systems $(\hat{\hat{c}}_\gamma\hat{\hat{t}}, \hat{\hat{x}})$ and $(\hat{\hat{c}}\hat{\hat{t}}, \hat{\hat{r}})$ respectively, in the absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$ containing the absolute-absolute rest masses $\hat{\hat{m}}_0$, $\hat{\hat{M}}_0$ of particles and bodies, now found to be the only possible Newtonian mechanics on a flat absolute spacetime. It at the same time refers to the relative Euclidean 3-space Σ (with physical significance) of CM and CG. Leibnitz should not have advocated for the rejection of space with physical significance and absolute space, the two spaces which he thought are one and the same thing. The two spaces exist separately in nature as now found.

Ernst Mach's argument is tantamount to his acceptance of the existence of both the physical space and the absolute space with a clear distinction between the two. This is so because he advocated for the relegation of the non-observable and non-detectable Newtonian absolute space concept along with other non-observable and non-detectable entities in physics, while concentrating on physics of the observed universe (in the observed physical space). This was an appropriate policy at the time, in order to keep religion and metaphysics (thought to be bonded to physics by the absolute space concept) distinct from physics. However the Newtonian absolute spacetime, now identified as the universal absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$, exists in nature, as found to this point in the present theory, and plays vital roles in physics, as shall be found with further development. Now, therefore, is the time to review Mach's policy (or philosophy of logical positivism) and incorporate the Newtonian absolute space (i.e. the absolute-absolute spacetime $(\hat{\hat{\rho}}, \hat{\hat{c}}\hat{\hat{t}})$) into physics, as started in this paper, in order to have a more complete description of nature.

*It is yet to be determined whether or not the physical 3-space is the origin of inertia of objects in the present theory.

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