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Introduction to the Problems of Relativistic and Absolute Space, Time, and Motion

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Since the 1905 conception of the special theory of relativity (STR) by Albert Einstein, there has been no other theory of physics which has been both hailed as one of the most profound accomplishments of the human mind (Planck, Laue, Langevin, Eddington, Pauli, de Broglie, Born, Heisenberg, Thirring, *et al*) and dismissed as experimentally unconfirmable, physically untenable, and logically unsound (Poincaré, Rutherford, Lenard, Abraham, Soddy, Alfvén, Nordenson, Dingle, Theimer, *et al*). The STR is a theory " relative to the observer", which predicts the physical state of matter (bodies, planets, galaxies, interstellar gases and plasmas) to depend on the velocity +**v** of the material object relative to the observer or the velocity −**v** of the observer relative to the material object. Space and time are no longer independent but postulated to be interrelated through a space–time metric, which is invariant in Lorentz (L) transformations between inertial frames (IF) S and S':

$$ds^2 = dx^2 + dy^2 + dz^2 - c^2dt^2 = dx'^2 + dy'^2 + dz'^2 - c^2dt'^2 = ds'^2 \tag{1}$$

Rewriting (1) as $ds^2 = \gamma_{\mu\nu}dx^\mu dx^\nu$ with $x^1 = x$, $x^2 = y$, $x^3 = z$, $x^4 = ct$ (summation over μ and v), it is seen that the 4–dimensional Minkowski space has an L–invariant metric tensor, $\gamma_{ij} = +1$, $i = j = 1, 2, 3$; $= -1$, $i = j = 4$; $= 0$, $i \neq j$. Since in the STR only the relative velocity **v** between material body and observer matters, n observers in different IFs would measure n different physical states for one and the same body during a common observation period. Thus, the STR transcendents physics and reality and leads to the surrealism of a multi–valued world based on an inherent many–valued logic.

Whereas the STR and L–covariant physics are believed to hold in IFs, the general theory of relativity (GTR) developed by Einstein and Hilbert (1907–1915) is assumed to be valid for arbitrary, accelerated frames Σ in the presence of gravitational fields. Let us consider the transformation of the Galilean coordinates x^μ ($\mu = 1, 2, 3, 4$) of an IF S to the general coordinates x^μ ($\mu = 1, 2, 3, 4$) of a noninertial (NIF) or accelerated frame Σ. Based on Riemann's geometry for general, many–dimensional curved spaces, Einstein assumed the metric $d\mathrm{s}^2$ of the space–time continuum in the NIF Σ to be invariant in general transformations $S \rightarrow \Sigma$:

$$ds^2 = \gamma_{\mu\nu}dx^\mu dx^\nu = g_{\alpha\beta}d\mathrm{x}^\alpha d\mathrm{x}^\beta = d\mathrm{s}^2 \tag{2}$$

where

$$g_{\alpha\beta} = \gamma_{\mu\nu}(dx^\mu / d\mathrm{x}^\alpha)(dx^\nu / d\mathrm{x}^\beta), \quad g_{\alpha\beta} = g_{\beta\alpha} \tag{3}$$

is the metric tensor of Σ, which is not invariant in general transformations [1]. Since the metric tensor is symmetric, $g_{\alpha\beta}$ has 16–6 = 10 (scalar) elements which are functions of the x^μ. Thus, we recognize that the collective $\{x^\mu\}$ of points forming the 4–dimensional space in the NIF Σ is no longer quasi–Euclidian (Minkowski space) flat but a "curved" or Riemannian space (Riemann developed the geometry of curved n–dimensional spaces as a generalization of Gauss′ geometry on 2–dimensional curved surfaces).

By Eoetvoes experiment, the inertial and gravitational masses of a body are equal, $m_i = m_g = m$ [1]. Accordingly, in the Newtonian equation of motion for a body with velocity $\mathbf{v}$ in a gravitational field $\mathbf{g}$, the named masses drop out if and only if the velocity dependence of m can be neglected: $d\mathbf{v}/dt = \mathbf{g}$, $v/c \to 0$. Hence, the accelerated motion of a body in a homogeneous gravitational field $\mathbf{g}(t)$ of an IF S appears as an inertial motion in a NIF Σ, which moves nonuniformly relative to S with acceleration $\mathbf{a}(t) = -\mathbf{g}(t)$. Thus, Einstein arrived at his equivalence principle: *It is physically impossible to decide whether a body is accelerated in a homogeneous gravitational field in an IF or performs an inertial motion in a suitably accelerated NIF.* Note that this hypothesis is applicable only to bodies with velocity independent masses. Furthermore, homogeneous gravitational fields $\mathbf{g}(t)$ do not exist exactly in nature, i.e., are conceivable only in the sense of a local approximation.

By means of this equivalence principle, Einstein explains the motion of a body under the influence of a gravitational field in a quasi–Euclidian Minkowski space (IF) as an inertial motion in a Riemannian space, the metric ds^2 of which is given by the coefficients $g_{\alpha\beta}(x^\mu)$ which determine the curvature of the non–Euclidian space–time by (3). The coefficients $g_{\alpha\beta}$ depend on the mass distribution in the universe, i.e., these masses are ultimately seen as the cause of the curvature of the world′s space–time. The gravitational forces are expressed in the GTR through the metric tensor $g_{\alpha\beta}$. Hence, the mass of a body and its gravity field are envisioned as a *geometric* effect in the non–Euclidian space–time. Moreover, the 4–dimensional space, as a collective of points $\{\mathbf{x}, ict\}$, is a complex space since $i = \sqrt{-1}$ separates the 3–dimensional space $\{\mathbf{x}\}$ from the 1–dimensional space $\{t\}$, i.e. is not real in a physical sense. Thus, in its ultimum consequence the GTR leads to a denial of physical reality since measurable masses and gravitational forces are represented as *geometric* effects in a *complex* (mathematical) curved space–time.

As an illustration of the physics relative to the observer (STR), consider the different relativistic temperatures derived by Planck (1908 [2]) as $T = T_0(1-v^2/c^2)^{1/2}$ and by Ott (1963 [3]) as $T = T_0/(1-v^2/c^2)^{1/2}$. Hence, an inertial observer moving with a speed $v \sim c$ relative to water at rest in an IF S with a proper temperature $T_0 = 300$ K would see (i) ice at a temperature $T \ll 300$ K according to Planck and (ii) a plasma at a temperature $T \gg 300$ K according to Ott. Furthermore, n observers moving with different speeds v_n relative to a glass of water would measure, from their IFs, the water to have simultaneously n different temperatures during any common observation period. Such obvious contradictions and absurdities are cherished as mystified paradoxes in the relativity literature. According to Arzéliez [4]: "*Criticisms of relativity theory are symptoms of mental abnormality and to treat them seriously is a waste of time*". Essen [5]: "*A common reaction of experimental physicists to the relativity theory is that although they do not understand it themselves it is so widely accepted that it must be right*".

The GTR is an ingenious mathematical construction the cosmological applications of which surpass the surrealism of the paradoxes of the STR. For lack of space, I quote here only the distinguished cosmologist Kaufmann [6]: "*A black hole is one of the most fantastic things ever predicted by modern science. It is a place where gravity is so strong that nothing — not even light — can escape. It is a place where gravity is so strong that a hole has been rent into the very fabric of space and time. Surrounding this yawning spasm is a horizon in the geometry of space where time itself stands still. And inside this hole, beyond this horizon, the directions of space and time are interchanged.*"

"*There are wormholes to other universes, time tunnels and time machines that would bring you back to where you started before you left. There is antigravity beyond the hole's center. And around the hole, there are regions where you have to travel at the speed of light in order to remain in the same place.*"

Since the dawning of subjective relativism in physics, Einstein's special and general relativities found attention by philosophers and logicians up to our times [7]. O. Kraus (1925) [8]: "*On the top of the space and time doctrines of the relativity theory there stands the unwritten word: Alles scheinen, nichts sein.* " (Appearing to be everything, but being nothing.) F. Lipsius (1927) [9]: "*The contradiction contained in the relativization of space and time lies in the statement that space and time depend on the velocity of the observer. Yet, there can be no doubt that it is the motion, which presupposes space and time.*" W. Rauschenberger (1931) [7]: "*Bodies can expand in space and time, but never space and time themselves*". H. Nordenson on the GTR (1969) [10]: "*Neither Einstein nor anybody else can know anything about the physical meaning of all these formulae. They are all mathematical constructions without known physical meaning*".

Unfortunately, I can give here only an incomplete impression of the way how Einstein's special and general relativities changed (' revolutionized') physics in the 20th century. Although it is inconceivable to me that these theories will survive for an other century, Einstein's initiatives in making contributions of unprecedented originality to physics will be remembered for times to come. In contrast, the contemporary leaders of physics appear to feel obliged to preserve the past accomplishments in quantum mechanics, relativity theories, and L–covariant theories in general, by permitting further scientific advances only in infinitesimal steps. Criticism of the ' accepted' and ' thousands of times' experimentally confirmed theories of Einstein, Schroedinger, and Dirac is usually suppressed.

According to Popper [11]: " It is an interesting fact that Einstein was for years a dogmatic positivist and operationalist. He later rejected this interpretation: he told me in 1950 that he regretted no mistake he ever made as much as this mistake". Einstein referred to his operative definitions of time and space in the STR and his positivistic interpretation of the Michelson–Morley experiment. It is a matter of simple logic that one can not conclude from the non–observation of an effect (ether) in one or a finite number of experiments that the effect (ether) does not exist. In 1949, Einstein confessed with regard to the STR, the GTR, and his unified field theory to his friend M. Solovine [12]: "*There is not a single concept, of which I am convinced that it will survive, and I am not sure whether I am on the right way at all*".

It was Einstein's fate that he had to abandon his special and general relativities, i.e., those theories which were the dearest to him. He received the Nobel Price for the equation

$h\nu = (1/2)mv^2 + P$ of the photoelectric emission of an electron (m) from the surface of a solid (work–function P), a contribution of which he was less fond. In my judgement, Einstein's most significant accomplishment was the derivation of the interrelation of induced and spontaneous emission, which made him the father of quantum electrodynamics and the laser. Later, electron emission through intense laser beams (many–photon interactions) with a photon energy $h\nu < P$ refuted the general validity of his formula.

Already before 1955, the international physics establishment used Einstein's contributions to physics and reputation as a scholar to promote its own interests. Now, 40 years after Einstein's death, modern physics is still based on theoretical foundations most of which Einstein rejected in his later years. Nor is there any indication that in the foreseeable future the keepers of 'accepted' physics will find their way back to Descartes: "*De omnibus est dubitandum*".

For the above and other reasons, the articles of this Collection on relativistic and absolute space and time physics are devoted to the late Albert Einstein. The idea and initiative to publish this Collection is due to Professor Shuoping Wu, an internationally recognized electronics scientist and Advisor of the Editorial Committee, and Professor Kexi Liu, Executive Editor of the Chinese Journal of Systems Engineering and Electronics. Based on the concept of the dialectic approach to the truth, they suggested to publish not only papers which question and propose alternatives to the orthodox relativity theories, but also papers which support and further develop the STR and GTR. Furthermore, credit goes to some very important volunteers, our reviewers, — without their efforts this Collection would not have been possible. My personal thanks to all of them.

Next, we will more specifically discuss relativistic and absolute space and time, with regard to (i) the contributions in this Collection and (ii) the further development of space and time physics.

Relativistic Versus Absolute Space and Time

Contradicting Maxwell, Larmor, Heaviside, Hertz, and others, Voigt (1887), Lorentz (1904), and Einstein (1905) introduced the hypothesis that Maxwell's equations and the electromagnetic (EM) wave equations hold in this form not only in the ether frame $S^o(0)$ but in all other IFs $S(\mathbf{w})$ with ether velocities $\mathbf{w} \neq \mathbf{0}$, too [1]. This proposition is physically equivalent to the assumptions: (i) an EM wave carrier or ether (vacuum substratum) does not exist, (j) the velocity of a light signal has the same value c in all IFs, and (k) electrodynamic phenomena are relative to the observer (nonexistence of a preferred or substratum frame S^o).

In Einstein's 1905 electrodynamics paper [13], the L–transformations, which relate the coordinates of a point (x, y, z, t) in an IF S to the coordinates (x', y', z', t') of the same point in an other IF S' moving with a constant velocity $\mathbf{v}$ relative to S, are derived from two principles: (i) The constancy of the velocity $c = c'$ of a vacuum light signal in all IFs and (ii) the linearity of the transformations (implying Euclidian geometry and homogeneity of space and time). The STR is Einstein's physical interpretation of the Lorentz transformations, which embraces the new interrelated space and time concepts, the relativity of the simultaneity of events, and the relativity of all physical velocities in favor of the observer.

Unprecedented in the history of science, already in 1906 Planck introduced the STR into his teaching program in Berlin. The Editor of the Annalen der Physik, Paul Drude, an eminent physicist and optics specialist, was the first and probably the last physics editor in the 20th century who took full responsibility for what he had published: he committed suicide in 1906.

In order to comprehend the *physical* implications of what happened from 1905 to 1906 to physics, consider the acoustic wave equation $\partial^2 p^o / \partial t^{o2} = c_s^{o2} \nabla^{o2} p^o$ for the pressure perturbation $p^o(\mathbf{r}^o, t^o)$ in an IF $S^o(\mathbf{r}^o, t^o)$, in which the wave carrier (gas) is at rest. This wave equation is not generally valid since it holds only in the wave carrier rest frame S^o. For this reason, this wave equation is covariant with respect to L–transformations, in which the velocity of light c is replaced by the velocity of sound c_s. The acoustic wave equation for an arbitrary IF $S(\mathbf{r}, t)$, in which the wave carrier (gas) streams with a velocity $\mathbf{w}$, is by linear gasdynamics $(\partial / \partial t + \mathbf{w} \cdot \nabla)^2 p = c_s^2 \nabla^2 p$. The latter wave equation is applicable in this form to all IFs and is Galilei (G) covariant, since the operators $(\partial / \partial t + \mathbf{w} \cdot \nabla) = (\partial / \partial t' + \mathbf{w}' \cdot \nabla')$, $\nabla = \nabla'$, the field $p(\mathbf{r}, t) = p'(\mathbf{r}', t')$, and $c_s = c'_s$ are invariants in G–transformations $S \rightleftharpoons S'$. It is recognized that the L–transformations are *mathematical space–time substitutions* which leave the special ($\mathbf{w} = 0$) wave equation covariant. Whereas the G–transformations are *physical space–time substitutions* which leave the general ($\mathbf{w} \neq 0$) wave equation covariant. In essence, this is the trivial physics which Voigt, Lorentz, and Einstein did not understand [14].

TRANSFORMATION THEORY OF WAVE EQUATION. Consider the transformation of the wave equation in the 2–dimensional x–τ space S $(\tau = ct)$, $\partial^2 \psi / \partial \tau^2 = \partial^2 \psi / \partial x^2$ for the field $\psi(x, \tau)$ into a wave equation of the same form in the 2–dimensional ξ–η space S', $\partial^2 \Psi / \partial \xi^2 = \partial^2 \Psi / \partial \eta^2$ for the field $\Psi(\xi, \eta) = \psi(x, \tau)$. As shown by Wilhelm, the space–time transformation $\xi = \xi(x, \tau)$, $\eta = \eta(x, \tau)$, which leave the wave equation form–invariant are given by the fundamental equations [15]:

$$\partial \xi / \partial x = \pm \partial \eta / \partial \tau, \qquad \partial \xi / \partial \tau = \pm \partial \eta / \partial x \tag{4}$$

with $\partial^2 \xi / \partial x^2 = \partial^2 \xi / \partial \tau^2$ and $\partial^2 \eta / \partial x^2 = \partial^2 \eta / \partial \tau^2$. The partial differential equations (4) have an infinite number of linear and nonlinear solutions (depending on the boundary and initial conditions, or constraints). They play a similar role in the solution of hyperbolic boundary–value problems as the Cauchy–Riemann equations in the solution of elliptic boundary–value problems (conformal mappings). E. g., equations (4) permit an analytical solution of the moving boundary–value problem for the compression of EM waves between conducting copper plates imploded by explosives [16].

• **Subluminal L–Transformations.** By (4), with upper signs +, the L–transformation from the frame $S(x, \tau)$ to the frame $S'(\xi, \eta)$, where S' moves with velocity $\mathbf{u} = u\hat{\mathbf{x}}$ relative to S, is for subluminal velocities $|\mathbf{u}| / c < 1$:

$$\xi = \gamma(x - \beta\tau), \quad \eta = \gamma(\tau - \beta x), \quad \beta = |\mathbf{u}| / c, \quad \gamma = 1 / (1 - \beta^2)^{1/2} \tag{5}$$

• **Superluminal L–Transformations.** By (4), with upper signs +, the L–transformation from the frame $S(x, \tau)$ to the frame $S'(\xi, \eta)$, where S' moves with velocity $\mathbf{u} = u\hat{\mathbf{x}}$ relative to S, is for superluminal velocities $|\mathbf{u}| / c > 1$:

$$\xi = \gamma^* (\beta x - \tau), \quad \eta = \gamma^* (\beta \tau - x), \quad \beta = |\mathbf{u}| / c, \quad \gamma^* = 1 / (\beta^2 - 1)^{1/2} \tag{6}$$

Note that the constant coefficients γ and γ^* of the subluminal and superluminal L–transformations (5) and (6) have been determined by means of the space–time invariance,

$$x^2 - \tau^2 = \xi^2 - \eta^2 = \text{L– inv}, \quad |\mathbf{u}| < \text{or} > c \tag{7}$$

$S(x,\tau)$ and $S'(\xi, \eta)$ are IFs by implication since the ordinary wave equation holds only in non–accelerated reference systems. S' is assumed to move with velocity $\mathbf{u} = u\hat{\mathbf{x}}$ relative to S. Note that the superluminal L–transformations can also be derived in analogy to the usual derivation of the subluminal transformations [17]. One of the main predictions of the STR is the nonexistence of superluminal velocities. The superluminal L–transformations (6) invalidate this STR claim.

It is essential to recognize that the partial differential equations (4) permit an infinite number of mathematical space–time transformations. The selection of the subluminal L–transformations, or any other mathematical transformations, which leaves the wave equation covariant, as the physical space–time transformations is arbitrary and unsupported by all known experiments.

MINKOWSKI'S SPACE–TIME INVARIANCE. If the vacuum were a space without substratum, the light flashes originating at the times $t = 0$ and $t' = 0$ from the sources Q and Q' at the origins O and O' of the IFs $S(\mathbf{r}, t)$ and $S'(\mathbf{r}', t')$ would be given by $r = ct$ and $r' = ct'$ (STR notation), respectively. Minkowski's space–time invariance goes far beyond these equations by asserting that one single light source Q fixed to the origin O of the IF $S(\mathbf{r}, t)$ generates not only a light flash about O of S but also light flashes $r' = ct'$, $r'' = ct''$, $\cdots$, $r^n = ct^n$ about the origins O', O'', $\cdots$, O^n of an unlimited number of other IFs S', S'', $\cdots$, S^n. Hence, if corresponding axes of the IFs S', S'', $\cdots$, S^n are parallel to the axes x, y, z of S and their origins O', O'', $\cdots$, O^n coincide with the origin O of S at time $t' = t'' = \cdots = t^n = t = 0$, then by (1):

$$r'^2 - c^2 t'^2 = r''^2 - c^2 t''^2 = \cdots = (r^n)^2 - c^2 (t^n)^2 = r^2 - c^2 t^2 = \text{L– inv} \tag{8}$$

The discovery of this interrelation of ' space and time' seduced Minkowski (1909) to the prophesy: " *Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two shall preserve an independent reality*". In reality, these novel space–time concepts are based on a confusion of the Lagrangian coordinates $X(t), Y(t), Z(t)$, $X'(t'), Y'(t'), Z'(t')$, $\cdots$ of the spherical wave fronts in S, S', $\cdots$ with the independent space and time variables (x, y, z, t), (x', y', z', t'), $\cdots$ in the Eulerian field theory of Maxwell's equations ($\partial \mathbf{r} / \partial t = \mathbf{0}$, $\partial t / \partial \mathbf{r} = \mathbf{0}$). Hence, space (x, y, z) and time (t) in S, space (x', y', z') and time (t') in S', $\cdots$ are independent of each other.

IFs are *material* frames with adequate inertia so that their uniform motion in space is not noticeably perturbed during the physical processes occurring in them. Even if one uses atoms as IFs S, S', S'', $\cdots$, it is impossible to have the origins of two or more atoms S, S', S'', $\cdots$ coincide at the same time, e.g. $t = t' = t'' = \cdots = 0$. Alone for this reason, the Minkowski space–time invariance (8) can not be realized in experiments, i.e. it has no physical meaning.

In Newton's experiment with the falling apple (m_0) in the gravitational field $\mathbf{g}= - g\hat{\mathbf{z}}$, the Lagrangian position coordinate $Z(t)$ of the apple is determined by $d^2Z(t)/dt^2=-g$ with $dZ(t=0)/dt=0$; hence $Z(t)=Z(0)-\frac{1}{2}gt^2$. Similarly, the Lagrangian positions of all particles in the universe (planets, molecules, atoms, electrons, elementary particles) are functions $\mathbf{X}(t)$ of time. In summary, the existence of EM wave fronts $R(t)$ of light flashes and the Lagrangian positions $\mathbf{X}(t)$ of Newton's apple, any particle, or photon of the universe are *no* evidence for Minkowski's " interrelation of space and time".

Minkowski's unification of space and time is erroneous for fundamental reasons, too. A space element $dxdydz$ is a scalar, whereas a time element dt is a vector in the 1–dimensional t–space. An inversion of time is not possible since it would lead to a chaos of causality violations. Contrary to relativistic claims, events (e.g., the ticking of a clock) can go only forward but not backward in time. Whereas in space $\{x, y, z\}$ bodies can move forwards and backwards in any direction. Space $\{x, y, z\}$ exists in all its elements $dxdydz$ at the same time, whereas time exists only successively. For these reasons, too, the 4–dimensional Minkowski space does not represent more than a fictitious mathematical space.

The motion $\mathbf{v}(t)=d\mathbf{X}(t)/dt$ of a body m is a sequence of continuous displacements $d\mathbf{X}(t)$ of m within a succession of infinitesimal but nonvanishing time elements dt. The motion $\mathbf{v}(t)$ already presupposes the concepts of space and time, since motion ' outside' of space and time is inconceivable. However, as a body m moves in the force field of an other body M, the continuous displacements $d\mathbf{X}(t)$ of m in successive time elements dt generates its own time $t=\int dt$, in the absence of any independent periodic time counter (clock). Thus, time in the absence of any moving (periodic or other) body is unthinkable, too.

THE " PHYSICS" OF THE LORENTZ TRANSFORMATIONS. The space–time invariance (1) is not satisfied by the G–transformations $x=x'+ut'$, $y'=y$, $z'=z$, $t=t'$ between the IFs $S(\mathbf{r},t)$ and $S'(\mathbf{r}', t')$, where S' moves with a velocity $\mathbf{u}=u\hat{\mathbf{x}}$ along the x–axis of S. For this reason, consider modified G–transformations, in which the length and time scales are " corrected" by the dimensionless factors α, κ, σ and δ, and time is shifted by a function $\Theta=\Theta(?)$ [18],

$$x=\alpha(x'+ut'),\ y=\kappa y',\ z=\sigma z',\ t=\delta(t'+\Theta) \tag{9}$$

in order to create mathematically the appearance of a light signal $r'=ct'$ about the origin O' of the IF S' as S' moves away with velocity $\mathbf{u}$ from the light source Q fixed to the origin O of the IF S. Substitution of (9) into (1) gives an identity in which the coefficients of x'^2, y'^2, z'^2 and $-c^2t'^2$ must be 1, and the coefficient of t' must be 0. By these conditions: $\alpha=1/(1-\mathbf{u}^2/c^2)^{1/2}$, $\kappa=1$, $\sigma=1$, $\delta=1/(1-\mathbf{u}^2/c^2)^{1/2}$, and $\Theta=ux'/c^2$. Substitution of α, κ, σ, δ, and $\Theta(x')$ into (9) shows that the (subluminal) L–transformations are the distorted G–transformation (9), which satisfy the space–time invariance (1):

$$x=(x'+ut')/(1-\mathbf{u}^2/c^2)^{1/2},\ y=y',\ z=z',\ t=(t'+ux'/c^2)/(1-\mathbf{u}^2/c^2)^{1/2} \tag{10}$$

Accordingly, the L–transformation (10) is a falsified G–transformation (9) which fakes a light flash $r'=ct'$ about the *origin* O' (without attached light source Q') in any IF $S'(\mathbf{r}', t')$, although there is only one real light source Q, which is fixed to the origin of $S(\mathbf{r},t)$.

The physically inconceivable light flash $r'= ct'$ about the origin O' of any IF S' is a hallucination created by the space–dependent time shift $\Theta= ux'/c^2$ and the rescaling of the space and time measures by $\alpha=\delta=1/(1-\mathbf{u}^2/c^2)^{1/2}$. It is energetically impossible that one single real light flash $r= ct$ about the origin O of an IF S produces light flashes $r'= ct'$ about the origins O' of an *unlimited* number of other IFs S'. The light flashes $r'= ct'$ about the origins O' of the IFs S' are *mathematical illusions* without EM momentum and energy in the complex Minkowski space. Hence, the L–transformations (10) are not *physical* space–time transformations and the Minkowski invariance (1) does not represent a *measurable* interrelation of space and time.

Special relativity is not based on physics or experimental facts but on the 'surreal' assumption that a single light source Q fixed to the origin O of an IF S produces a light flash $r= ct$ not only about the origin O of S but also light flashes $r'= ct'$ about the origins O' of all other conceivable IFs S' initially ($t= t'=0$) coincident with S. Einstein on space–time (1910) [1]: "*After reading Minkowski's paper, I do no longer feel that I understand my own theory*".

Abolishment of the Ether. In marketing the STR and its novel space–time concepts, Einstein characterized (i) the absoulte reference frame of Newton (absolute space) as a frame S^0 in "absolute rest" and (ii) the G–transformations $x'= x-ut,\ y'= y,\ z'= z,\ t'= t$ as approximate space–time transformations following from the "generally valid" L–transformations (1) in the limit $c\to\infty$. These misrepresentations can be found not only in most relativity texts but in uncountable journal publications, too. (i) Einstein's " absolute rest" is an irrelevant *metaphysical* concept, since the masses of the universe can not be at rest relative to a (nonexisting) reference point "outside" the universe. (ii) Einstein's limit $c\to\infty$ of the L–transformations (10) leads to a *physical* contradiction, since in G–covariant electrodynamics [23–26] the velocity of light is $c= 1/\sqrt{\mu_0\varepsilon_0}\approx 3\times10^8$ m/s $\neq\infty$.

For the latter reason, any space–time transformations, relativistic or absolute, which yield the G–transformations in the limit $c\to\infty$, are flawed in the physics. In the case of the L–transformations (10), the physical blunder is obvious. The L–transformations (10) imply both a contraction of the *entire* $\{x', y', z')$ space in the x'–direction and a dilation of the *entire* $\{t'\}$ space. The empty STR space $\{x', y', z'\}$ and the abstract time–space $\{t'\}$ can not be contracted respectively dilated.

Only a *material* body can be contracted or a *material* clock can be retarded, by moving them relative to something real, which provides a physical interaction, e.g. the ether of the vacuum. According to the L–transformations (10), contraction of a rod relative to the observer (**u**) means ' contraction of space' in the direction of **u**, and retardation of a clock relative to the observer (**u**) means ' dilation of time space' . This confusion of the *a priori* given concepts of (i) space and (ii) time with the (i) measured length of a rod and (ii) time interval recorded by means of a clock is an other basic misunderstanding in relativistic physics.

Einstein had to abolish the ether, since it (i) limits *isotropic* light propagation to the ether rest frame S^0 and (ii) causes anisotropic light propagation in all IFs $S\neq S^0$(contradictions to STR). Einstein did not succeed in his time to explain how EM fields can exist in an empty vacuum. Born (1964) attempted to explain the alleged nonexistence of the ether like this [19]: "*Elec-*

tric and magnetic stresses are not something in the ether, they are the ether!". This statement implies that EM wave fields are emitted into an empty vacuum (no ether) by the EM source, a concept (Ritz's ballistic theory of light) which is refuted by experiments (light propagation velocity is independent of the velocity of the light source).

According to Bell (1992) [20]: "*There is an other way of formulating Einstein's view. You can pretend that whatever inertial frame you have chosen is the ether of 19th century physics and in that frame you can confidently apply the ideas of Fitzgerald contraction, Larmor dilation, and Lorentz lag*". The ether can be at rest only in one IF $S^o(\mathbf{w}=0)$ and will stream with uniform velocities $\mathbf{w}\neq\mathbf{0}$ in all IFs $S(\mathbf{w})\neq S^o$. Bell's (i) suggestion that every IF S has its 'own ether' attached to S and (ii) implication that the vacuum is filled with an unlimited number of ethers (corresponding to all possible IFs) are untenable.

In 1904, Hasenoehrl derived the velocity of light $\mathbf{c}(\theta)=\mathbf{v}+\mathbf{c}^o(\theta^o)$ in an IF $S(\mathbf{w})$ moving with a velocity $\mathbf{v}=-\mathbf{w}$ relative to the ether (S^o), where θ is the angle between $\mathbf{c}$ and $\mathbf{v}$ [$c^o(\theta^o)=c$ by isotropic light propagation in S^o] in polar coordinates (c, θ, φ, with $\mathbf{v}$ in the direction $\theta=0$) as [21]:

$$c(\theta)=(c^2-\mathbf{v}^2\sin^2\theta)^{1/2}-|\mathbf{v}|\cos\theta,\quad 0\leqslant\theta\leqslant\pi,\ 0\leqslant\varphi\leqslant 2\pi \tag{11}$$

with $c(0,\pi)=c\mp|\mathbf{v}|$ and $c(\pi/2)=(c^2-\mathbf{v}^2)^{1/2}$. Accordingly, light propagates anisotropically with velocity $c(\theta)$ in all IFs $S\neq S^o$. The relativity principle of the constancy "$c(\theta)=c$" of the velocity of a light signal in all IFs S is physically untenable, even if c is interpreted as a 2–way velocity of light.

In 1905, Einstein postulated the principle of the invariance of the velocity c of light in the Ann. Physik [13]. In applications, however, he used a constant c in his "stationary frame" and violated the L–invariance of c in the "moving frame" by assuming there light velocities $c\pm v$! If Einstein had not discarded Hasenoehrl's $c(\theta)\neq c$ [(11) published in 1904 in the Ann. Physik, too], he could have recognized already in 1904 that he was on the wrong way.

Nonrelativity of Physical Velocities. The concepts from Maxwell to Hertz concerning the propagation of EM waves in the "luminiferous ether" of the vacuum have been vindicated through the experiments of Penzias & Wilson, which demonstrate on a cosmic scale that the space is filled with a uniform and isotropic (at large) 2.7 K microwave background [22]. Measurement of this background EM radiation (excitation of vacuum substratum) permits localization of a distinguished reference frame S^o in space as that frame in which the microwave flux is isotropic [22]. In all other IFs $S\neq S^o$, EM waves propagate *anisotropically* [22]. Alone these experimental facts refute the STR, which is based, inter alia, on the hypothesis of the physical equivalence of all IFs. From the measurement of the velocity of the Earth relative to the cosmic frame S^o the terrestrial ether velocity is obtained as $\mathbf{w}\sim 3\times10^5$ m/s.

Maxwell's equations are L–covariant, i.e. they are *not* form–invariant in G–transformations. Recognizing the physical importance of the distinguished IF S^o, in which light propagates isotropically, led Wilhelm to the discovery of G–covariant electrodynamics in 1983 [23, 24] for arbitrary IFs $S(\mathbf{w})$ which move with a velocity $\mathbf{u}=-\mathbf{w}$ relative to the substratum rest frame S^o. The G–covariant electrodynamic equations reduce for $\mathbf{w}=\mathbf{0}$ to the L–covariant Maxwell equations and, therefore contain all results of L–covariant electrodynamics and the STR in the special case $\mathbf{w}=\mathbf{0}$. G–covariant electrodynamics explains all known crucial optical and electrodynamic experiments as shown elsewhere [25].

The G–covariant EM wave equations permit calculation of the substratum effects ($\mathbf{w}$) on electrodynamic phenomena. Contraction of a moving rod is a real effect caused by the convective 'compression' of the electric equipotential surfaces of its electrons and nuclei in the direction of their motion $\mathbf{v}-\mathbf{w}=\mathbf{v}^{\mathrm{o}}$ relative to the substratum. Retardation of a moving atomic or light clock, using a light signal reflected forth and back between mirrors held apart by a rod, is a real effect caused by anisotropic light propagation between the mirrors and contraction of the supporting rod in the ether flow $\mathbf{w}$. Owing to the EM nature of mass, the momentum and kinetic energy of a charged particle moving with a velocity $\mathbf{v}^{\mathrm{o}}$ relative to S^{o} can be calculated by means of G–covariant electrodynamics. [26]

Thus, the length $l(\mathbf{v}^{\mathrm{o}})$ of a rod parallel to its absolute velocity $\mathbf{v}^{\mathrm{o}}=\mathbf{v}-\mathbf{w}$, the rate $\nu(\mathbf{v}^{\mathrm{o}})$ of a clock, the mass $m(\mathbf{v}^{\mathrm{o}})$, momentum $\mathbf{p}(\mathbf{v}^{\mathrm{o}})$, and kinetic energy $K(\mathbf{v}^{\mathrm{o}})$ of a particle, moving with a velocity $\mathbf{v}$ in an arbitrary IF $S(\mathbf{w})$, were found to be given by the G–invariants [26]:

$$l=l_0[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong l_0(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{12}$$

$$\nu=\nu_0[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong \nu_0(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{13}$$

$$m=m_0/[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong m_0/(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{14}$$

$$\mathbf{p}=m_0(\mathbf{v}-\mathbf{w})/[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong m_0\mathbf{v}/(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{15}$$

$$K=m_0c^2\{[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{-1/2}-1\}\cong m_0c^2[(1-\mathbf{v}^2/c^2)^{-1/2}-1],\quad \mathrm{v}\gg \mathrm{w} \tag{16}$$

$$T=T_0/[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong T_0/(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{17}$$

$$n=n_0/[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2}\cong n_0/(1-\mathbf{v}^2/c^2)^{1/2},\quad \mathrm{v}\gg \mathrm{w} \tag{18}$$

where l_0, ν_0, m_0 are the corresponding values when the rod, clock, or particle is at rest in the substratum frame S^{o}, $\mathbf{v}^{\mathrm{o}}=\mathbf{0}$, or $\mathbf{v}=\mathbf{w}$ in the observation frame S. Equations (12)–(18) are G–invariants since the respective system velocity $\mathbf{v}-\mathbf{w}=\mathbf{v}^{\mathrm{o}}$ is relative to the substratum. The derivation of the formula for the temperature $T(\mathbf{v}^{\mathrm{o}})$ of a body involves also statistical considerations, whereas the particle density $n(\mathbf{v}^{\mathrm{o}})$ $(=dN/dV)$ follows from (12).

The approximations of (12)–(18) for system velocities $\mathrm{v}\gg \mathrm{w}\sim 3\times 10^5$ m/s on the Earth are only quantitatively correct. They are not qualitatively correct since the approximation for v $\gg$ w changes the physical nature of (12)–(18): The exact formulas are G–invariant ($\mathbf{v}^{\mathrm{o}}$) or independent of the IF of observation $S(\mathbf{w})$, whereas the approximate formulas are relative to the observer ($\mathbf{v}$), i.e. depend on the respective IF of observation. Thus, although the STR formulas (functions of $\mathbf{v}$) are quantitatively about correct on the Earth, they are unsound in its qualitative variability (multivaluedness) with the velocity $\mathbf{v}$ relative to the observer.

It is important to recognize that the dynamical quantities (12)–(18) are G–invariants since they depend on the G–invariant velocity (difference) $\mathbf{v}-\mathbf{w}=\mathbf{v}^{\mathrm{o}}=$G–inv relative to the substratum frame S^{o}. For this reason, the STR paradoxes relative to the observer ($\mathbf{v}$) do not exist in G–covariant electrodynamics. The dynamic formulas (12)–(18) indicate that velocities of physical objects are not relative to the observer (**v**) but relative to the substratum or absolute space ($\mathbf{v}^o$). In other words, physical velocities are not relative to the observer as the STR asserts.

It was a fortunate circumstance for Einstein in 1905 that the ether velocity on the Earth is small compared to the velocity of light, $w \ll c$. For the latter reason, (12)–(18) reduce approximately to the corresponding relativistic formulas, as shown above for relativistic velocities $v \gg w$. If the ether velocity on the Earth were of the magnitude $w \sim c$, the multivalued STR would have been refuted by terrestrial experiments long time ago.

Lenard objected to the STR principle of the relativity of all velocities with an experiment described by Eddington [27]:" *A train is passing through a station at 60 miles an hour. Since velocity is relative, it does not matter whether we say that the train is moving at 60 miles an hour past the station or the station is moving at 60 miles an hour past the train. Now suppose, as sometimes happens in railway accidents, that this motion is brought to a standstill in a few seconds. There has been a change in velocity or acceleration —a term which includes deceleration. If acceleration is relative this may be described indifferently as an acceleration of the train (relative to the station) or an acceleration of the station (relative to the train). Why then it injure the persons in the train and not those in the station?*"

Eddington's answer [27]:" *The cause of injury in the railway accident is easily traced. Something hit the train; that is to say, the train was bombarded by a swarm of molecules and the bombardment spread all the way along it. The cause is evident —recognized by everyone, no matter what his frame of reference, as occuring in the train, not the station. Besides injuring the passengers this cause also produces the relative acceleration of the train and station—an effect which might equally well have been produced by molecular bombardment of the station, though in this case it was not.*"

It is obvious why Eddington is considered to be one of the greatest theoretical physicists of this century. By 1923 also his understanding of experimental physics reached a profoundness comparable to the depths of unlimited space and time [28]:" *Events before* $t = -\infty$ may produce consequences in the neighborhood of the observer and he might even see them happening through a powerful telescope". Eddington was instrumental in persuading English thinkers to abandon Newton's absolute space and time in favor of Einstein's space–time relativities.

Let us turn for an answer to the ultimum authority, Einstein [29]: " *It is certainly true that the observer in the railway carriage experiences a jerk forwards as a result of the application of the brake, and that he recognizes in this the non–uniformity of motion (retardation) of the carriage. But he is compelled by nobody to refer this jerk to a " real" acceleration (retardation) of the carriage. He might also interpret his experience thus: My body of reference (the carriage) remains permanently at rest. With reference to it, however, there exists (during the period of application of the brake) a gravitational field which is directed forwards and which is variable with respect to time. Under the influence of this field, the embankment together with the Earth moves nonuniformly in such a manner that their original velocity in the backwards direction is continuously reduced*".

Lenard's simple experiment is explainable by Newtonian dynamics in absolute space. Since the passengers in the train get hurt while those in the station remain unharmed, the velocity of the station can not be relative to the train. Hence, the velocity of the train is not relative to the station either. If one solves the collision problem in the frames of the train S or station S' with *relative* velocities one finds two contradicting solutions, which demonstrate mathematically the *nonrelativity* of the velocities of train and station. Unique solutions are obtained for the velocities and accelerations after the (inelastic) collision by means of the G–invariant conservation equations for the momenta (14) and energies (15) of the colliding bodies (train & station), which are relative to absolute space (S^o) [25].

NONEXISTENCE OF PARADOXES IN ABSOLUTE SPACE AND TIME. In his attempts at explaining the fallacies of the STR to distinguished representatives of the English science establishment, Dingle discovered his relativistic clock paradox, which has remained unrefuted to this date [30]. Absolute space and time physics shows that this and other paradoxes (to be discussed) are the creations of the multivalued logic hidden in the STR, i.e. do not exist in reality.

• **Dingle's Clock Paradox.** Consider two identical clocks, one is attached to an IF S and the other to an IF S'. By the STR, the rate of a clock moving with a velocity $\mathbf{v}$ relative to the observer is $\nu=\nu_0(1-v^2/c^2)^{1/2}$. Let S' move with velocity $+\mathbf{v}$ relative to S; then S moves with velocity $-\mathbf{v}$ relative to S'. Accordingly, the observer in S would see his S–clock run at the proper rate ν_0 and the clock in S' at the slower rate ν. Whereas the observer in S' would see his S'–clock run at the proper rate ν_0 and the clock in S at the slower rate ν. In view of these contradicting STR predictions, Dingle asked England's distinguished scholars to explain which of the two identical clocks runs faster (ν_0) and which slower (ν). He received no meaningful answer in his days [30].

According to Bridgman the clock paradox is not a physical but a legal matter [31]: "*The question whether the moving clock is really or only apparently slowed is as illegitimate as the question as to whether a moving meter stick is really shortened or not*".

Since the STR predicts similar formulas for the length $l=l_0(1-v^2/c^2)^{1/2}$ of a moving rod, the mass $m=m_0/(1-v^2/c^2)^{1/2}$ of a particle, the temperature $T=T_0(1-v^2/c^2)^{\pm 1/2}$ of a body, analogous contradictions exist for two identical rods, paraticle masses, and the temperatures of bodies observed in two different IFs S and S'.

At the beginning, I treated the ' paradoxes' which result when a body of temperature T_0 fixed to an IF S (so that the body velocity relative to S^o does not change) is simultaneously observed by $n=1, 2, 3,\cdots$ observers in IFs S^n moving with different velocities $-\mathbf{v}_n$ relative to S. For the rate of a clock, the length of a rod, and the mass of a particle, all at rest in an IF S, analogous ' paradoxes' result.

All these paradoxes relative to the observer ($\mathbf{v}$) are meaningless since physical velocities are relative to absolute space, $\mathbf{v}^o=\mathbf{v}-\mathbf{w}=$G–inv.

• **Simultaneity Paradox.** Let the events "1" at x_1 and "2" at x_2 be simultaneous in the IF S: $t_1=t_2$. By the inverse L–transformation of (10), these events are nonsimultaneous in all other IFs S' (moving with velocities $\mathbf{u}=u\hat{\mathbf{x}}$ relative to S): $t'_2-t'_1=-\gamma(x_2-x_1)u/c^2$. The relativisitic prediction $t'_2\neq t'_1$ in S' is an illusion produced by the nonphysical time–shift function $\Theta(x)=ux/c^2$ and the rescaling factor $\gamma=1/(1-\mathbf{u}^2/c^2)^{1/2}$.

The relativistic nonsimultaneity is unobservable in experiments, in accord with absolute space–time physics. By the G–invariance of time, two events that are simultaneous in an IF

S are simultaneous in all other IFs S', too: $t = t' =$ G–inv; hence $t'_1 = t'_2$ in S' if $t_1 = t_2$ in S.

• **Causality Violation.** In an IF S, consider an event at (x_1, t_1) which is the cause of an event at (x_2, t_2), i.e. in S: $t_1 < t_2$. By the inverse L–transformation of (10), the time–distance between these events is in all other IFs S' (moving with velocity $\mathbf{u} = u\hat{\mathbf{x}}$ *along the* x–axis of S): $t'_2 - t'_1 = \gamma(t_2 - t_1)\ (1 - uV/c^2) < 0$ for $V > (c/u)c$, where $V = (x_2 - x_1)/(t_2 - t_1)$. Hence, for an adequately superluminal action transfer speed V, the event (x'_2, t'_2) would occur earlier than its cause (x'_1, t'_1) in any IF $S' \neq S$. This unrealistic inversion of the sequence of cause and event is again created by the nonphysical time–shift $\Theta(x) = ux/c^2$ and the relativistic rescaling factor $\gamma = 1/(1 - \mathbf{u}^2/c^2)^{1/2}$.

Violation of causality has not been observed in experiments, in accord with absolute space and time physics. By the G–invariance of time, a cause (x_1, t_1), producing an event (x_2, t_2) in an IF S, occurs also in all other IFs $S' \neq S$ earlier than its consequence: $t = t' =$ G–inv, i.e. $t_2 - t_1 = t'_2 - t'_1$; hence $t'_2 > t'_1$ in S' if $t_2 > t_1$ in S.

The relativistic paradoxes discussed here (and many others) expose the follies of the STR. By G–covariant electrodynamics and absolute space and time physics, none of these paradoxes exist in the real world. In the relativity literature, such physical impossibilities are mystified as true paradoxes beyond the grasp of most human intellects.

The Technical Relevance of Special Relativity. The philosopher and member of the Swedish Academy of Sciences Harold Nordenson presented a devastating analysis of the logic of special relativity [10]. Being an industrialist, Nordenson also discovered a feature of the STR which has been overlooked by academics [10]: "*The relativity theory is not only fantastic, but also of an inconsequence unprecedented in the history of science*".

Since the STR is allegedly the relevant theory of space and time, one would expect that the bureaus of standards and space administrations of the technical nations would use the STR as the theoretical basis for the calibration of frequency and time standards and the time–transfer to, and time–keeping with, satellites or rockets on space missions to other planets, respectively. However, there is no indication in the literature that the relativistic space–time concepts were ever used for technical purposes. For such applications, e.g., navigation in space with the help of the global positioning system, the synchronization of clocks in laboratories, as well as the clocks of astronauts on space missions, are carried through under the assumption of an absolute, G–invariant time [5]. Clocks are synchronized, without difficulty, by means of radio waves, which permit time–equalization up to cosmic distances [5]. The radio waves generate a control picture on the screen of an oscillograph, which permits to observe and correct deviations of the rate of a distant clock with a relative accuracy of order 10^{-14}. The best Cesium frequency standards (based on atomic beam methods) realize the definition of a second with a relative uncertainty of 10^{-14} [34].

Since Einstein postulated the speed of light c to be a L–invariant, i.e. to be the same for all IFs, the speed of light c is a de facto *unit of velocity* in the STR. Since $c =$ Length / Time, one can not assume *independent* and *constant* length and time units within the frame of the STR. As follows from the L–transformations, the units of space and time are intermixed and *vary* with v^2/c^2 in the STR [5]. Thus, the STR demands that the use of constant time and length units has to be abandoned. For this reason alone, Einstein's revolutionary space–time concepts are not promising for applications, and have been ignored in realistic space and time measurements [5, 32]. *This is a compromise of the STR and L–covariant physics in general.*

In view of these artificial complications, it is not advisable to found practical space and time measurements on the STR and / or the GTR. For *distant* clock synchronizations and time–transfer procedures within absolute space and time, the G–invariant theories of clock retardation and EM Doppler effect apply [25]. The corresponding relativistic theories of these effects are approximations for $v \gg w$ on the Earth. These relativistic uncertainties would further affect (questionable) *relativistic* synchronization and time transfer technology with interrelated space and time, in particular in view of the high accuracy of Cesium clocks.

The grave consequences resulting from the physically untenable assumption of the *constancy* of the velocity c of a light signal for time–transfer and the establishment of independent and constant time and length units are obvious. Earlier, we explained that the L–transformations, with their numerous paradoxes, are the direct consequence of the principle of the L–invariance of the velocity of light. It is also embarrassing that the leading space–time theory (STR) has found no use in all other technical developments in the 20th century, such as mechanical systems, electrical, electronic, communication, or computer systems, astronautical systems, and even high–energy weapons systems.

The widespread opinion that Einstein was the first to predict, by means of the STR, in 1905 the equivalence of mass and energy, $E_0 = m_0 c^2$, which made him the ' father of the atomic bomb,' is without basis. Already in 1903, Abraham showed that $E(\mathbf{v}) = (3/4) m(\mathbf{v}) c^2$ for the EM energy and mass of a *moving* ($\mathbf{v}$) charged particle [32]. As explained by Planck in 1907 [2] and in more detail by Ives in 1952 [34], Einstein's derivation is defective and circular (he used $E_0 = m_0 c^2$ in an omitted step). The first valid and exact deduction of $E_0 = m_0 c^2$ (without 3 / 4 factor), using Poincaré's momentum of radiation **p**, was given by Planck in 1907 [2]. Einstein's invalid 1905 derivation, based on the STR formalism, provides no physical insight either.

Poincaré derived already in 1900 the momentum of radiation $p = S / c^2$ with $S = Ec$ as flux of radiation, from which he concluded in a numerical example that $m = E / c^2$ is the mass of radiation ($\mathbf{S} = \iiint \mathbf{E} \times \mathbf{H} d^3 r$) [35]. In 1904 and 1905 (months before Einstein), Hasenoehrl showed that the EM radiation energy E enclosed in a *moving* cavity has a mass $m = (8/3) E / c^2$ and $m = (4/3) E / c^2$, respectively (the unessential factors " 8 / 3" and " 4 / 3" were removed theoretically by Fermi [36]) [21, 37]. In the text, Hasenoehrl clearly recognizes the EM nature of mass, a concept which was later experimentally confirmed through electron–positron annihilation into two γ quanta, $e_+ + e_- = \gamma + \gamma$, which proves the equivalence of mass and EM energy: $m_\pm \cdot c^2 = h\nu$. This equivalence follows from other particle–antiparticle reactions, too.

In spite of these experimental facts, relativistic physics denies the EM origin of particle mass and asserts that $E_0 = m_0 c^2$ is the consequence of relativistic space–time. This physically meaningless assertion is readily disproved by means of G–invariant electrodynamics and absolute space and time, which yields for the G–invariant mass of a particle moving with a velocity $\mathbf{v}$ in an IF $S(\mathbf{w})$ [26]

$$m^2 (1 - \mathbf{v}^{o2} / c^2) = m_0^2, \quad \mathbf{v}^o = \mathbf{v} - \mathbf{w} = \text{G} - \text{inv} \tag{19}$$

Hence

$$\mathbf{v}^{o2}dm + m\mathbf{v}^{o} \cdot d\mathbf{v}^{o} = c^{2}dm \tag{20}$$

by differentiation. The kinetic energy $K(v^o)$ of the particle m is given by the work–integral,

$$K = \int_0^{v^o} [d(m\mathbf{v}^o)/dt^o] \cdot d\mathbf{s}^o = \int_0^{v^o} (\mathbf{v}^{o2}dm + m\mathbf{v}^o \cdot d\mathbf{v}^o) = c^2 \int_{m_0}^{m} dm,$$

$$d\mathbf{s}^o = \mathbf{v}^o dt^o \tag{21}$$

where $d\mathbf{s}^o$ is the G–invariant displacement of the particle in dt^o. Thus, one finds from the G–invariant concepts of mass and absolute space & time the fundamental G–invariant formulas for the kinetic energy $K = mc^2 - m_0c^2$ and mass–energy equivalence [26]:

$$K = m_0c^2/[1-(\mathbf{v}-\mathbf{w})^2/c^2]^{1/2} - E_0 = \text{G}-\text{inv}, \quad E_0 = m_0c^2 \tag{22}$$

The corresponding relativistic equation, which depends on the particle velocity $\mathbf{v}$ relative to the observer, leads to the mentioned 'paradoxes' and, therefore, is untenable.

Although Einstein appears to have known Hasenoehrl's *earlier* papers on the anisotropy of light propagation in IFs $S \neq S^o$ of 1904 [21] and the equivalence of EM radiation energy and mass [21, 37], Einstein ignored Hasenoehrl's original contributions throughout his life. As to the application of his mass–energy relation $K_0 - K_1 = \frac{1}{2}Lv^2/c^2$ [38], from which one can conclude that $L = mc^2$(not stated), Einstein made only the vague suggestion [38]: "*it is not impossible that with bodies whose energy content is variable to a high degree (e.g. with radium salts) the theory may be successfully put to the test*".

Already in 1904, Soddy demonstrated clear understanding of $E = mc^2$ in his treatise on radioactivity [39]: "*It is not to be expected that the law of conservation of mass will hold true for radio–active phenomena. —Since during disintegration electrons are expelled very near to that of light, which, after expulsion, experience resistance and suffer dimimution of velocity, the total mass must be less after disintegration than before. On this view atomic mass must be regarded as a function of the internal energy, and the dissipation of the latter in radio–activity occurs at the expense, to some extent at least, of the mass of the system*".

For the above facts, the main contributions to $E = mc^2$ and its physical understanding are not due to the STR or Einstein. In particular, he did not foresee the immense energy releases in fission (Hahn & Strassmann, 1939) and fusion (Bethe 1940) reactions, or in nuclear weapons (Fluegge, 1942). The STR indeed has been of an inconsequence unprecedented in the history of science [10].

Ultimately, G–invariant electrodynamics and all derived formulas follow from the existence of a substratum (ether) in the vacuum, which is the carrier of all known force interactions. From the wave equations of a highly incompressible, superfluid substratum (assumed to consist of etherons with positive and negative gravitational masses) result the EM wave and field equations for the substratum frame $S^o(\mathbf{r}^o, t^o, 0)$, presumed the Heaviside identification for the EM fields is used: $\mathbf{B}^o = \alpha\rho\tilde{\mathbf{v}}$, $\mathbf{E}^o = (\beta/\varepsilon_0)\tilde{\boldsymbol{\varphi}}$, where $\tilde{\mathbf{v}}(\mathbf{r}^o, t^o)$ and $\tilde{\boldsymbol{\varphi}}(\mathbf{r}^o, t^o)$ are the velocity and rotation field perturbations in the substratum [40]. The constants are related to the inertial mass density ρ and the permeability μ_0 of the substratum: $\alpha = (\mu_0/\rho)^{1/2}$, $\beta = 2(\rho/\mu_0)^{1/2}$, and $G = \rho c^2$ (shear module of substratum).

Owing to the incompressibility of the substratum, $\nabla \cdot \tilde{\mathbf{v}} = 0$, the G–invariant magnetic induction satisfies $\nabla \cdot \mathbf{B} = 0$. The Heaviside identification can be experimentally confirmed through magnetic flux compression [41]. For compression by a cylindrical copper liner with a radius decreasing rapidly by implosion, $R(t) \to 0$, the axial substratum velocity field is at time t: $\tilde{\mathbf{v}}(t) = \tilde{\mathbf{v}}(0)R(0)^2 / R(t)^2 \gg \tilde{\mathbf{v}}(0)$ for $R(t) \ll R(0)$ [40].

Recently, the Larmor–Thomson ether theory has been rediscovered, with wrong EM field identification and other physical mistakes, and *marketed* under the misleading name " Planck ether theory". It would be erroneous to infer from this failed attempt that ether physics does not work. Quite on the contrary, not only Maxwell's equations in S^0, but also the equations of quantum mechanics and gravitation in S^0 can be deduced from a superfluid 2–component ether model [40].

This Collection contains contributions which (1) deal with electrodynamic and gravitational fields in absolute space (Euclidian) and time and (2) justify and / or generalize Einstein's special and general relativities. The former papers (1) demonstrate that the socalled ' relativistic' (STR & GTR) problems can be solved in general with much less expenditure within the frame of absolute space and time using understanding of physics in the classical sense. The solutions in absolute space and time consider a preferred IF S^0 and are, therefore, more general than the corresponding relativistic solutions which are based on the equivalence of all IFs. On the other hand, the latter papers (2) deal with (i) attempts at justifying the kinematics of the STR, (ii) adapting the STR to realistic physical spaces and particle models, and (iii) applications of the STR and GTR. A generalization of the STR to the new realities (preferred cosmic reference frame, anisotropic light propagation in vacuum) has not been accomplished, and appears to be impossible without giving up the principle of relativity.

The Geometrization of Gravitation in Curved Space–Time

During the establishment of the STR and GTR, the French referred to these theories as " *la physique géomètrique des Allemands*". This qualification was not appreciated by most German scientists (with the eventual exception of Planck, Born, von Laue, Minkowski, Heisenberg, Pauli, and German relativity teachers) nor by Einstein, the originator of the geometrization of physics [1].

Einstein's GTR (i) " *is one of the greatest examples of the power of speculative thought*" according to Weyl [42] and (ii) " *was probably the greatest scientific discovery that was ever made*" according to Dirac [42]. It is the merit of Chandrasekhar to have demonstrated that to this date no convincing *physical* foundations exist for the GTR [42]:" ··· *a mixture of physical reasonableness, mathematical simplicity, and aesthetic sensibility lead one, more or less uniquely, to Einstein's field equations*".

The essential *hypothesis* of the GTR asserts that in the presence of masses (gravitational fields) space–time is a quasi–Riemannian manyfold with a metric tensor $g_{\alpha\beta}$ given by (3). The time track of a *free* particle in Euclidian space is given by the variational equations $\delta u^\alpha = 0$ where $\alpha = 1, 2, 3, 4$ and $u^\alpha = dx^\alpha / ds$ is the 4–vector tangential to its track (a straight line in

Minkowski space, corresponding to a uniform motion in ordinary space). The particle motion in a curvilinear or quasi–Riemannian space is given by covariant differentials, i.e. $du^\alpha + \Gamma^\alpha_{\beta\gamma} u^\beta dx^\gamma = 0$ of $u^\alpha = dx^\alpha / ds$, $\alpha = 1, 2, 3, 4$. Thus, one finds the basic differential equations for the world–line of a particle in quasi–Riemannian or curved 4–dimensional space [43]:

$$d^2 x^\alpha / ds^2 + \Gamma^\alpha_{\beta\gamma} (dx^\beta / ds)(dx^\gamma / ds) = 0 \tag{23}$$

where

$$\Gamma^\alpha_{\beta\gamma} = g^{\alpha\nu} \Gamma_{\nu,\beta\gamma} = \frac{1}{2} g^{\alpha\nu} (\partial g_{\nu\beta} / \partial x^\gamma + \partial g_{\nu\gamma} / \partial x^\beta - \partial g_{\beta\gamma} / \partial x^\nu) \tag{24}$$

are the Christoffel symbols (=0 in rectilinear systems, $g_{\alpha\beta}$=constants). Equation (23) permits evaluation of the *geodesic* line of particle motion in *curved* space–time. It is seen that the coefficients $\Gamma_{\beta\gamma}$ determine the *intensity* of the force field in the world–line equation (23).

Next, the metric tensor $g_{\alpha\beta}$ is to be determined in such a way that the resulting curvature of space–time corresponds to the moving matter present. By differential geometry, the Riemannian curvature tensor is given by [43]

$$R^\alpha_{\beta\gamma\nu} = \partial \Gamma^\alpha_{\beta\nu} / \partial x^\gamma - \partial \Gamma^\alpha_{\beta\gamma} / \partial x^\nu + \Gamma^\kappa_{\beta\nu} \Gamma^\alpha_{\kappa\gamma} - \Gamma^\kappa_{\beta\gamma} \Gamma^\alpha_{\kappa\nu} \tag{25}$$

As expected, the curvature tensor (25) is formed exclusively from the first and second derivatives of the elements $g_{\alpha\beta}$ of the metric tensor [see (24)].

The energy momentum tensor $T_{\alpha\beta}$ of matter (dimension of an energy density), e.g., for an ideal fluid (energy density $\alpha \sim \rho_0 c^2$, pressure p) or EM continuum with field tensor $F_{\alpha\beta} = \Phi_{\beta;\alpha} - \Phi_{\alpha;\beta}$ (convariant derivatives), is in curvilinear coordinates with metric $g_{\alpha\beta}$

$$T_{\alpha\beta} = (\alpha + p) u_\alpha u_\beta + p g_{\alpha\beta}, \quad u_\alpha = dx_\alpha / ds \tag{26}$$

$$T_{\alpha\beta} = \varepsilon_0 c^2 [F_{\alpha\mu} F^\mu_\beta - \frac{1}{4} g_{\alpha\beta} (F_{\mu\nu} F^{\mu\nu})], \quad F_{\alpha\beta} = \partial \Phi_\beta / \partial x^\alpha - \partial \Phi_\alpha / \partial x^\beta \tag{27}$$

where $\Phi = (\mathbf{A}, \varphi / c)$ is the EM 4–potential ($\mathbf{A}$ = vector potential, φ = scalar potential). $R^\alpha_{\beta\gamma\nu}$ is a (mixed) tensor of rank 4 and the energy–momentum tensor $T_{\alpha\beta}$ is of rank 2, satisfying the covariant (energy & momentum) conservation equations $T^\alpha_{\beta;\alpha} = 0$. Hence, one can not (as Einstein) propose $T_{\beta\nu}$ to be proportional to the truncated curvature of Ricci tensor with covariant derivatives $R^\alpha_{\beta;\alpha} \neq 0$ [43],

$$R_{\beta\nu} = R^\alpha_{\beta\alpha\nu} = \partial \Gamma^\alpha_{\beta\nu} / \partial x^\alpha - \partial \Gamma^\alpha_{\beta\alpha} / \partial x^\nu + \Gamma^\kappa_{\beta\nu} \Gamma^\alpha_{\kappa\alpha} - \Gamma^\kappa_{\beta\alpha} \Gamma^\alpha_{\kappa\nu} \tag{28}$$

whence

$$R = g^{\beta\nu} R_{\beta\nu} \tag{29}$$

follows as scalar curvature (invariant). Hilbert showed by means of the Bianchi identities that the modified tensor $G_{\alpha\beta}$ satisfies all requirements [44]:

$$G_{\alpha\beta} = R_{\alpha\beta} - \frac{1}{2} g_{\alpha\beta} R, \quad G^\alpha_{\beta;\alpha} = 0 \tag{30}$$

Thus, Hilbert derived the field equations of gravitation in the form of a *proportionality* between energy–momentum (matter) tensor and a curvature tensor (geometry of the quasi Riemannian space–time on 20 November 1915 [44]:

$$R_{\alpha\beta} - \frac{1}{2} g_{\alpha\beta} R = \kappa T_{\alpha\beta}, \quad \kappa = 8\pi K / c^4 \tag{31}$$

or

$$R_{\alpha\beta} = \kappa (T_{\alpha\beta} - \frac{1}{2} g_{\alpha\beta} T) \tag{32}$$

since $-R = \kappa T = \kappa T^\alpha_\alpha$ by contraction of (31). The constant κ is obtained by comparison of the lowest approximation of (32), $R_{44} \approx (1/2)\kappa T_{44} \approx (1/2)\kappa \cdot \rho_0 c^2$, with the Newtonian field equation of gravitation, $\nabla^2 \Phi = 4\pi K \rho_0$ (K = gravitation constant) [45].

By (31) or (32), there are 10 equations for the ten metric elements $g_{\alpha\beta}$. Since $T^\alpha_{\beta;\alpha} = 0$, four of the equations are identities. Accordingly, four of the elements of $g_{\alpha\beta}$ can be chosen arbitrarily as functions of the x_μ.

On 25 November 1915, Einstein proposed (32), by adding to his previous, incomplete field equations the missing term $-(1/2)\kappa g_{\alpha\beta} T$ [45]. In the relativity literature, the fact that Hilbert was the first to correctly derive the gravitational field equations is suppressed (for details, see the investigation by Mehra [46]).

Based on the derivation of the gravitational field equations, we note the following restrictions and problem areas:

(a) The GTR holds only for source particles and / or test particles with velocity independent mass. This is a questionable restriction for many cosmological applications, as well as *perturbation* effects due to the velocity dependence of mass (see, e.g., Bagge's classical explanation of the advance of the perihelion of Mercury [47]).

(b) Physically, it is not clear why the space–time of the GTR should be Riemannian. According to Chandrasekhar [42], " *the answer is that it is the ' most natural assumption' one can make*".

(c) The speed c of EM waves in vacuum occurs in the general coordinate $x^4 = ct$ of Riemannian geometry (2)–(3) and in Einstein's proportionality constant κ of (31). By (31), gravitational waves propagate with the speed c of light [43]. Since gravity fields (acting on masses) are physically not EM fields (acting on charges and magnetic dipoles), it would be an unprecedented accident of nature if gravity waves propagated with the speed of light c, — like EM waves.

(d) Although real bodies are deformed in the force fields of other masses, it is physically inconceivable that 4–dimensional space–time can be curved by masses. After all, 4–dimensional space–time is a fictitious, mathematical manyfold and is, therefore, not measurable, observable, or curvable in a physical sense.

(e) On the right side of the gravitation equations (31) is a physical energy–momentum tensor $T_{\alpha\beta}$, whereas the left side is a curvature tensor $G_{\alpha\beta}$ of a fictitious 4–dimensional space–time. If ' 4–dimensional geometry' is a form of ' material reality', then ' material reality' must be a form of ' 4–dimensional geometry' . This equivalence appears to be physically untenable.

(f) The GTR is based on the principle of the physical equivalence of " acceleration fields

a(t)" and " homogeneous gravitation fields **g**(t)". In experiments, the former are readily generated, whereas the spatial homogeneity of the latter can be generated only *approximately* within a small region of space. Hence, the equivalence principle appears to be unrealizable in general. It breaks down completely for negative masses.

(g) An acceleration field **a**(t) can be applied to a point of a body by means of any contact force. However, it is experimentally impossible to model such a time–dependent *contact* field through a gravitational ' contact' field, which is a source field and necessarily extends over all space. In the GTR, the incompatibility in the physical nature of acceleration and gravitational fields appears to have been overlooked.

(h) The most crucial theoretical discoveries on the GTR are due to Penrose (1965) and Hawking (1967), who showed that the functions $g_{\alpha\beta}(x^{\mu})$ in the gravitational field equations, when applied to large and very dense cosmic systems, exhibit properties which are totally incompatible with their definitions as metric elements of curved space–time [48]. This breakdown of the Hilbert–Einstein theory occurs in strong (but not unrealistic) gravitational fields, for which the solutions $g_{\alpha\beta}(x^{\mu})$ become unphysical and the notions of space and time lose all physical meaning. Thus, the work of Penrose and Hawking demonstrates that the *nonlinear* Hilbert–Einstein theory becomes worthless in the case of very strong gravitational fields.

In summary, the geometrization of gravitation shows the powers of creative imagination and tensorial differential geometry (in the fictitious 4–dimensional curved space–time), but it does not reveal the power of physical understanding.

According to Einstein [49]:" *The pretension of general covariance [GTR] in the transition from one system to an other takes away the last trace of physical objectification from space and time*". E. g., the following observations allegedly hold for one and the same event: " *The world rests, the train is decelerated*". ⇄" *The train rests, the world is decelerated*". These conclusions from the GTR by Einstein indicate a confusion of the kinematics (appearances) with the dynamics (reality) of systems. In this respect, the GTR is a successful extension of the STR to accelerated or gravitating systems.

Einstein's fascinations with the STR and GTR appear to be founded on his philosophy of science [49]: " *Experience justifies us to believe that nature is the realization of the most simple mathematical ideas*". The alternative view of Alfvén [50]:" *The general theory of relativity is more dangerous because it came into the hands of mathematicians and cosmologists. They looked down on the experimental physicist whose only job was to confirm the highbrow conclusions they had reached, and those who were not able to confirm them were thought to be incompetent*".

Einstein considered the confirmation of the GTR through (i) the advance of the perihelion of Mercury (APM), (ii) the deflection of light rays (DLR) from a star passing by the Sun and measured on the Earth, and (iii) the frequency change $\Delta\nu = \nu_2 - \nu_1 \approx -\nu_1(\Phi_2 - \Phi_1)/c^2$ of photons in the gravitational potential field $\Phi(\mathbf{r})$ as crucial. In this connection, it should be noted that a theory can only be refuted but not proven by experiments. In particular, Einstein claimed that only the GTR can explain these experiments. The historical facts disprove this:

(i) A classical theory of the APM was first given in 1889 by Gerber using a *retarded* gravitational interaction potential between Mercury and Sun, which is in full agreement with the observed $\Delta\theta / 100a$ of the APM [51]. Using the experimental value for $\Delta\theta$, Gerber calculated the velocity of light as $c=3.055\times10^8$ m / s by means of his formula. Einstein derived, by means of suitable *approximations*, a formula for $\Delta\theta$ which is *identical* with that of Gerber, from his gravitational field equations in 1915 [52].

Using a classical Lagrange function for Mercury, Bagge showed in 1981 that the APM is a perturbation effect due to the *minimal* dependence of the inertial and gravitational mass of Mercury on its *absolute velocity* about the Sun [47]. Thus, the APM can be explained through the velocity dependence of mass, which the GTR *completely neglects* through the equivalence principle. Finally, Potjekhin obtained the Gerber–Einstein formula for the APM from the field equations for Heaviside's gravitational source and vortex $\boldsymbol{H}, \boldsymbol{G}$ fields in Euclidian space [53].

(ii) By means of classical dynamics in the Sun's gravitational field, von Soldner derived for the first time the DLR in 1801 and 1804 [54]. The same result was rediscovered in 1911 by Einstein using the equivalence principle and an Euclidean metric [55]. Then in 1916, Flamm [56] using the GTR equation (24) and Einstein [52] using Fermat's principle and an approximate Riemannian metric (2) derived an angle for the DLR exactly *twice* as large as that originally found by von Soldner. Based on the concept of the polarization of the electron–positron vacuum by gravitational fields, Bagge calculated a dielectric constant for the gravity perturbed vacuum and explained the DLR by the Sun as *classical EM wave refraction* in 1981 [57].

The integrity of the confirmation of Einstein's DRL theory by Eddington is questioned widely by plasma spectroscopists since the data were manipulated by ' averaging' . Whether the strange factor ' 2' in the GTR theory exists or is due to the curvature of space–time is an open question.

(iii) Einstein found the gravitational shift via Fermat's principle in 1911 as quoted earlier [55]. The same formula for Δv readily follows (without GTR) from energy conservation: $h\nu_1+(h\nu_1/c^2)\Phi_1=h\nu_2+(h\nu_2/c^2)\Phi_2$, or $\Delta\nu\approx-\nu(\Phi_2-\Phi_1)/c^2$ where $\nu=(\nu_1+\nu_2)/2$. The experimental confirmation of Einstein's gravitational redshift theory is inconclusive due to nonideal effects and measuring uncertainties, in particular in regions of space filled with dense gases or plasmas [58].

In summary, it is noted that Einstein's crucial tests of the GTR and curved space–time are not convincing. The classical derivations are simpler and explain the experiments *physically*. In particular, the question has to be asked whether the agreements of the GTR with experiments is due to suitable approximations. The continued claims that only the GTR can explain the crucial experiments appears to indicate that contemporary relativists do not take the truth very seriously.

Leon Brillouin criticized the GTR alone for its artificial, mathematical difficulties [59]: " *Einstein introduced a very heavy mathematical structure [curved space–time] that goes beyond any physical need*" . As first proposed by Heaviside [60], and later by Carstiou [61], and Potjekhin [53], gravitation can be understood *in Euclidian* space through 4 partial differential equations similar to those of Maxwell, in which the gravity sources due to the mass equivalent of the gravitational field energy in space occur as nonlinear terms. The latter approach as well as approximations of the GTR to quasi–Euclidian Minkowski space are promising for applications as shown in papers of this Collection.

RELATIVISM IN PHYSICS AND CULTURE

Already before 1905, the perils of relativism for Western Civilization were predicted by Friedrich Nietzsche and Oswald Spengler. According to relativism, there is no TRUTH, but rather a multitude of truths, corresponding to the multitude of frameworks within which human beings like to conduct their lives and relations with others. The unlimited relativism, achieved through the liberalism in ' free societies' , has led under the guidance of the *international* entertainment and opinion–forming media ' cultures' to a ' reevaluation of all values' and an unprecedented moral decay during the second half of this century in the big cities of the New Abendland, with the Old Abendland lagging behind this ' progress' by some years. The values and standards of the preceding centuries are gradually being given up in exchange for the pleasures, relativism, and decadence of ancient Sodom and Gomorrah. The Creator and the Absolute are being abandoned by the ' educated' masses in favor of the Golden Calf and the Absurd —

According to Einstein's relativities, there is no unique physical reality but a multitude of physical realities, a different physical reality for every observer. The universe is believed to assume simultaneously different physical states during a common observation period by different observers. We recognize that relativism in physics is, in principle, similar to the relativism in the behavior of ' modern' men. In ' modern' physics, understanding of physics and nature has been reduced to the meaningless phrase ' space–time' by artificially rendering the laws of physics Lorentz–invariant. As the relativity theories began to prosper since about 1930 (in Germany after 1945; in the Soviet Union after 1953), an unprecedented infertility and decline in basic and theoretical physics set in, which is becoming more and more obvious in the last days of this unusual century.

As the L–invariant Dirac equation predicts an electron–postitron vacuum with infinite charge, mass, and energy densities, the contradiction with the STR was nullified by declaring the Dirac ether (defining a preferred IF) to be ' virtual' . In order to avoid ultraviolet blowups of the zero–point radiation of the vacuum, it became customary to cut off its spectrum at an upper frequency $\omega_0 < \infty$, so that again L–invariance is violated and a preferred IF is introduced contradiciting the STR. Elementary particles are postulated to be *point–particles* in order to avoid relativistic causality violation. The divergencies in quantum electrodynamics, due to L–invariance and unsound *physical* assumptions, have been ' resolved' with the help of *mathematical* renormalization tricks. In the National Laboratories, huge Einstein posters discourage physicists from questioning the sanctified relativities, with the quotation:" *Great spirits have always encountered opposition from mediocre minds*" .

As the cosmic 2.7 K microwave background, discovered by Regener (1930) and on a cosmic scale by Penzias & Wilson (1965), proves the existence of a distinguished IF for the entire universe, ' Neolorentzians' appeared on the stage of modern physics to ' save' space–time and STR. Prokhovnik, using ideas of the late Builder and Janossy, announced the impossible (based on his ' research') in a text with the strange title, " The Logic of Special Relativity" : The preferred cosmic frame and anisotropic light propagation *physically* explain and justify special relativity ! In spite of coverups and mathematical swindles, the eternal ether condemned to death in 1905 ever since raised its head in victory everywhere in L–covariant physics [1,62].

More and more complicated formalisms are being developed in L–covariant physics and general relativity, by relying on mathematics and ' space–time' (flat or curved) as the essence of physics. The special and general relativities are happily mixed with (incompatible) absolute space and time concepts, whenever this becomes necessary to avoid obvious embarrassment. As the ether and absolute space and time more and more infiltrate L–covariant physics under the pressure from experiments, the latter will go through a hybrid Lorentzian–Galilean stage and finally enter the terminal phase of selfdestruction in *pure* absolute space and time. It is improbable that L–covariant physics and relativistic space–time will survive, with or without ' fabric' . Physics can not be *manipulated* by relativistic theories forever, since technology will continue to be firmly based on experiments and absolute space and time.

The ether is omnipresent in the deficiencies of L–covariant theories, is illusive in many measurements since $w \ll c$ on the Earth. But you can feel the incompressible ether flow ($\mathbf{B} \propto \tilde{\mathbf{v}}$) by playing with magnets in N–N (repulsion by ether jets) or N–S (attraction by reduced ether pressure perturbation in gap between poles) positions. When a ' red' cup (IF S') moving with uniform velocity collides with a ' green' cup (IF S) fixed to a table S (both cups filled with water), the water always spills over in the direction from the ' red' to the ' green' cup, no matter whether the experiment is observed from S or S'. If the STR were right, then the water would have to be spilled always from the ' moving' cup to the ' resting' cup, in the IF S or S'. The masses of the universe define a preferred IF as known since Newton. How could such simple physical facts be misunderstood by the greatest thinkers of our times ?

EM, gravitational, and matter waves are excitations in the ether, in the same sense as shear and acoustic waves are excitations of a gas, fluid, or solid. Elementary particles, such as electrons, protons, neutrons, etc are defects in the ether and have finite lifetimes, similar to the finite lifetimes of defects in ordinary solids. The ether is the missing physics, which permits unification of electromagnetic, gravitational, and quantum phenomena as different excitations of one new state of matter. The ether is probably a superconducting condensate of etherons having positive and negative electric and gravitational charges. Once the unphysical concepts of real (measurable) fields in empty vacuum and relativistic space–time are overcome, theoretical physics will have again a future in the vacuum substratum of absolute space and time.

A final word from Gamow on 18 April 1955 at the deathbed of Einstein:" *Now he is certainly in heaven and will know whether he was right or wrong with his trial at subordinating physics to geometry*" .

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