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Breaking a Dogma in Physics: Euclidean Relativity Outperforms Einstein's Relativity

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Abstract: Today's concepts of space and time trace back to Albert Einstein's theories of relativity. In special relativity, he derives relations of how a "moving observer" experiences space and time with respect to an "observer at rest". In general relativity, he derives relations of how mass and energy are affecting space and time. Both theories have been very successful, but fail to solve fundamental mysteries such as competing values of the Hubble constant, dark energy, the wave–particle duality, and quantum entanglement. Here we show that this failure is due to prioritizing a primary observer: Einstein's relations are valid only for a "system at rest" or a momentarily comoving reference frame. There is no superordinate reference frame in which all observers ("at rest" and moving) are treated alike. In what we call "Euclidean relativity", we replace Minkowski spacetime (MS) with Euclidean spacetime (ES). We claim that an observer's reality is formed by projecting ES to 3D space. The major benefit is: ES is a superordinate frame which is not limited to individual observers. It even gives us a Theory of Everything. Matching the symmetry simplifies physics! Alternative models of Euclidean relativity run into paradoxes as they claim reality to be in ES. Our theory profits from two concepts: "distance" (space and time in one) and "wavematter" (electromagnetic wave packet and matter in one). Time is a subordinate quantity: covered distance divided by the speed of light. Wavematter is a generalized concept of energy: Waves and particles are the same thing (energy), but seen from two perspectives. Length contraction, time dilation, acceleration, and gravitation are geometric effects.

Keywords: Euclidean relativity; Euclidean spacetime; Hubble constant; wave–particle duality; quantum entanglement; Theory of Everything

1. Introduction

Here we report on new concepts of time and energy, how they give birth to a Theory of Everything, and how they solve 16 mysteries of physics. Today's concepts of space and time are based on Albert Einstein's theory of special relativity (SR) [1], which is usually taught in Minkowski spacetime (MS). Hermann Minkowski's geometric interpretation [2] became an integral part of SR as it was very successful in explaining relativistic effects. SR is limited to inertial reference frames. In general relativity (GR) [3], gravitation is included, and flat MS turns into a curved spacetime with a pseudo-Riemannian metric. Even in GR, MS is a good approximation in infinitesimal regions surrounding any point.

Einstein's SR and GR have proven reliable concepts for describing the world that we perceive on and from Earth. Explaining the lifetime of muons [4], predicting the deflection of starlight during a solar eclipse [5], and the high accuracy of GPS systems are just a few examples. Quantum field theory [6] unifies classical field theory, SR, and quantum mechanics, but GR is excluded. In GR, matter is localized, and forces act globally. In quantum mechanics, matter is a wave function distributed in space, and forces act locally.

Our theory confirms relativity and quantum mechanics as the two pillars of physics, but we do question the ground on which they stand: today's concepts of time and energy. We must stress this point because our theory [7] was already peer-reviewed once, and the outcome was disturbing: We wouldn't know anything about physics. The review reports disclosed that most reviewers made a severe mistake: *They took today's concepts of time and energy for granted while evaluating our theory.* Mankind would still believe in the geocentric model if there hadn't been scientists who were able to empathize with new ideas. We often

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feel like a Kopernikus in modern times, but our opponent isn't the church—it is science: SR and GR have turned into a dogma that must not be questioned. Interestingly enough, no reviewer gave examples where our theory would contradict our own concepts. If you oppose our theory, please go ahead and search for such a contradiction.

Five journals rejected our manuscript at the editor's desk because of "missing significance" or "no scholarly research". The editor of a top journal argued we wouldn't provide extraordinary proof for our extraordinary claims. *Isn't solving 16 top mysteries extraordinary proof?* Another editor argued we would address "too many topics in physics". *Well, breaking a dogma usually comes along with a sudden and broad understanding.* Most physicists seem to be comfortable with SR and GR in the sense of "never change a winning team". Editors and reviewers might fear about their reputation or their journal's reputation. We request Occam's razor to be applied. Our theory is more powerful than SR and GR while making less assumptions: Dark energy and non-locality become redundant concepts.

We kindly ask all readers including editors and reviewers: Do not take SR and GR for granted while reading this report! If you do, you won't understand. We have revised our reasoning and now start off in Sect. 2 with a stunning proof: Einstein's concept of time is limited. We are aware that our discovery will upset colleagues. It will do so particularly if they have spent years in investigating concepts like dark energy that now become obsolete. While we have empathy with them, we wish to make clear that science must always question its concepts. If new concepts prove to be more powerful, we better get used to them.

Immanuel Kant [8] provided the philosophical framework of classical physics. Find out for yourself whether our theory could be the philosophical framework of cosmology and quantum mechanics. 16 fundamental mysteries can all be solved, but not by flipping a switch. Improving physics requires that we let go of some basic concepts. Here are our two main concerns regarding today's physics: (1) In SR and locally in GR, there is assumed to be a "system at rest". *This assumption makes GR incompatible with quantum mechanics because there is nothing at rest at the microscopic level.* (2) In SR and GR, space and time are two concepts despite the insight that the spacetime interval is locally an invariant. Thinking of space and time as two, and not one, cleared the way for accepting an asymmetry that most of us aren't even aware of: There is supposed to be accelerated expansion of space, while time is running uniformly. *How could there be such an asymmetry in one spacetime?*

Illustrations like Fig. 1 have been released to show the timeline of the universe. This artwork is supposed to show inflation [9] and expansion [10] of space after the Big Bang, but it is neither in line with GR nor does it make sense: Fig. 1 suggests that an observer is able to see space from outside of space. *How could someone be outside of space?*

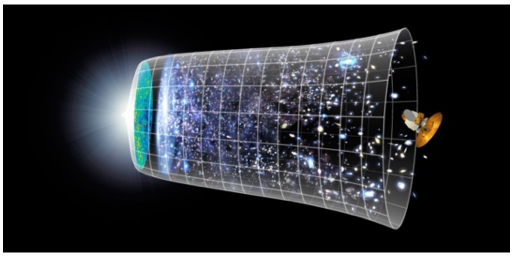

Figure 1. Timeline of the universe in today's model of cosmology. Artwork illustrating the Big Bang (left), time (horizontal grid), and space (circular grid). Credit: NASA/WMAP.

In Sect. 3, we will introduce Euclidean spacetime (ES), which is based on a Euclidean metric. We ground our theory "Euclidean relativity" on three postulates: *(1) The equations describing the laws of physics have the same form in all 3D space reference frames. (2) In ES, the speed of light is both absolute and universal. (3) In ES, all energy is "wavematter" (electromagnetic wave packet and matter in one).* Our first postulate is the same as in SR, except that Euclidean relativity isn't limited to inertial frames and that physical reality is an observer's 3D space. Our second postulate is stronger than in SR. Everything is moving through ES at the speed of light. Our third postulate generalizes Einstein's mass–energy equivalence.

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Some people claim that everything would move *through MS* at the speed of light [11]. They multiply the dimension of time t by the speed of light c to match the unit of space. Moving through MS at the speed of light is a pointless concept: An "object at rest" would move in time at the trivial speed "one second per one second".

Our theory must not be confused with the Hypergeometrical Universe Theory (HU theory) [12], which never passed the peer-review process. There are two huge differences: (1) HU theory claims four spatial dimensions and thus fails to solve geometric paradoxes like the ones that we discuss in Fig. 6. In our initial model [13], we struggled with the same issue until we surrendered the idea of four spatial dimensions. *Only by merging space and time into one concept "distance" do we succeed in outperforming SR and GR.* (2) In HU theory, matter is made from deformed space. *We claim that space is non-deformable.*

There are alternative models of Euclidean relativity: [14] introduces ES, but conceives of our "wavematter" as a "character paradox". [15] correctly takes proper time of an object as its fourth coordinate. [16] extrapolates ES to GR, but sticks to four spatial dimensions. [17] identifies Lorentz transformations as rotations in ES, but holds on to time as a primary quantity. [18] investigates velocity and momentum in ES. [19] adds a boundedness postulate in the fourth dimension. Yet all these alternative models claim reality to be in ES. In none of them is reality formed by projecting ES to 3D space. And so, like the HU theory, they all run into geometric paradoxes that we discuss in Fig. 6.

Before we go into the details, it is helpful to bring our theory into line with Newton's physics and Einstein's physics. In Newton's physics, all objects are moving through non-deformable 3D space *as a function of independent time.* The speed of matter is $v_{3D} \ll c$. In Einstein's physics, all objects are moving through deformable MS given by 3D space and time, *where time is linked to space, but different from space* (time is measured in seconds). The speed of matter is $v_{3D} < c$. In our theory, all objects are moving through non-deformable ES given by 4D distance (all distances are measured in light seconds), *where time is not a primary quantity anymore, but a subordinate quantity derived from covered distance, and reality is formed by projecting ES to 3D space.* The 4D speed of everything in ES is $v = c$.

Since breaking a dogma is likely a once-in-a-century event, we provide a roadmap of how we proceed. Section 2: We prove that Einstein's concept of time is limited. Section 3: (a) We present two sets of ES coordinates. (b) In hyperspherical coordinates, we derive a new concept of time and—to our own surprise—a Theory of Everything. Section 4: (a) We convert hyperspherical to Cartesian coordinates. (b) From the ES geometry, we derive the equations of length contraction and time dilation. (c) We solve geometric paradoxes in ES. Section 5: We compare ES with MS. Section 6: (a) We explain why most theories of physics, like electrodynamics or thermodynamics, won't change under our new concept of time. (b) We solve 16 fundamental mysteries of physics. Section 7: We draw conclusions.

2. Einstein's Concept of Time Is Limited

The concept of time in today's physics traces back to Albert Einstein. For this reason, we call it "Einstein time". Einstein begins his theory of SR with an instruction of how to define simultaneity: He synchronizes clocks by means of light signals. On pages 897–898 of his publication [1], Einstein describes how to measure space and time in a system at rest (K) and in a system (we call it K′) that is moving relative to K at a constant speed (we call it v_{3D}). In K, the coordinates of space (x_1, x_2, x_3) are measured with a ruler at rest. In K′, the coordinates of space (x'_1, x'_2, x'_3) are measured with a ruler moving with K′.

On page 898 [1], Einstein assumes that time t is determined for all points in K with clocks synchronized in K. He also assumes that time t' is determined for all points in K′ with clocks synchronized in K′. Einstein then proves that the principle of relativity is compatible with the invariance of c, and he derives the Lorentz transformations

$$x'_1 = \gamma\,(x_1 - v_{3D}\,t) \qquad x'_2 = x_2 \qquad x'_3 = x_3 \;, \tag{1a}$$

$$t' = \gamma\,(t - v_{3D}\,x_1/c^2) \;, \tag{1b}$$

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where $\gamma = (1 - v_{3D}^2/c^2)^{-0.5}$ is the Lorentz factor. All of Einstein's considerations and calculations are correct, but only under a very important premise: *Eqs. (1a-b) are valid only for the primary observer (we call him R) in the system at rest K.* Einstein's first postulate (principle of relativity) requires that an observer B in the system K′ can also be the primary observer. In this case, B calculates the coordinates of K with the Eqs. (1a-b), except that x_1, x_2, x_3, t are the coordinates of K′ and that x_1', x_2', x_3', t' are the coordinates of K. Yet again, there is the same premise: *Now Eqs. (1a-b) are valid only for the primary observer B.*

So, Einstein's concepts of space and time are limited to the perspective of the primary observer who is at rest. The problem is: It is impossible to define a superordinate frame of reference in Einstein's relativity (SR and GR) in which two observers R and B are at rest at once (except for the trivial speed $v_{3D} = 0$). Even in GR, only the primary observer is at rest in a "momentarily comoving reference frame". That is, in both SR and GR there is no superordinate reference frame in which R and B are treated alike. Our claim: In cosmology and quantum mechanics, we do need such a superordinate frame. We need concepts that aren't limited to an "observer at rest", but absolute! We will prove our claim *indirectly* by solving 16 mysteries in Sect. 6 which today's physics can't solve.

That last paragraph serves as a springboard for our theory. We knew that SR and GR can't be all that wrong as they have been very successful for more than 100 years. So, our toughest task was to figure out *why* they are only an approximation. SR and GR describe reality for observer R or else for observer B, *but they don't describe reality for R and B at once.* Just as Newton's concepts of space and time are good only for $v_{3D} \ll c$, so are Einstein's concepts good only for individual observers. They aren't good for understanding the big picture in cosmology or the basics in quantum mechanics. In Sect. 4, we will show that the limitation of Einstein's concept of space cancels out, while the limitation of Einstein time persists. We call Einstein's physics "egocentric" as it prioritizes the perspective of the primary observer: In SR and GR, each observer has his own concept of time.

The weakness of SR and GR is due to the fact that Albert Einstein's approach was purely theoretical. Theoretically, there are an "observer at rest" and a "moving observer". Yet in experimental physics, there is no real observer who would consider himself moving at a constant speed relative to an observer at rest. The "moving observer" will, of course, tell us that he is at rest! If Einstein had been an experimental physicist, he would probably have searched for a superordinate reference frame in which R and B are treated alike. We will demonstrate that ES is such a superordinate frame. So, we won't synchronize R's and B's clocks separately as Einstein did. *Instead, we will define one absolute time for all observers in ES, and we will project ES for each observer to his 3D space (to his reality).*

It was argued that we would provide graphical solutions (3D projections) rather than mathematical proofs. We wish to emphasize that there are two ways of how to solve problems in physics: (1) We can solve them *mathematically* by setting up and solving equations. (2) We can solve them *graphically* by drawing and interpreting diagrams. We have chosen the second way, but we encourage all colleagues to use our report as a guideline and solve the same 16 mysteries that we do, but mathematically.

We now prove how grotesque Einstein time actually is. We do so by means of Minkowski diagrams, a standard tool in today's physics. Hermann Minkowski, a teacher of Albert Einstein, developed these diagrams based on Einstein's theory to visualize for one dimension of space how an object is moving through MS [2]. Unlike in any distance–time graph, distance is displayed horizontally, and time is displayed vertically. Time is multiplied by the speed c, so that light is always moving at $45°$ to either axis.

We consider two identical rockets that differ only in color (Fig. 2 left). Their length at rest is 0.5 Ls (light seconds), and they move at a relative speed of $v_{3D} = 0.6\,c$. We use these high values to prove that Minkowski diagrams are not in line with experimental physics. A Minkowski diagram (Fig. 2 right) transfers the geometry into a graph. Observer R is in the rear end of the red rocket (his view is the red frame). Observer B is in the rear end of the blue rocket (his view is the blue frame). The red rocket is "at rest" and has moved 1.0 s in the time t. The blue rocket has moved $v_{3D}t = 0.6$ Ls in the axis x_1 and 1.0 s in the time

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t. Because of length contraction, the blue rocket contracts to 0.4 Ls. Because of time dilation, the rear end of the blue rocket has moved only 0.8 s in the time t'. We draw your attention to the tip of the blue rocket. It has moved even less: 0.5 s in the time t'. Only for clarity do we draw 2D rockets although there is just one spatial axis.

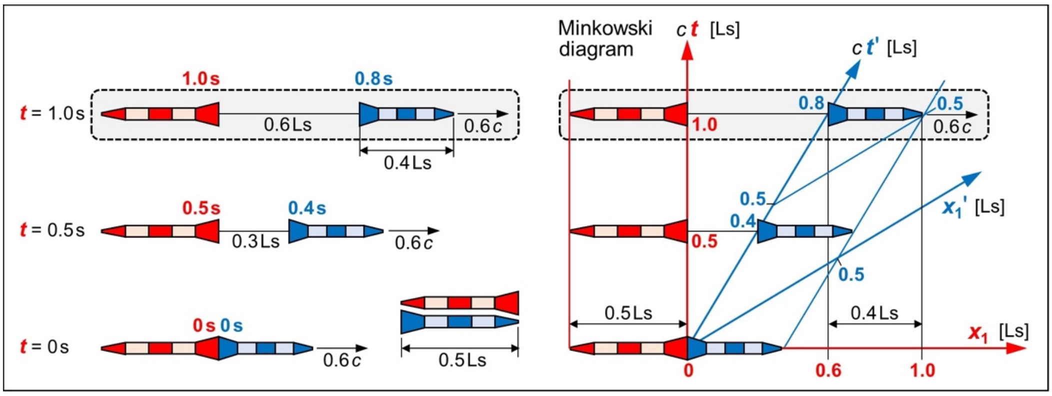

Figure 2. Two identical rockets in MS. **Left:** Both rockets have a length at rest of 0.5 Ls. Their relative speed is 0.6 c. The blue rocket is shorter (length contraction). Clocks inside the blue rocket display less time (time dilation). **Right:** The geometry from the left is transferred to a Minkowski diagram. In the blue frame, clocks inside the blue rocket display different times (0.8 and 0.5 printed in blue).

Fig. 2 tells us that Minkowski diagrams are *mathematically* correct, but not in line with experimental physics. A team of observers inside the blue rocket will also synchronize all of their clocks, but a Minkowski diagram displays different times on clocks inside the blue rocket (0.8 and 0.5 printed in blue in Fig. 2 right). Here is our explanation: The blue rocket isn't aligned perpendicularly to a vector that we call "flow of time" (Fig. 3 left). In a Minkowski diagram, the moving rocket is drawn horizontally as if its time were flowing into the same direction as the time of the observer at rest. To restore symmetry, the blue rocket *must be rotated* (Fig. 3 right). Rotation is the clue to full symmetry!

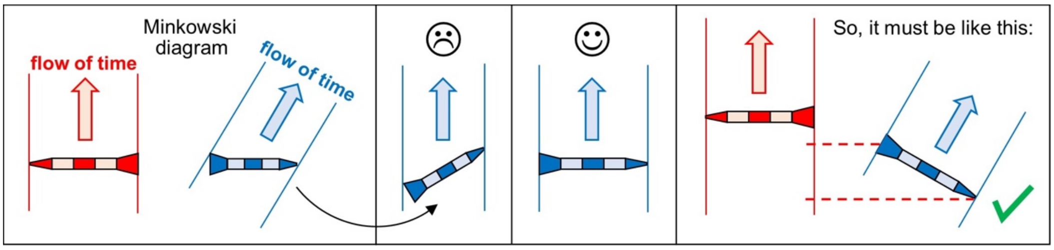

Figure 3. How to proceed from a Minkowski diagram to an ES diagram. **From left to right:** A Minkowski diagram is not in line with experimental physics. Clocks display equal time only if the rocket is aligned perpendicularly to its flow of time. This isn't the case for the blue rocket. A rotation (physical repairment) leads to an ES diagram that is fully symmetric.

A cartoon gives us an instruction of how to draw a correct diagram: We must replace the two asymmetric dimensions space and time in a Minkowski diagram (Fig. 4 top) with symmetric dimensions *to enable a rotation of the blue rocket*. We call it "physical repairment": Both space and time are replaced with a new quantity "distance" (space and time in one, explained in Sect. 3). We end up with an ES diagram (Fig. 4 center), where d_1 and d_4 are distances in ES. Here the values 0.8 and 0.5 are printed in the red frame: They are measured by observer R. Observer B has also synchronized his clocks!

ES diagrams are *both mathematically and physically* correct: (1) No reference frame is prioritized. Only in the projection to 3D space does the blue rocket contract (Fig. 4 bottom). (2) In the red (blue) frame, odometers inside the red (blue) rocket are synchronized. In ES, clocks measuring seconds are replaced with odometers measuring light seconds. *There is no need to calibrate these odometers because light seconds in ES are absolute.*

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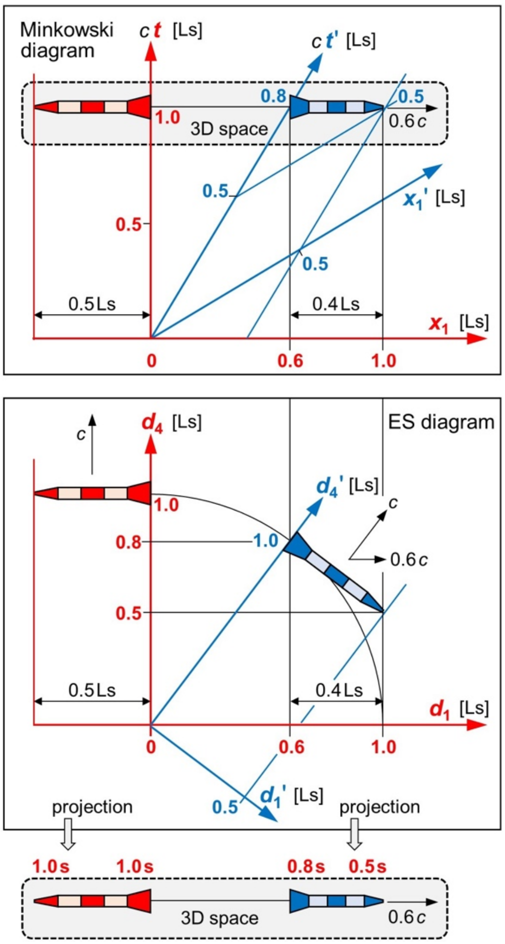

Figure 4. Minkowski diagram, ES diagram, and 3D projection for two identical rockets. **Top:** In the blue frame of the Minkowski diagram, clocks inside the blue rocket display different times (0.8 and 0.5 printed in blue). **Center:** d_1 and d_4 are distances in ES. In the red (blue) frame of the ES diagram, odometers inside the red (blue) rocket are synchronized. Here 0.8 and 0.5 are printed in the red frame because they are measured only by observer R. **Bottom:** Projection to R's 3D space.

It is well known that the concept of simultaneity isn't absolute in MS. Einstein was aware of this limitation. On page 897 of his publication [1], he writes: "Two events which are simultaneous when viewed from one system will not be simultaneous when viewed from a system moving relative to this system." Physicists have accepted for more than 100 years that observer R in our example is prioritized over observer B. Fig. 4 center tells us that there is no need for such a prioritization. It is indeed possible to display R's view and B's view in a single diagram: We only need to rotate the ES diagram to see B's view. Minkowski diagrams can't accomplish that. We would need a second Minkowski diagram to see B's view. *Why hold on to MS, in which the statement "B has synchronized his clocks" is both true (for B) and false (for R) at once?* Albert Einstein was one of the most brilliant physicists ever, but obviously he wasn't aware that a rotation in a symmetric 4D manifold solves the issue of simultaneity. Physics has followed him blindly. It is time, to wake up!

3. Euclidean Spacetime—Hyperspherical Coordinates

SR and GR are customized to individual observers. Their performance is limited because they are neither absolute nor symmetric, but egocentric: Each observer has his own concept of time. Physics can hold on to SR and GR as it did for more than 100 years, but ignoring Euclidean relativity will make it impossible to discover the truth about time. Einstein's second postulate of SR [1] is physically reasonable, but not strong enough. In our second postulate, the speed of light is not only absolute, but also universal.

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Now that we know the weakness of MS, we introduce ES. Mathematically, ES is an open 4D manifold with a Euclidean metric. We describe ES in four *absolute* hyperspherical coordinates $(\phi_1, \phi_2, \phi_3, r)$, where each ϕ_i is a hyperspherical angle and r is *radial distance* from an origin—or in four *relative, symmetric* Cartesian coordinates (d_1, d_2, d_3, d_4), where each d_i is *axial distance* from an origin. Physics is well aware that distance can be spatial or temporal. We merge space and time into one quantity that we call "distance". That is, we conceive of distance (either the one radial distance r or the four axial distances d_i) as "space and time in one". Strictly speaking, space and time are not two [20]! The new idea: *It is not predefined for all objects alike which d_i relates to time.* On the contrary, MS is neither absolute nor symmetric, but comes in four *heterogeneous* coordinates (x_1, x_2, x_3, t), where each x_i is always space and t is always Einstein time.

Hyperspherical coordinates are good for grasping the big picture as in cosmology. We claim that a huge amount of energy was injected into ES at some point that we take as origin O. Ever since has this energy been moving radially away at the speed of light. We live in the 3D hypersurface of an expanding 4D hypersphere. Hyperspherical coordinates have the benefit of reducing all that is ever happening to one formula. So, this formula is the Theory of Everything in hyperspherical coordinates: *All energy is covering radial distance r which, divided by Euclidean time τ, is equal to the speed of light c.*

$$r/\tau = c \qquad \textit{(Theory of Everything).} \tag{2}$$

$$\tau = r/c \qquad \textit{(Euclidean time).} \tag{3}$$

Time τ is not a primary quantity anymore, but a subordinate quantity derived from covered distance r. We suggest that in ES the universal constant c is not specified in meters per second, but in its own new unit (to be given), and time is specified in meters per that new unit.

All quantities in Eq. (2) are absolute as we would expect of a TOE: Everything is the same distance r away from the origin O, everything experiences the same Euclidean time τ, and everything is moving at the same speed c. In hyperspherical coordinates, there is no motion within the hypersurface spanned by ϕ_1, ϕ_2, ϕ_3. In Sect. 6.6, we will explain how motion is enabled in my view of the hypersurface. Hyperspherical coordinates also tell us that relativity in ES and MS is quite different: Let $\boldsymbol{r}$ be the vector which is pointing from the origin O to some object. We then define a vector "flow of time" for that object as $\boldsymbol{r}/c$. *In ES, Euclidean time and the hypersurface are absolute, but the orientation of the 4D vector "flow of time" and my view of the hypersurface (which is my 3D space) are relative. In MS, Einstein time and 3D space are relative, and there is only a 1D vector "time's arrow".*

Our Theory of Everything (TOE) is the reward for applying a very powerful strategy: Matching the symmetry simplifies physics! In hyperspherical coordinates, everything is moving radially at a constant speed: the speed of light. So, there can't be any acceleration (neither radial nor tangential) in these coordinates. In Sect. 6.6, we will prove that acceleration and thus gravitation emerge from a rotation of observed moving objects in ES and a projection to 3D space.

4. Euclidean Spacetime—Cartesian Coordinates

Cartesian coordinates are good for projecting ES to an observer's 3D space (which is his reality). Hyperspherical coordinates are converted to Cartesian coordinates by

$$d_1 = r \cos\phi_1 \ , \tag{4a}$$

$$d_2 = r \sin\phi_1 \cos\phi_2 \ , \tag{4b}$$

$$d_3 = r \sin\phi_1 \sin\phi_2 \cos\phi_3 \ , \tag{4c}$$

$$d_4 = r \sin\phi_1 \sin\phi_2 \sin\phi_3 \ . \tag{4d}$$

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In Cartesian coordinates, too, all objects are moving at the speed c. Yet in these coordinates, their speed splits up into four components $u_i = \mathrm{d}d_i/\mathrm{d}\tau$

$$u_1 = c \cos\phi_1 \ , \tag{5a}$$

$$u_2 = c \sin\phi_1 \cos\phi_2 \ , \tag{5b}$$

$$u_3 = c \sin\phi_1 \sin\phi_2 \cos\phi_3 \ , \tag{5c}$$

$$u_4 = c \sin\phi_1 \sin\phi_2 \sin\phi_3 \ . \tag{5d}$$

From Eqs. (4a-d) and Eqs. (5a-d) and the Pythagorean identity $\sin^2\phi_i + \cos^2\phi_i = 1$, we derive the following two equations

$$d_1^2 + d_2^2 + d_3^2 + d_4^2 = r^2 \ , \tag{6}$$

$$u_1^2 + u_2^2 + u_3^2 + u_4^2 = c^2 \ . \tag{7}$$

From Eqs. (3) and (6), we derive the general definition of Euclidean time in Cartesian coordinates with the origin O

$$\tau = \sqrt{d_1^2 + d_2^2 + d_3^2 + d_4^2} \,/\, c \ . \tag{8}$$

In our ES diagrams, we often choose Cartesian coordinates in which an object (like a rocket) starts moving from an origin P other than O. *Because of the ES symmetry, we are free to label all four axes.* In this report, we always assume that the axis d_4 coincides with the vector $\boldsymbol{r}/c$ and relates to the object's time. Because of our second postulate, objects never remain at the origin. In ES, nothing is ever at rest. Once you try to keep an object at some origin, you will automatically draw a 3D space diagram. In our 3D projections, we project objects and their 4D motion from ES to 3D space. Again, we are free to label the axis that we project onto. In this report, we always assume that—if two objects are moving against each other in ES—they will always do so only in the axes d_1 and d_4. So, our ES diagrams display only d_1 and d_4, and our 3D projections display only d_1. Just keep in mind that d_1 always stands for d_1, d_2, d_3.

We now prove two basic features in Cartesian ES coordinates: (1) If I observe a moving object, its 3D space is rotated with respect to my 3D space causing *length contraction.* (2) If I observe a moving object, its time flows in a 4D direction other than my time causing *time dilation.* That is, length contraction and time dilation are not unique to MS, but also geometric effects in ES! We consider two identical rockets that differ only in color (r = red rocket, b = blue rocket). The reference frame of an observer R in the rear end of the red rocket has the coordinates d_1, d_2, d_3, d_4. The reference frame of an observer B in the rear end of the blue rocket has the coordinates d'_1, d'_2, d'_3, d'_4. Initially, both rockets are back-to-back at the same point P. In MS, we would say that they are "at rest". In ES, both rockets move in the common axis $d_4 = d'_4$ (related to either rocket's time) at the speed c.

Next, we assume that these two rockets are also moving against each other. As we explained above, the additional motion occurs in the axis d_1 from R's view and in the axis d'_1 from B's view. In R's 3D space (Fig. 5 bottom left), the blue rocket is moving at the 3D speed $v_{3D} = u_1$. In B's 3D space (Fig. 5 bottom right), the red rocket is moving in opposite direction, but at the same speed. Our ES diagrams must fulfill three requirements: (1) The first postulate must be satisfied. (2) According to our second postulate, the red rocket must keep on moving in the axis d_4 at the speed c, and the blue rocket must keep on moving in the axis d'_4 at the speed c. (3) Both rockets started at the same point P. There is only one way to draw ES diagrams (Fig. 5 top left and top right) that fulfill all requirements: *We must rotate the two frames of reference with respect to each other.* Only a rotation guarantees

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that the situation is symmetric, so that the equations describing the laws of physics have the same form for R and B! Only for clarity do we draw 2D rockets although the width of either rocket is in the invisible dimensions d_2 and d_2' (or d_3 and d_3').

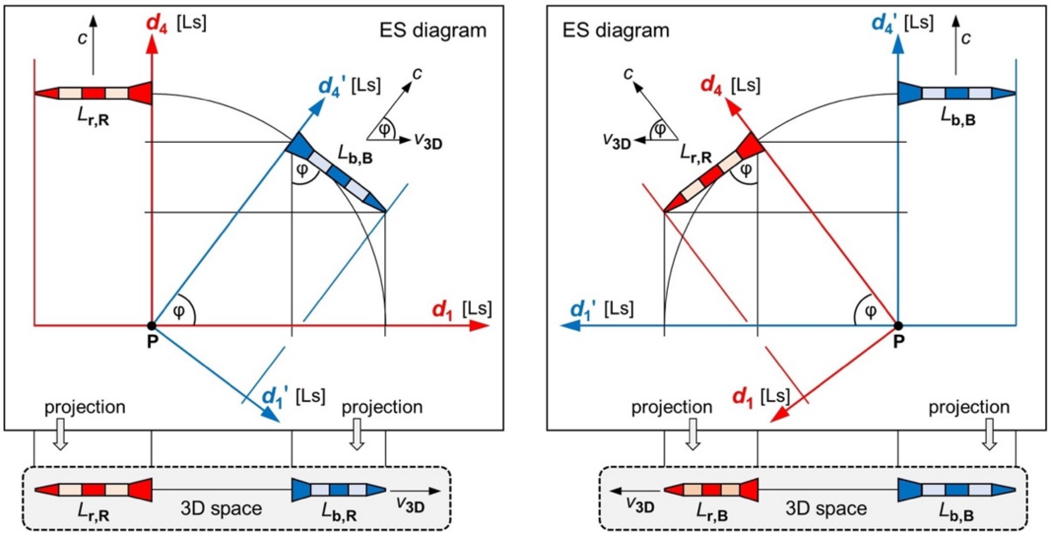

Figure 5. ES diagrams and 3D projections for two identical rockets. All axes are in Ls (light seconds). **Top left and top right:** Two rockets are moving against each other. The situation is symmetric with respect to the two reference frames. **Bottom left:** Projection to R's 3D space. The blue rocket contracts to $L_{\mathrm{b,R}}$. **Bottom right:** Projection to B's 3D space. The red rocket contracts to $L_{\mathrm{r,B}}$.

We define $L_{i,J}$ as length of the rocket with color i (r = red, b = blue) as seen from the perspective of observer J (R = observer R, B = observer B). From Fig. 5, we derive

$$\sin^2\varphi + \cos^2\varphi = (L_{\mathrm{b,R}}/L_{\mathrm{b,B}})^2 + (v_{3\mathrm{D}}/c)^2 = 1\ , \qquad (9)$$

$$L_{\mathrm{b,R}} = \gamma^{-1} L_{\mathrm{b,B}} \qquad \textit{(Length contraction)}, \qquad (10)$$

where $\gamma = (1 - v_{3\mathrm{D}}^2/c^2)^{-0.5}$ is the same Lorentz factor as in MS. So, we calculate the same length contraction in ES as in MS: The blue rocket appears contracted to observer R by the factor γ^{-1}. Yet which distances will R observe in his axis d_4? For the answer, we mentally continue the rotation of the blue rocket (Fig. 5 top left) until it points vertically down ($\varphi = 0°$) and serves as R's ruler in the axis d_4. The projection to 3D space now tells us that the ruler contracts to zero. The dimension d_4 "is suppressed" (disappears) for R. He *observes* a 3D space, but only *feels* d_4 as "aging" (time passing by). From Fig. 5, we also derive

$$\sin^2\varphi + \cos^2\varphi = (d_{4,\mathrm{B,R}}/d'_{4,\mathrm{B,B}})^2 + (v_{3\mathrm{D}}/c)^2 = 1\ , \qquad (11)$$

$$d_{4,\mathrm{B,R}} = \gamma^{-1} d'_{4,\mathrm{B,B}}\ , \qquad (12)$$

where $d_{4,\mathrm{B,R}}$ and $d'_{4,\mathrm{B,B}}$ are the distances that B has moved in d_4 (R's view) or else in d_4' (B's view). With $d'_{4,\mathrm{B,B}} = d_{4,\mathrm{R,R}}$ (full symmetry in ES) and $d_{4,\mathrm{B,R}} = c\tau_{\mathrm{B,R}}$ and $d_{4,\mathrm{R,R}} = c\tau_{\mathrm{R,R}}$ (we remember that d_4 is that axis which an object deems time), Eq. (12) turns into

$$\tau_{\mathrm{B,R}} = \gamma^{-1} \tau_{\mathrm{R,R}} \qquad \textit{(Euclidean time contraction)}, \qquad (13)$$

$$\tau_{\mathrm{R,R}} = \gamma\, \tau_{\mathrm{B,R}} \qquad \textit{(Euclidean time dilation)}, \qquad (14)$$

where $\tau_{\mathrm{R,R}}$ and $\tau_{\mathrm{B,R}}$ are the distances that observer R and observer B have moved in time from the perspective of observer R! Eq. (14) tells us that the effect of time dilation occurs

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only if an observer R compares how R and some other observer B have moved in R's time. Because of $d'_{4,\mathrm{B,B}} = d_{4,\mathrm{R,R}}$ (that is, $\tau_{\mathrm{B,B}} = \tau_{\mathrm{R,R}}$), there is no time dilation if we compare R's time with B's time. We derived Eq. (11) from a projection to the axis d_4. So, time dilation is equivalent to "distance contraction" in the fourth dimension of ES. Because of the projection, we better use Eq. (13) and speak of a "time contraction" in ES.

We just proved that geometric effects in ES take the place of relativistic effects in MS. In MS, time dilation and length contraction are deemed complementary effects. In ES, they both result from a rotation and a projection to the axis d_4 or to 3D space. There is no need to introduce a new concept of space (apart from accepting that space can't be deformed) because rotations and projections are standard operations of space. *Because rotations aren't operations of Einstein time, we do need a new concept of time:* B's time (related to d'_4) flows in a 4D direction other than R's time (related to d_4). This is why the limitation of Einstein's concept of space cancels out, while the limitation of Einstein time persists.

Now we discuss three instructive, geometric paradoxes that demonstrate the benefit of our concept "distance". Problem 1: A rocket moves along a guide wire at a high speed. The wire enters the rocket at its top and exits at its rear end. In ES, rocket and wire move at the speed of light. We may assume that the wire moves in some axis d_4. As the rocket moves along the wire, it can also move in the axis d_4, but slower than the speed of light. Wouldn't the wire eventually be outside the rocket? Problem 2: In billiard, the white cue ball is hit to collide with the red ball. In ES, cue ball and red ball move at the speed of light. We may assume that the red ball moves in some axis d_4. As the cue ball covers spatial distance to the red ball, it can also move in the axis d_4, but slower than the speed of light. How can the balls ever collide if their d_4 values never match? Problem 3: An observer in the tip of a rocket sees how a mirror is passing the rocket. He sends a short light pulse to the mirror and tries to detect the reflection. In ES, rocket, mirror, and light pulse all move at the speed of light, but in different directions. We may assume that the rocket moves in some axis d_4. How can the light pulse ever be reflected back to the observer?

The questions that we asked in the last paragraph seem to be geometric paradoxes in Euclidean relativity, but they aren't! In all problems, the fallacy lies in the assumption that there are four spatial dimensions. ES is four dimensions of distance and only three of them are space. We solve all three problems by projecting ES to 3D space (Fig. 6). *Projections tell us what reality is like because "suppressing the axis d_4" is equivalent to "length contraction makes d_4 disappear"*. We easily verify in 3D space: The guide wire remains within the rocket, the cue ball collides with the red ball, the light pulse is reflected back to the observer. Theories that don't project ES to 3D space can't solve any of these geometric paradoxes.

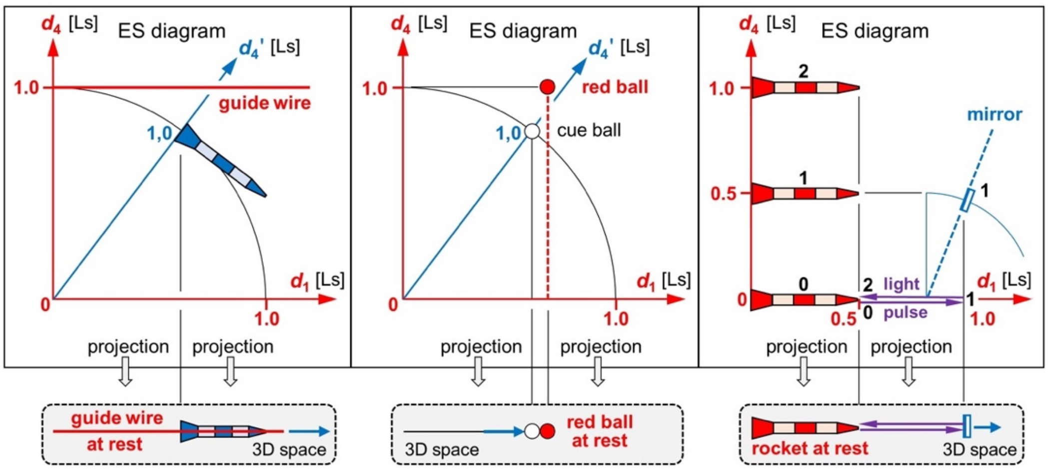

Figure 6. Graphical solutions to three geometric paradoxes. **Left:** A rocket moves along a guide wire. In 3D space, the guide wire is always within the rocket. **Center:** A cue ball is hit to collide with the red ball. In 3D space, the cue ball collides with the red ball. **Right:** An observer inside a rocket tries to detect the reflection of a short light pulse. Between two snapshots (0–1 or 1–2), rocket, mirror, and light pulse move 0.5 Ls in ES. In 3D space, the light pulse is reflected back to the observer.

5. Comparing Euclidean Spacetime with Minkowski Spacetime

In order to evaluate all benefits of Euclidean relativity, we must understand the similarities and the differences in ES and MS. We begin with the similarities: (1) Either concept comes in 4D. (2) Either concept can be interpreted as 3D space and 1D time. (3) In either concept, the 3D space is observable, whereas the fourth dimension can't be observed, but only felt as aging. This is why we can never observe the big picture. In ES, we can at least imagine it. (4) In either concept, there is length contraction and time dilation.

We now discuss major differences and always refer to Fig. 4: (1) In a Minkowski diagram, the vertical axis is time, but the horizontal axis is space. The 4D symmetry is broken. A moving object must not be drawn rotated because its length can't be a mix of space and time. In a Cartesian ES diagram, all axes are distance. Here a moving object can and must be drawn rotated to keep the 4D symmetry.

(2) In a Minkowski diagram, the moving reference frame is oblique. The MS geometry is pseudo-Euclidean. MS comes with an *indefinite* metric

$$ds^2 \;=\; -\,dx_1^2 \,-\, dx_2^2 \,-\, dx_3^2 \,+\, c^2\,dt^2 \;. \qquad (15)$$

In a Cartesian ES diagram, the moving reference frame is only rotated. The ES geometry is Euclidean. ES comes with a *positive-definite* metric

$$ds^2 \;=\; dd_1^2 \,+\, dd_2^2 \,+\, dd_3^2 \,+\, dd_4^2 \;. \qquad (16)$$

(3) In a Minkowski diagram, light is moving at $45°$ to either axis. In a Cartesian ES diagram, light is moving horizontally as in Fig. 6 right. Here is why: In 3D space, light is already moving at the speed c. So, it can't move in the axis d_4.

(4) In a Minkowski diagram, lines of simultaneity are horizontal lines for observer R ("at rest") and oblique lines for observer B (moving relative to R). In a hyperspherical ES diagram, lines of simultaneity are circles around the origin O. In a Cartesian ES diagram, lines of simultaneity are lines perpendicular to the axis d_4 (for R) or the axis d'_4 (for B). The rockets in Fig. 4 center must not be curved to follow the indicated circle because this is not a hyperspherical ES diagram, but a Cartesian ES diagram.

(5) In MS, we always compare two reference frames with each other that come with a restriction: The primary frame must be "at rest", and the other one must move relative to the primary frame. In Fig. 4 top, observer R is "at rest" in 3D space and moving in time. From R's perspective, observer B is moving in 3D space and time. *MS doesn't care about B's perspective.* To be taken care of, B needs to be the primary observer. In ES, we can have as many observers as we like—with no restrictions.

(6) In MS, the "moving observer" is *only virtual* as there is no real observer who would consider himself moving at a constant speed relative to an observer at rest. As we pointed out in Sect. 2, the "moving observer" will also tell us that he is at rest. In ES, all observers are *real*, but no observer can observe all four dimensions. For each observer, his reality is formed by projecting ES to 3D space. Physics is about describing reality and real observers. So, physics shouldn't hold on to MS where moving observers are virtual.

(7) *In MS, time is related to an observer:* Each observer has his own Einstein time t. R measures his time in the variable t; and in the primed variable t', R measures in his flow of time how B's clocks are running. That is, t' isn't the time that B is measuring himself. *In ES, time is related to the Big Bang:* All observers have the same Euclidean time τ. Absolute time is measured in the variable d_4/c (by observer R) or else d'_4/c (by observer B). The 4D vector "flow of time" is different for R and for B because the two axes d_4 and d'_4 are rotated with respect to each other.

(8) *In MS and ES, there is a different way of storytelling:* In Fig. 4 top, one observer R is observing two rockets (red and blue). The values 0.8 and 0.5 (printed in blue) are actually measured by R. In Fig. 4 center, either one rocket is observed by two observers (R and B). We only need to rotate the ES diagram to see B's view.

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(9) In MS, length contraction and time dilation are called "relativistic effects". They are derived mathematically from the two postulates of SR [1], but there is no true physical explanation for them. In ES, there is no need to coin the word "relativistic" as everything is moving at the speed c. Here length contraction and time dilation (better: time contraction) are pure geometric effects.

(10) In MS, the "proper time" t' (time that elapsed in a frame where an object deems itself at rest) is an invariant. In ES, the distance d_4 (which relates to Euclidean time τ in ES and to the measured "coordinate time" t in MS) is an invariant. In Fig. 4, there is $\tau = t$ only for observer R in the red frame. Choosing the proper time of objects as an invariant has been very unfortunate, especially in cosmology. *Because cosmology ought to describe the universe, it must not be anchored in single objects, but in absolute time.* This is why cosmology didn't succeed in solving all those mysteries that we solve in Sect. 6.

Retrospectively, the tragedy took its course when physicists assumed that there is a "system at rest". This assumption destroys the 4D symmetry and makes MS egocentric. It also makes GR incompatible with quantum mechanics because there is nothing at rest at the microscopic level. Our second postulate makes sure that nothing is ever at rest in ES. It was bad luck that Einstein time isn't deemed limited in daily life, that the equations of length contraction and time dilation have the same form in ES and MS, and that they keep their form even in MS when replacing observer R with observer B.

Physicists believed and still believe that R and B can read the same time t' on clocks inside the blue rocket (Fig. 4 top). But as we have demonstrated with the values 0.8 and 0.5, the time t' is measured only by R. For comparison: In ES, the primed variable $d'_{4,\mathrm{B,B}}$ in Eq. (12) does reflect how B is measuring time. In MS, moving clocks are running slower, and a moving observer measures different times with his own clocks. This is grotesque! *Of course, all identically constructed clocks are running alike; of course, all observers will synchronize their own clocks.* Physicists accepted without protest that observer R is prioritized over observer B. Yet, of course, physics must be the same for all observers.

As we mentioned in our Introduction, the geometric interpretation of SR was added by Hermann Minkowski. Albert Einstein is said to have quipped: "Since mathematicians have assaulted the theory of relativity, I do not understand it anymore." [21]

6. Solving 16 Fundamental Mysteries of Physics

Before proving our theory indirectly by solving 16 fundamental mysteries of physics, we explain why most theories of physics won't change under our new concept of time. We give a practical and a theoretical argument. Here is the practical argument: Whenever we measure "time" in physics, we actually measure temporal distances. Any point in time is related to some other point in time. We have already shown that the equations of length contraction and time dilation have the same form in ES and MS. So, all distances—which includes temporal distances—transform alike in ES and MS.

And here comes the theoretical argument: Most theories of physics don't depend on how space and time are related to each other. In theoretical physics, there are space-related operators (Nabla, Laplace, integration) and time-related operators (first and second derivatives, integration), but no spacetime-related operators. Yet it is always the mathematical operators that determine the predictions of a theory. The different concepts of time in ES (absolute Euclidean time and a relative 4D vector "flow of time") and MS (relative Einstein time and no 4D vector "flow of time") don't affect theories that consider space and time separate concepts, like electrodynamics or thermodynamics. *The 4D vector "flow of time" is irrelevant in these theories.* We dispute only SR and GR and today's model of cosmology as they do focus on how space and time are related to each other.

Someone might ask: "How do we switch from MS to ES?" Well, all we have to do is get that limited concept of Einstein time out of our minds. We must carefully assign each measured distance to the correct observer. And we need to take to heart: (1) Time is absolute. (2) For a moving observer, 3D space is rotated with respect to my 3D space. (3) For a moving observer, the flow of time is rotated with respect to my flow of time.

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6.1. Solving the Mystery of Time

There is absolute Euclidean time τ. In hyperspherical coordinates with the origin O and according to Eq. (3), τ is radial distance r from O divided by the speed of light c. In Cartesian coordinates with the origin O and according to Eq. (8), τ is the square root of the sum of all four distances d_i squared and then divided by the speed of light c. In Cartesian coordinates with any point P as origin and an object moving in the axis d_4 at the speed c, this object conceives of distances in d_4/c as distances in τ. All these definitions refer to reference frames in ES. In my 3D space, I only feel τ as aging since time can't be observed in 3D space. For comparison: Einstein time t is barely defined as "what I read on my watch". This egocentric definition is attributed to Einstein himself.

6.2. Solving the Mystery of Time's Arrow

Let $\boldsymbol{r}$ be the vector which is pointing from the origin O to some object. Then the first definition of time in Sect. 6.1 can be written this way: Euclidean time is the absolute value of the 4D vector "flow of time" $\boldsymbol{r}/c$. Euclidean time is absolute, but the orientation of the 4D vector "flow of time" is relative. In ES, an object can't return to a position because it is steadily moving away from the origin O. In MS, an object can eventually return to a location in 3D space, but only at a later time. "Time's arrow" is a 1D vector in MS, but it has its counterpart in ES: We can't reverse the 4D vector "flow the time" in ES because radial momentum provided by the Big Bang drives all energy away from the origin O.

6.3. Solving the Mystery of Length Contraction

MS tells us that there is length contraction, but it doesn't give us any clue of *why* it is. In ES, we learn that length contraction is a geometric effect: It is due to a rotation! If the blue rocket in Fig. 5 moves relative to the red rocket, the blue frame of reference is rotated with respect to the red frame. Hence, B's 3D space is rotated with respect to R's 3D space. Hence, R observes a rotated blue rocket. In a projection to 3D space, this rotation causes length contraction. It is well known that in MS fast objects appear rotated to an observer [22]. In MS, this rotation is *virtual* and attributed to the travel time of light: Light from the tip of an approaching rocket reaches the observer earlier than light from its rear end. It is the same rotation that we describe in ES because travel time is encoded in the variable d_4' of the moving rocket. Yet in ES, the rotation is *real*.

6.4. Solving the Mystery of Time Dilation

MS tells us that there is time dilation, but again it doesn't give us any clue of *why* it is. In ES, time dilation is also due to a rotation! If the blue rocket in Fig. 5 moves relative to the red rocket, the time of the blue rocket flows in a 4D direction other than the time of the red rocket. In a projection to the axis d_4, this rotation causes time dilation.

6.5. Solving the Mystery of mc^2

The total energy of an object in ES must be equal to the total energy γmc^2 in MS as the fourth dimension can't take up or give away any energy. In MS, we are familiar with

$$\gamma\, m\, c^2 \;=\; E_{\text{kin,3D}} \;+\; m\, c^2 \;, \tag{17}$$

where $E_{\text{kin,3D}}$ is the kinetic energy of an object in 3D space and mc^2 is the object's "energy at rest". MS doesn't give us any clue of *why* there is a c^2 in both the total energy and the energy at rest for material objects that in MS never move at the speed c. ES now gives us the missing clue: $E_{\text{kin,3D}}$ is the kinetic energy only in the three dimensions d_1, d_2, d_3. That is to say: mc^2 is the kinetic energy in the fourth dimension d_4. Generally speaking, *mc^2 is the kinetic energy of moving through Euclidean time τ.* The multiplicator c^2 in Eq. (17) tells us that everything in ES is steadily moving at the speed of light even if it is at rest in MS. c^2 is handed down from ES to 3D space.

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6.6. Solving the Mystery of the Isotropy of the Cosmic Microwave Background

Now we are ready for our new model of cosmology, which is based on ES. It explains the isotropy of the cosmic microwave background (CMB) [23], Hubble's law [24], the cosmological principle [25], the flat universe, and even the two competing values of the Hubble constant [26,27]. There is no need to create space. Space exists just like numbers and can't be deformed. Because of some reason that we don't know, there was a Big Bang. In MS, it makes no sense to ask *where* the Big Bang occurred: Since space and time started as a singularity and space inflated thereafter, the Big Bang occurred "everywhere". In ES, it is indeed possible to localize the Big Bang at what we take as origin O. We claim that the Big Bang was a sudden incident that injected a huge amount of energy into ES all at once. "Sudden" allows for metaphysical speculations that aren't subject of this report.

During the initial stage after the Big Bang, there was a huge amount of concentrated energy inside ES. In the projection to 3D space, this energy created a very dense and hot plasma. While the plasma was expanding, it cooled down. During the recombination of plasma particles, electromagnetic radiation was emitted that we observe as CMB today. At a temperature of roughly 3,000 K, neutral hydrogen atoms formed [28]. According to the Lambda-CDM model, this stage was reached 380,000 years "after" (in terms of MS) the Big Bang. These are 380,000 light years "away from" (in terms of ES) the Big Bang. The value 380,000 still needs to be recalculated if the universe is expanding at a constant speed. Ever since has this energy been moving radially away in ES at the speed c.

Yet how can the CMB be so isotropic? For the answer, we must understand what is really going on in ES. We first consider a wrong approach: "CMB radiation is emitted from somewhere in space, and we watch it from somewhere else in space. Shouldn't we then observe CMB radiation from only one direction?" No, we should not as we need to correct two false assumptions here: (1) CMB radiation is not emitted; it was emitted. (2) We never stand still; we are also moving at the speed c.

Here is the correct approach: A 3D hypersurface containing all CMB radiation and all matter is expanding radially in ES at the speed c (Fig. 7 left). We live in the 3D hypersurface of an expanding 4D hypersphere. So, we always remain *within* the CMB. The word "within" solves our mystery! The CMB is so isotropic *because it is swinging equally into all three dimensions of my 3D space* (which is my view of the hypersurface and also my reality). In order to grasp the process of swinging, we again mentally continue the rotation of the blue rocket (Fig. 5 top left) until it points vertically down. We then replace that blue rocket with a photon and look at the projection to 3D space. From this little thought experiment, we learn: In each photon, I observe energy from ES whose 4D motion "swings completely" (by an angle of $90°$) into my 3D space.

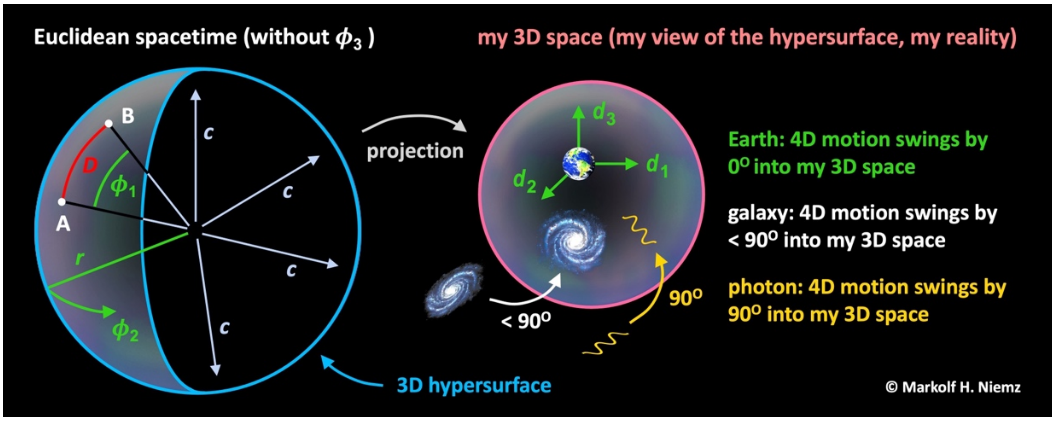

Figure 7. Model of cosmology based on ES (not to scale). Artwork illustrating how a 3D hypersurface is expanding in ES. **Left:** Non-observable ES in hyperspherical coordinates $(\phi_1, \phi_2, \phi_3, r)$. The angle ϕ_3 can't be displayed here. Hubble's law is derived from the geometry of the hypersurface. **Right:** Projection of ES to my 3D space in Cartesian coordinates (d_1, d_2, d_3), which is my view of the hypersurface and my reality. The axis d_4 (related to time) disappears because of length contraction.

Should you have trouble understanding the process of swinging, you are not alone. Our eyes aren't made for *perceiving* all four dimensions of ES. Yet we can *conceive* of them with our brain by employing our little trick: Rotating that blue rocket in Fig. 5 top left and looking at the projection to 3D space. This trick tells us that the process of swinging covers both geometric operations: *"Swinging" is a single word for the combined action of rotating and projecting.* In 3D space, we observe the final result of this combined action.

We just learned that a photon is energy from ES whose 4D motion swings completely into my 3D space. In the case of matter, like rockets and galaxies, the 4D motion "swings partly" (by an angle $< 90°$) into my 3D space, as in Fig. 5 bottom left. In the case of Earth, the swing angle is $0°$ since Earth isn't moving relative to myself. The process of swinging explains how motion is enabled in my view of the hypersurface.

Swinging also explains why this motion in 3D space can be on a curved line, as in the cyclic motion of planets. Motion on a curved line is due to an acceleration. To understand where acceleration emerges from, we assume that the blue rocket in Fig. 5 bottom left is accelerating in 3D space. According to Eq. (7), its speed u_1 in ES must then increase at the expense of its speed u_4. That is, the blue rocket is rotating in Cartesian ES coordinates! *An acceleration in 3D space is equivalent to a rotation in ES.* Acceleration and thus gravitation are pure geometric effects: They emerge from a rotation of observed moving objects in ES and a projection to 3D space. In Euclidean relativity, gravitation manifests as a rotation of objects. In GR, gravitation manifests as a deformation of spacetime [3].

Photons are *moving* in my view of the hypersurface at the speed c, whereas the entire hypersurface is *expanding* at the speed c. Someone might ask: "Don't photons then exceed the speed c?" No, they don't. Speeds in my view of the hypersurface must not be added to the speed of the hypersurface itself. What I deem photon, is energy from ES whose 4D motion swings completely into my 3D space. So, in the speed c of each photon I actually see the speed c of the hypersurface!

6.7. Solving the Mystery of Hubble's Law

The speed v_{3D} at which a galaxy A (Fig. 7 left) is moving away from another galaxy B or Earth relates to their distance D as c relates to the radius r of the hypersurface

$$v_{3D} \;=\; D\,c/r \;=\; H_0\,D \qquad \textit{(Hubble's law)}, \tag{18}$$

where $H_0 = c/r$ is the Hubble constant, c is in km/s, and r is in Mpc. There it is! Eq. (18) is Hubble's law: *The farther a galaxy, the faster it is moving away from Earth.* We just derived it from the geometry of an expanding hypersurface. Because of Eq. (3), there is $H_0 = 1/\tau$. So, the Hubble constant isn't a constant at all. We also must be careful with the popular metaphor of an inflating balloon. The hypersurface isn't the shell of a 3D sphere.

6.8. Solving the Mystery of the Cosmological Principle

The cosmological principle says that the spatial distribution of matter in the universe is both homogeneous and isotropic when viewed on a large enough scale [25]. Our model confirms both properties: (1) The distribution of energy in the very early hypersurface was homogeneous. Hence, the spatial distribution of matter in today's hypersurface is homogeneous. (2) The spatial distribution of matter is isotropic because matter, too, is swinging equally into all three dimensions of my 3D space, but by angles $< 90°$.

6.9. Solving the Mystery of the Flat Universe

As the entire hypersurface is expanding at the speed of light (Fig. 7 left), the radial dimension disappears for any observer inside the hypersurface. Together with this dimension, the 4D curvature of the 3D hypersurface disappears, as well. He observes a *flat* 3D universe. Our situation compares to that of an ant: Since it observes only two dimensions of space, the 3D curvature of Earth's 2D surface disappears for the ant.

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6.10. Solving the Mystery of the Hubble Constant

There are several methods of calculating the Hubble constant H_0, but unfortunately the results vary from one method to another. Here we consider measurements of the CMB made with the *Planck space telescope* [26], and we compare them with calibrated distance ladder techniques (measurement of both distance and redshift of celestial objects) using the *Hubble space telescope* [27]. By taking the ES geometry into account, we will now explain why the values of H_0 calculated with either method don't match. They don't even match within the specified error margins

$$H_0 = 67.66 \pm 0.42 \text{ km/s/Mpc} \text{ according to team A [26]},$$

$$H_0 = 73.52 \pm 1.62 \text{ km/s/Mpc} \text{ according to team B [27]}.$$

Team B made efforts to minimize the error margin by optimizing the distance measurement. Yet as we will prove now, team B's value of H_0 is wrong *because of a systematic error in the redshift measurement.* Let us assume that 67.66 km/s/Mpc would be today's correct value of H_0. We simulate a supernova at a distance of $D = 400$ Mpc from Earth. From Eq. (18), we calculate

$$v_{3D} = H_0 D = 27{,}064 \text{ km/s} , \tag{19}$$

$$z = \Delta\lambda/\lambda_0 \cong v_{3D}/c = 0.0903 , \tag{20}$$

where v_{3D} is the 3D speed at which the supernova is moving away from Earth. The redshift parameter z measures how an *expanding space* (team B) or an *expanding hypersurface* (our theory) stretches the wavelength of the supernova's light.

In the next paragraphs, we demonstrate that team B will measure a higher value of z and thus calculate a higher value of v_{3D} and thus calculate a higher value of H_0. Fig. 8 left shows the geometry of the supernova and Earth in hyperspherical coordinates. We define one circle called "past" where the supernova occurred and a second circle called "present" where its light is observed on Earth. Today, that supernova has turned into a neutron star. Fig. 8 right shows the same geometry, but in Cartesian coordinates. Because both light and matter are moving at the speed of light, Earth has moved the distance D in the axis d_4 when the supernova's light arrives. So, team B is receiving data from a time $\tau = 1/H_0'$ when there was a different radius r' and a different Hubble constant H_0'

$$1/H_0' = r'/c = (r - D)/c = 1/H_0 - D/c , \tag{21}$$

$$H_0' = 74.37 \text{ km/s/Mpc} . \tag{22}$$

Because of this higher value of H_0' and Eq. (18), *all data* measured by team B are related to a higher 3D speed of the past $v_{3D}' = 29{,}748$ km/s for the same D. So, team B will measure a redshift of $z = 0.0992$ according to Eq. (20) which is indeed higher than 0.0903. Team B isn't aware of Eqs. (21) and (22) and the geometry shown in Fig. 8. Yet because of that too high value of z, team B will calculate $v_{3D}' = 29{,}748$ km/s from Eq. (20), and $H_0' = 74.37$ km/s/Mpc from Eq. (18). So, team B will conclude that 74.37 km/s/Mpc would be the correct value of *today's* Hubble constant. In truth, team B ends up with a Hubble constant *from the past* as it has been relying on redshift data from the past!

A short calculation confirms: For $D = 400$ kpc, team B's Hubble constant H_0' would deviate from team A's Hubble constant H_0 by only 0.007 percent. Yet for distances up to 500 Mpc, team B's Hubble constant is *on average* (all $0 < D < 500$ Mpc taken into account) 8 to 9 percent higher than team A's Hubble constant. So, we advise team B to improve its value of H_0 by eliminating the systematic error in the redshift measurement. Team B can easily do so by adjusting the measured v_{3D}' to the actual v_{3D}. From Eq. (21), we derive

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$$H_0' \;=\; H_0\, c \,/\, (c \,-\, H_0\, D) \;=\; H_0 \,/\, (1 \,-\, v_{3\mathrm{D}}/c)\ , \tag{23}$$

$$v_{3\mathrm{D}} \;=\; v_{3\mathrm{D}}' \,/\, (1 \,+\, v_{3\mathrm{D}}'/c)\ . \tag{24}$$

We conclude: The redshift isn't due to an expanding space, but due to an expanding hypersurface! *The redshift is caused by the Doppler effect of receding galaxies.* Because team B is calculating a Hubble constant from the past, the method of team A should be preferred: $H_0 \approx 67 - 68$ km/s/Mpc. Supposing that the universe is expanding at a constant speed c, the age of the universe in Euclidean time τ is equal to $1/H_0$. This age is about 14.5 billion years, and not 13.8 billion years [29] as claimed by the Lambda-CDM model. The adjusted age explains that there are stars out there as old as 14.5 billion years [30].

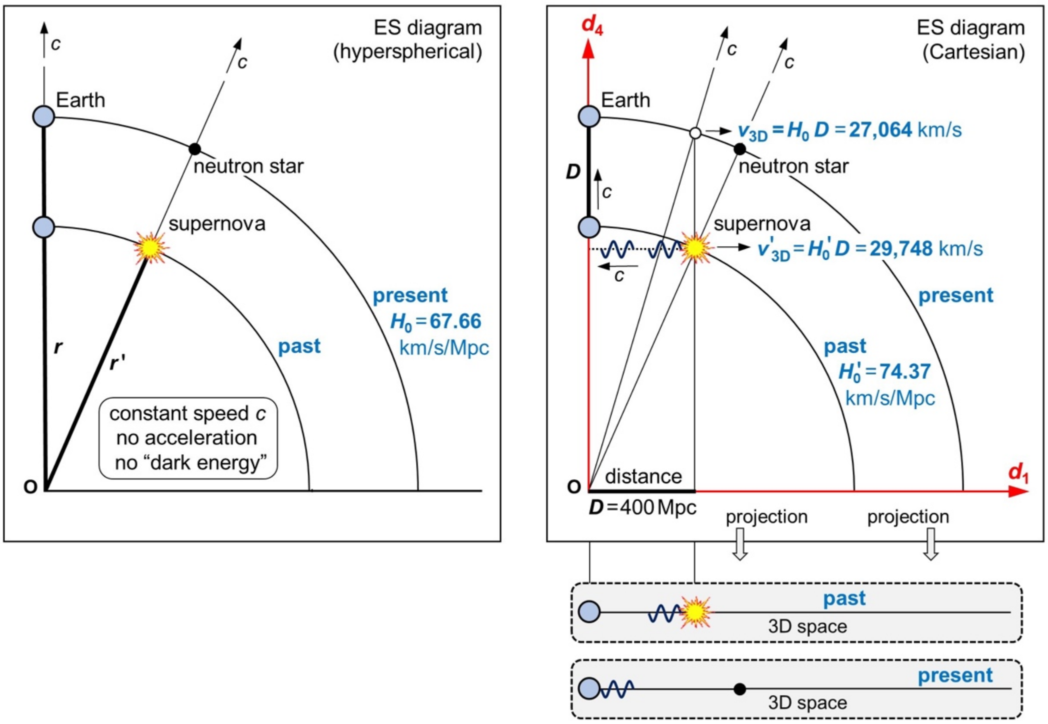

Figure 8. ES diagrams for team B's calculation of the Hubble constant. The location of the Big Bang serves as the origin O. **Left:** We suppose that 67.66 km/s/Mpc is the correct value of today's Hubble constant H_0 (present). The supernova occurred in the past when the radius r' of the hypersurface was smaller than today's radius r. **Right:** Team B observes the supernova at a distance of 400 Mpc. Since the occurrence of the supernova, Earth has moved 400 Mpc in the axis d_4. Team B calculates a Hubble constant H_0' from the past (74.37 km/s/Mpc). If a supernova occurs today in the same distance (small white circle), it recedes slower (27,064 km/s) than a supernova in the past (29,748 km/s).

In hyperspherical coordinates, there is no motion within the hypersurface. For this reason, the path of the supernova's light can't be drawn into Fig. 8 left. Motion within the hypersurface appears only in Cartesian ES coordinates (Fig. 8 right). Here the supernova's light is moving horizontally, like the light pulse in Fig. 6 right.

Of course, team B is well aware of the fact that the supernova's light was emitted in the past. Yet in the Lambda-CDM model, all that counts is the timespan Δt during which light is traveling from the supernova to Earth, thereby continuously stretching its wavelength. Hence, the total redshift is only developing during the journey to Earth. We can put it this way: For team B, the initial redshift parameter z is zero, and during the journey to Earth it increases continuously. z is an indicator for the expansion of space during the timespan Δt. The Hubble constant H_0 is just a parameter that indicates an average value of this expansion. The fact that the supernova itself occurred long ago in the past at some time t_s is irrelevant for team B's calculation.

In ES, on the other hand, the moment τ_s (when the supernova occurs) is significant, but the timespan $\Delta\tau$ (during which light is traveling to Earth) is irrelevant. The farther τ_s is in the past, the higher is the recession speed v'_{3D}, and the higher are both the redshift parameter z due to the Doppler effect and the Hubble constant H'_0 from the past. In ES, there is no expansion of space. Each supernova and all its light are moving radially and "actively" (not moved by space) away from the origin O. Each supernova is moving away from Earth, too, but in 3D space its light is traveling towards Earth (Fig. 8 right bottom). During this journey, the parameter z remains constant. Its initial value is measured when the light arrives on Earth. In ES, we can put it this way: The redshift of a supernova is tied up at the moment τ_s in some package and then sent to Earth, where it is measured.

6.11. Solving the Mystery of Expanding Space

To be able to explain the distance-dependent recession of galaxies, the concept of an expanding space has become an integral part of the CDM model. It was and still is believed that space must expand so that galaxies can recede the faster, the farther they are away from Earth. As we proved in Sect. 6.7, an expanding hypersurface readily explains Hubble's law. So, the concept of an expanding space is redundant. Space is neither inflating nor expanding, but the universe is expanding in ES.

Meanwhile, the CDM model was extended to the Lambda-CDM model with the cosmological constant *Lambda:* Cosmologists are now favoring an accelerated expansion over a uniform expansion of space [31]. This is because measured recession speeds v_{3D} of galaxies deviate from those values predicted by Hubble's law: v_{3D} is higher than predicted, and the deviations even increase with distance D. Of course, an acceleration would stretch the wavelength even more and thus increase v_{3D} according to Eq. (20). We criticize that the acceleration was added only to keep the underlying concept of MS alive.

We propose a much simpler way to explain the deviations from Hubble's law. As we can see from $H_0 = 1/\tau$, the Hubble constant is not a constant at all: The Hubble parameter H'_0 from "every past" is higher than today's value H_0. The "older" the considered redshift data are, the more will H'_0 deviate from today's value H_0, and the more will v'_{3D} deviate from v_{3D}. Until today, these deviations have been attributed to an accelerated expansion of space. Yet now we understand that they are due to the ES geometry: relying on redshift data from the past. Because the ES geometry alone explains the deviations from Hubble's law, there is no accelerated expansion of space either. We conclude: Any kind of expansion of space is only virtual!

6.12. Solving the Mystery of Dark Energy

The term "dark energy" [32] was coined to account for an accelerated expansion of space. We gave strong evidence that cosmology can do without an accelerated expansion. The universe is not driven by dark energy, but by *intrinsic energy:* Radial momentum provided by the Big Bang drives all energy away from the origin O. So, we request Occam's razor to be applied even if a Nobel Prize was given "for the discovery of the accelerating expansion of the Universe through observations of distant supernovae" [33]. We truly believe that cosmology has been misled by MS. The concept of dark energy, which has never been observed anyway, is redundant. It reminds us of speculations, like retrograde loops of planets, that were once made to keep the geocentric model alive.

In Tab. 1, we compare the Lambda-CDM model of cosmology with our new model based on ES. There are huge differences in the meaning of the Big Bang and in the concepts of universe, space, and time. In the Lambda-CDM model, "universe" is all space, all time, and all energy. In ES, "universe" is a 3D hypersurface (more precise: that volume of a 4D hypersphere which is permeated by objects). In the Lambda-CDM model, "space" is finite and deformable and that part of the universe which is permeated by objects. In ES, "space" is infinite and non-deformable. This is another reason why we disapprove of that NASA illustration in Fig. 1: It confines space, which we believe is impossible as space is infinite. In Fig. 7, we display a finite 3D hypersurface, which is possible.

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Lambda-CDM model of cosmology	Euclidean spacetime model of cosmology
Big Bang was the beginning of the universe.	Big Bang was the beginning of Euclidean time.
Big Bang occurred everywhere in today's space.	Big Bang can be localized at an origin O of ES.
Big Bang occurred about 13,8 billion years ago.	Big Bang occurred about 14,5 billion years ago.
Universe is all space, all time, and all energy.	Universe is a 3D hypersurface.
Space is finite and deformable.	Space is infinite and non-deformable.
Space is expanding non-uniformly.	Space does not expand.
Space is driven by dark energy.	Universe is driven by radial momentum.
"Time is what I read on my watch." (Einstein)	Time is radial distance from origin O divided by c.
Time flows uniformly and in one direction.	Time flows uniformly and in many directions.
There are two competing calculations of H_0.	H_0 is approximately 67–68 km/s/Mpc.

Table 1. Comparing the Lambda-CDM model of cosmology with our model based on ES.

6.13. Solving the Mystery of the Wave–Particle Duality

We can't tell which solved mystery is the most important one. Yet the wave–particle duality has certainly kept physicists busy since it was first discussed by Niels Bohr and Werner Heisenberg [34]. The Maxwell equations tell us that electromagnetic waves are oscillations of an electromagnetic field that move through 3D space at the speed of light. In some experiments, objects behave like "waves" (electromagnetic wave packets). But in other experiments, the same objects behave like particles. In MS, an object can't be both at once because waves distribute energy in space over time, whereas the energy of particles is localized in space at a given time. By combining our two new concepts of distance and wavematter, we will now demonstrate: *In ES, waves and particles are the same thing (energy), but seen from two perspectives.* For the avoidance of doubt, "wavematter" isn't just another word for the duality. Wavematter is a generalized concept of energy, which discloses why there is wave–particle duality in an observer's 3D space (in his reality).

Fig. 9 illustrates in Cartesian ES coordinates what our new concept of wavematter is all about. If I observe a wavematter (we call it the "external view"), that wavematter comes in four orthogonal dimensions: It propagates in my axis d_1 at some speed $v_{3D} \leq c$, and it oscillates in my axes d_2 (electric field) and d_3 (magnetic field); propagating and oscillating are functions of Euclidean time τ (related to my fourth axis d_4). So, I can observe how that wavematter is propagating and oscillating: *I deem it wave.*

From its own perspective (we call it the "internal view"), that wavematter propagates in its axis d'_4 at the speed c. Yet because of length contraction at the speed c, the axis d'_4 (its flow of time) is suppressed for that wavematter. So, all propagating and all oscillating disappears for itself: *It deems itself matter at rest.* We thus conclude that there is an external view and an internal (in-flight) view of each wavematter. In MS, a photon doesn't have a perspective of its own because there is no reference frame moving at the speed c.

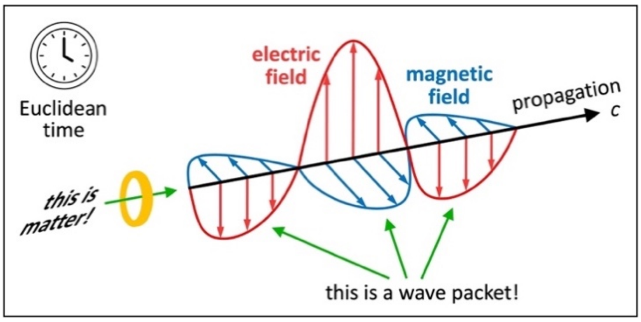

Figure 9. Concept of wavematter in Cartesian ES coordinates. Artwork illustrating how the same object can be deemed wave or matter. Wavematter comes in four dimensions: propagation, electric field, magnetic field, and Euclidean time. Each wavematter deems itself matter (internal view). If it is observed by some other wavematter (external view), it is deemed electromagnetic wave packet.

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As an example, we now investigate the symmetry in three wavematters WM_1, WM_2, and WM_3. We assume that they are all moving away from the same point P in ES and at the speed of light, but in different directions (Fig. 10 top left). d_1, d_2, d_3, d_4 are Cartesian coordinates in which WM_1 moves only in d_4. So, d_4 is that axis which WM_1 deems time multiplied by c, and d_1, d_2, d_3 span WM_1's 3D space (Fig. 10 bottom left). As the axis d_4 disappears because of length contraction, WM_1 observes neither time nor propagation: It deems itself matter at rest (M_1).

WM_3 moves orthogonally to WM_1. d'_1, d'_2, d'_3, d'_4 are Cartesian coordinates in which WM_3 moves only in d'_4 (Fig. 10 top right). In this case, d'_4 is that axis which WM_3 deems time multiplied by c, and d'_1, d'_2, d'_3 span WM_3's 3D space (Fig. 10 bottom right). As the axis d'_4 disappears because of length contraction, WM_3 observes neither time nor propagation: It also deems itself matter at rest (M_3).

Yet how do WM_1 and WM_3 move in each other's view? We must fulfill our postulates and the requirement that they both started at the same point P. There is only one way to draw ES diagrams (Fig. 10 top left and top right) that fulfill all requirements: We must rotate the two frames of reference with respect to each other. Only a rotation guarantees that the situation is symmetric, so that the equations describing the laws of physics have the same form! Because of the rotation, WM_3's 4D motion swings completely into WM_1's 3D space. So, WM_3 moves at the speed c in d_1, d_2, d_3 and is deemed wave (W_3) by WM_1. Vice versa is WM_1 deemed wave (W_1) by WM_3.

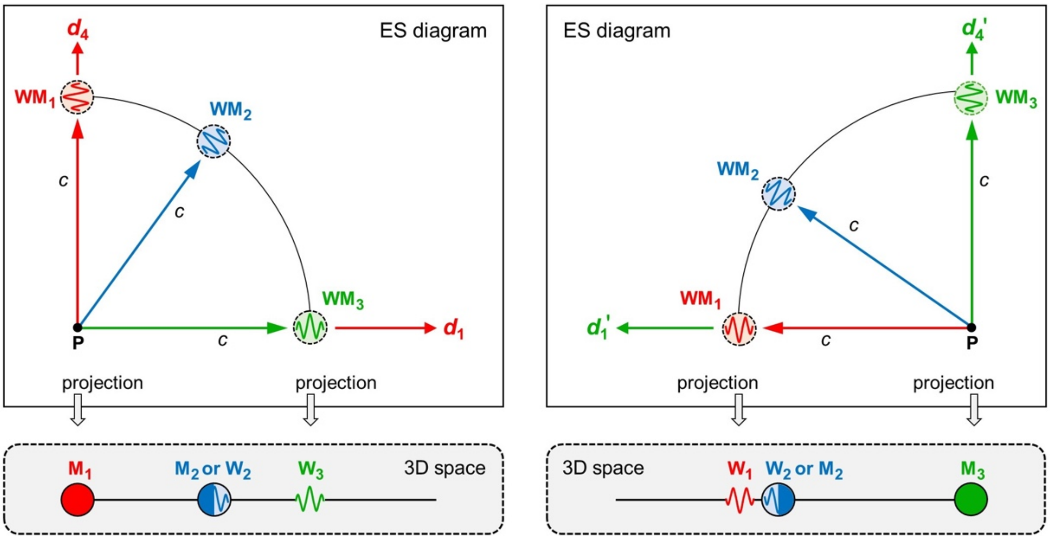

Figure 10. ES diagrams and 3D projections for three wavematters moving away from the same point P. **Top left:** ES in the coordinates d_1, d_2, d_3, d_4 in which WM_1 moves in d_4. d_1 stands for d_1, d_2, d_3. **Top right:** ES in the coordinates d'_1, d'_2, d'_3, d'_4 in which WM_3 moves in d'_4. d'_1 stands for d'_1, d'_2, d'_3. **Bottom left:** Projection to WM_1's 3D space. WM_1 deems itself matter (M_1) and WM_3 wave (W_3). **Bottom right:** Projection to WM_3's 3D space. WM_3 deems itself matter (M_3) and WM_1 wave (W_1).

And what is WM_2 deemed by WM_1 and WM_3? For the answer, we split WM_2's 4D motion into a motion parallel to WM_1's motion (here WM_1 is viewing WM_2 internally) and a motion orthogonal to WM_1's motion (here WM_1 is viewing WM_2 externally). WM_1 can thus deem WM_2 either matter (M_2) or wave (W_2), but not both at once. WM_3 can likewise deem WM_2 either matter or wave, but not both at once.

The secret to understanding our two new concepts "distance" and "wavematter" is all in Fig. 10. Here we see how they go hand in hand: We claim the symmetry of all four Cartesian coordinates in ES and—on top of that—the symmetry of all objects in ES. *What I deem wave, deems itself matter.* I conceive of waves as "energy passing by", and each object that I deem wave conceives of me as "energy passing by". Just as distance is space and time in one, so is wavematter wave and matter in one. Strictly speaking, wave and matter are not two! Here is a compelling reason for this outstanding claim of our theory: Albert

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Einstein taught us that energy is equivalent to mass. *Full symmetry of matter and waves is a consequence of the mass–energy equivalence.* As the axis d_4 disappears because of length contraction, energy in a propagating wave "condenses" to mass in matter. In MS, there is no such symmetry. Hence, we have the same issue here that we already discussed in Sect. 2: In Einstein's relativity (SR and GR), there is no superordinate frame of reference in which all objects ("at rest" and propagating) are treated alike. In ES, all wavematters are treated alike. *Only in an observer's 3D space is a wavematter deemed wave or matter.*

With all this insight, we are now prepared to bring light into the concept "photon". It actually stems from a misinterpretation of the wave–particle duality. The term "photon" was coined to explain this duality from the perspective of an observer, that is, from just one perspective: An observer can—depending on the experiment—confirm that electromagnetic radiation is either wave or photon. Yet the wave–particle duality is a matter of two perspectives. In ES, each wavematter (each photon, too) has a perspective of its own. We repeat a statement from above, but replace "matter" with "particle": *What I deem wave, deems itself particle.* We now break the spell on the wave–particle duality in its two flagship experiments: the double-slit experiment and the outer photoelectric effect.

In a double-slit experiment, an observer detects coherent waves passing through a double-slit and producing some pattern of interference on a screen. We already know that he observes wavematters from ES whose 4D motion swings by an angle of 90° into his 3D space. He deems all these wavematters waves because he isn't tracking through which slit each wavematter is passing. If he did, the interference pattern would disappear immediately. *So, he is a typical external observer.* Experiments with low-noise video cameras have also been performed [35]. Their results confirm our theory: There is interference of waves if photons aren't tracked. Yet once we discuss this experiment *from the internal view* of each wavematter ("Which CCD pixel will detect me?"), it behaves like a particle.

The outer photoelectric effect is quite different. Of course, we can externally witness how one photon is releasing one electron from a metal surface. But the physical effect itself ("Do I have enough energy to release one electron?") is all up to the photon's view. Only if its energy exceeds the binding energy of an electron is that electron released. Hence, we *must* interpret this experiment from the internal view of each wavematter. Here its view is crucial! It behaves like a particle which we nowadays call "photon".

The wave–particle duality has also been observed in matter, like electrons [36]. How can they behave like waves in a double-slit experiment? According to our third postulate, all energy is wavematter. So, electrons are wavematter, too. From the internal view, each electron is a particle ("Which slit will I go through?"). From the external view, when they aren't tracked, electrons are waves. In ES, all wavematters are moving at the speed of light, regardless of whether we deem them waves or matter. It all depends on the swing angle whether I deem a wavematter either wave (90°) or matter ($< 90°$) in my 3D space. Fig. 10 even tells us why I deem macroscopic wavematters matter: Their speed in 3D space is low compared with the speed of light thus favoring the internal view. This argument justifies drawing solid rockets and celestial bodies in our ES diagrams.

6.14. *Solving the Mystery of Quantum Entanglement*

The term "entanglement" [37] was coined by Erwin Schrödinger when he published his comment on the Einstein–Podolsky–Rosen paradox [38]. The three authors argued in a thought experiment that quantum mechanics wouldn't provide a complete description of reality. John Bell proved that quantum mechanics is incompatible with local hidden-variable theories [39]. Schrödinger's word creation didn't solve the paradox, but demonstrates up to the present day the difficulties that we have in grasping quantum mechanics. Many experiments have confirmed that entangled particles violate the classical concept of locality [40–42]. Ever since has entanglement been considered a non-local effect.

We will now "untangle" quantum entanglement *without* the issue of non-locality. All we need to do is discuss quantum entanglement in ES. Fig. 11 illustrates two wavematters that were created at once in the same point P and move away from each other in opposite

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directions at the speed c. We assume that they are entangled (for example, they were created in a non-linear crystal in P). One wavematter moves in the positive axis d_4, the other one in the negative axis d_4. If they are observed by a third wavematter in its own 3D space spanned by d_1', d_2', d_3', they are deemed two objects, especially if they are already far away from each other. That third wavematter can't understand how the entangled wavematters can communicate with each other in no time. This is again the external view.

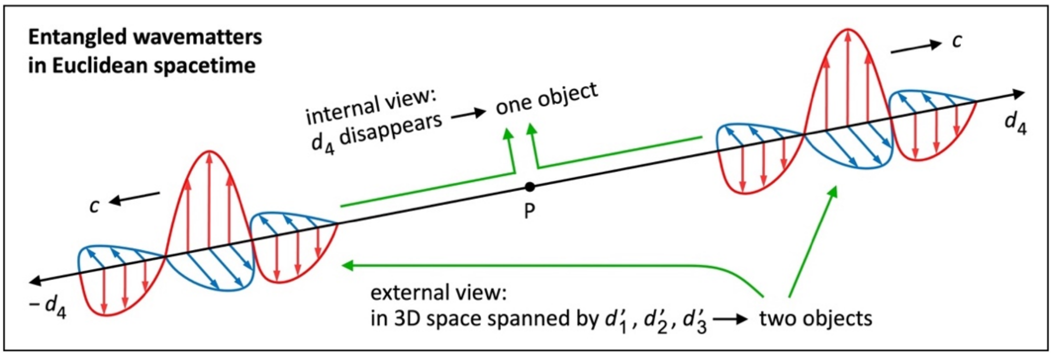

Figure 11. Quantum entanglement in ES. Artwork illustrating internal view and external view. For each wavematter (internal view), the axis d_4 disappears because of length contraction. It deems its twin and itself one object. For a third wavematter (external view) that is not moving in the axis d_4, the axis d_4 doesn't disappear. It deems them two objects.

And here comes the internal (in-flight) view in ES: For each entangled wavematter in Fig. 11, the axis d_4 disappears because of length contraction at the speed c. That is to say: In the projection to its own 3D space spanned by d_1, d_2, d_3, either wavematter deems itself at the same position as its twin. *From their common perspective, they have never been separated.* This is why they communicate with each other in no time! Our solution to entanglement isn't limited to photons. According to our second postulate, everything is moving through ES at the speed c. Hence, electrons or atoms can be entangled, too. They move at a speed $v_{3D} < c$ in my 3D space, but in their axis d_4 they also move at the speed c.

6.15. Solving the Mystery of Spontaneity

In *spontaneous emission,* a photon is emitted from an excited atom. Prior to the emission, the photon's energy was moving with the atom. After the emission, that energy is moving by itself. MS can't explain how that energy is boosted to the speed c in no time. In ES, both atom and photon are moving at the speed c. So, there is no need to boost any energy to the speed c. All it takes is energy whose 4D motion swings by an angle of $90°$ into an observer's 3D space, and that energy is able to speed off at once.

In *absorption,* a photon is spontaneously absorbed by an atom. Here MS can't explain how the energy of that photon is slowed down in no time to become part of an atom. In ES, both photon and atom are moving at the speed c. So, there is no need to slow down any energy to the speed of an atom.

In *pair production,* two gamma photons convert into a subatomic particle and its antiparticle, like an electron and a positron. Here MS can't explain how the energy of the two gamma photons is slowed down in no time to become matter and antimatter. In ES, all objects are moving at the speed c. So, there is no need to slow down any energy.

In *annihilation,* a subatomic particle and its antiparticle, like an electron and a positron, convert into two gamma photons. Here MS can't explain how the energy of matter and antimatter are boosted to the speed c in no time. In ES, all objects are moving at the speed c. So, there is no need to boost any energy to the speed c.

All these spontaneous effects are another clue that everything is moving through ES at the speed of light. Our concept of wavematter even explains why the two gamma photons created in an annihilation process are entangled [43]: In their common 3D space (in their reality), they have never been separated.

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6.16. Solving the Mystery of How to Unify Relativity and Quantum Mechanics

In the last decades, physicists have been trying to unify GR and quantum mechanics. We demonstrated that a "system at rest" is the catch in Einstein's relativity. GR is incompatible with quantum mechanics because there is nothing at rest at the microscopic level. ES has the power to solve mysteries that today's physics either didn't solve (for example, the two competing values of the Hubble constant and the wave–particle duality), or that is has solved, but with concepts that we proved to be redundant (for example, dark energy and non-locality). Solving mysteries in cosmology and in quantum mechanics shows that ES improves our understanding of both. From all this insight, we conclude: *We must not unify GR with quantum mechanics, but Euclidean relativity with quantum mechanics.*

7. Conclusions

For the first time on Earth, living things understand what time is all about. We live in the 3D hypersurface of an expanding 4D hypersphere. Its radius, divided by the speed of light, is time. We—two physicists—felt spontaneously that our discovery is a paradigm shift in both physics and philosophy. It felt like "wow!" Just imagine: The human brain is able to grasp the idea that we are all moving through Euclidean spacetime at the speed of light. *With this in mind, conflicts of mankind become all so small.*

We introduced two new concepts to physics: "distance" (space and time in one) and "wavematter" (electromagnetic wave packet and matter in one). Interestingly, there is the same symmetry in either concept: In Cartesian ES coordinates, it is not predefined for all objects alike which axial distance d_i relates to time. We are free to label all four axes. The decision "space or time?" is made by projecting ES to 3D space. Also, it is not predefined in ES whether a wavematter is wave or matter. The decision "wave or matter?" is made again by projecting ES to 3D space. My reality is formed by projecting ES to my 3D space. Only then does my 4D motion disappear due to length contraction at the speed c.

We solved 16 fundamental mysteries which can be taken as 16 proofs for our theory: (1) time, (2) time's arrow, (3) length contraction, (4) time dilation, (5) mc^2, (6) isotropy of the cosmic microwave background, (7) Hubble's law, (8) cosmological principle, (9) flat universe, (10) Hubble constant, (11) expanding space, (12) dark energy, (13) wave–particle duality, (14) quantum entanglement, (15) spontaneity, and (16) how to unify relativity and quantum mechanics. As non-cosmologists, we had an advantage in setting up our theory because we aren't caught up in Einstein's relativity. For a quantum leap in understanding, we must overcome traditional thinking. Einstein sacrificed the absoluteness of space and time. We sacrifice the absoluteness of waves and matter. Quantum leaps can't be planned. They happen like the spontaneous emission of a photon. ☺

Textbooks must now be rewritten: (1) There is absolute Euclidean time. (2) Space and time are not two, but one [20]. (3) Wave and matter are not two either, but one. We owe Einstein a great debt of gratitude for his theories of relativity, yet even he could not overcome the thinking in both space and time. We explained our new concepts and confirmed how powerful they are. We can even tell the source of their power: beauty and symmetry! Once you have cherished this beauty, you will never let it go again. It is not by chance that we solved many mysteries at once. Only a Theory of Everything has the power to do so. It is impossible to address all of physics in one report, but we encourage our colleagues to solve even more mysteries. Hopefully, our graphical solutions will contribute to a better understanding of physics. We are confident that—based on our pioneering work—there will be new approaches to a Grand Unified Theory based on Euclidean time.

Author Contributions: Markolf has a Ph.D. in physics and is a full professor at Heidelberg University, Germany. He studied in Frankfurt, Heidelberg, at UC San Diego, and Harvard. He contributed the concepts "distance" and "wavematter", absolute Euclidean time, and the Theory of Everything. Siegfried taught physics and mathematics at the Waldorf School in Darmstadt, Germany. He contributed that Minkowski diagrams aren't in line with experimental physics and the Hubble constant. Everything else was solved together.

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