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Abstract: Similarly to his special theory of relativity, Einstein's special principle of relativity extends beyond the limits currently known to it. Up to now, the principle has not been suspected to have the potential to translate laws. However, the principle holds an inherent capacity to translate physical laws and, in so doing, speeds up our understanding and control of physical reality. Such a translation of laws leads to the faster discovery of other laws, such as the Laws of Electronic Motion, characterizing the motion of electrons around the atomic nucleus, and the Third Law of Biological Resistance, facilitating the successful control of drug resistance in medicine. The ability of the special principle of relativity to translate laws shines forth once the said principle is duly interpreted. This interpretation exposes a parallelism between experimental frames of reference and justifies the applicability of the laws of one frame of reference in other parallel frames of reference. This process opens the door to our faster discovery of the laws governing a multiplicity of frames parallel to a frame we already know the laws of. In practice, the interpretation of Einstein's special principle of relativity speeds up our understanding of the workings of physical reality and strengthens our capacity to subdue matter.

Keywords: relativity; special principle; space-time; translation; parallelism; parallel; reference frame; successful control; law

Introduction

Contrary to what was thought up until recently, Einstein's special theory of relativity holds a potential greater than has so far been suspected. Theoretical mathematicians have, in fact, shown that, once extended, Einstein's special theory of relativity remains true for speeds greater than the speed of light in a two-dimensional space-time reference frame [1–3]. Similarly, the special principle of relativity holds a potential greater than has so far been suspected. Up to now, the principle has been understood as being valid and applicable to (physical) inertial reference frames only. However, the principle remains valid beyond those traditional reference frames. The principle remains valid beyond those traditional inertial reference frames because the *parallelism of frames* is an integral part of this physical universe—and possibly of the multiverse as well [4,5]. Once we become aware of this fundamental feature and apply the known characteristics of a given frame to another distinct but *parallel* frame, we literally gain deeper insights into and a better understanding of the behavior of matter in the new frame under consideration, as well as an increased capacity to successfully control this matter. These *parallelisms* and the applicability of the laws of one frame of reference to other multiple but *parallel* frames of reference allow Einstein's special principle of relativity to take on a new dimension, so far unsuspected, which speeds up and strengthens our understanding and our ability to successfully subdue physical reality and the matter involved therein. Beyond atomic physics, another area of applicability of the translation of laws is infectious diseases medicine wherein the translation of Newton's Third Law of Motion from the Classical Mechanics reference frame into the Medical reference frame points to one of the major steps that <u>must</u> be taken to finally overcome antibiotic resistance in medicine [6].

Methods

Einstein's special principle of relativity is interpreted and extended to experimental reference frames—beyond the space-time reference frame traditionally assigned to it. This interpretation uses the *parallelism* occurring between multiple frames of reference as *the* required condition for the applicability of physical laws across all such *parallel* frames.

Results and Discussion

1.1. Parallelism of Frames and the Interpretation of Einstein's Principle

To begin with, we ought to reckon that physical laws tend to find analogies in areas other than their original area of enunciation, as reflected by the set of isomorphic laws discussed below. This is potentially the result of the physical universe functioning according to one and a single blueprint which takes on varying hues as we move from one area of scientific investigation to another. The applicability of physical laws in areas other than their original area of enunciation is encapsulated in Einstein's special principle of relativity, which states:

"Physical laws remain the same in all inertial reference frames," [7]

which, diluted, means:

"If a system of coordinates K is chosen so that, in relation to it, physical laws hold good in their simplest form, the <u>same</u> laws hold good in relation to any other system of coordinates K' moving in uniform translation relatively to K." [8,9]

(*Emphasis original*)

The special principle of relativity has so far been understood as referring only to inertial reference frames while it, in fact, finds applications in more than just inertial reference frames. However, as we acknowledge that the 'reference frames' Einstein referred to are not just *physical* or *inertial* frames of reference but include multiple <u>*types*</u> of frames, so do we have to reckon that 'translation,' as he put it, does not mean just literal *physical* translation. Indeed, *translation* here refers to any existing <u>*parallelism*</u> between the multiple reference frames in presence.

As an example, Darcy's Law in fluid dynamics holds in heat conduction by having analogies with Fourier's Law of Heat Conduction. Then, Fourier's Law holds in electrical science by having analogies with Ohm's Law of Electrical Resistance. Then, Ohm's Law holds in diffusion theory by having analogies with Fick's Law of Diffusion; so forth. In other words, although Einstein's special principle of relativity has traditionally been understood to describe only *space-time* reference frames, it does describe more than just space-time reference frames. Beyond space-time frames, the *types* of frames the principle refers to also include what can be called '*experimental reference frames.*' And the '*uniform translation*' condition stated in the principle, in addition to referring to *physical* translation, also means the <u>*replication*</u> of <u>*all*</u> the defining experimental characteristics of one *experimental* reference frame in another *experimental* reference frame. This gives rise to a form of *parallelism* between the *experimental* reference frames in presence. Then, this *parallelism* subsequently allows the laws of one *experimental* reference frame to hold true and, therefore, stay applicable, sometimes upon slight adjustments of coefficients, in another *experimental* reference frame *parallel* to the former. This causes Einstein's special principle of relativity to remain valid beyond actual *physical* translation and beyond *space-time* reference frames and to cover other types of frames among which *experimental* reference frames.

As stated, *uniform translation* in *experimental* reference frames takes the form of <u>*replication*</u> of <u>*all*</u> of the defining characteristics of one *experimental* reference frame into another *experimental* reference frame. *Translation* means that there occurs a <u>*replication*</u> of the defining experimental features of one reference frame into the second reference frame, and then the translation is *uniform* because the replication involves <u>*all*</u> of the defining features of the first reference frame.

As an illustration, let us consider Darcy's Law which describes groundwater flow in a soil medium and Ohm's Law which describes the flow of electrons in an electrical wire. We know that the mathematical expressions of those two laws (as in the case of Fourier's, Hopkinson's, and Fick's Laws) show analogies or resemblance, as can be seen in their expressions below. However, beyond

the analogies observable in their mathematical expressions, the construct or design of each experimental frame does show analogies with the construct or design of the other experimental frame, as explained below.

Darcy's Law

Darcy's Law [10] is a relationship between the discharge rate of water through a porous medium and the hydraulic conductivity of the said medium, the cross-sectional area of the flow, and the pressure drop between point *a* and point *b* over a given length of the medium [11]:

$$Q = -KA(P_b - P_a)/L$$

where:
Q = discharge rate
K = hydraulic conductivity
A = cross-sectional area
$P_b - P_a$ = pressure drop between point a and point b (expressed in height or depth of water)
L = length traveled
The flux, q, which is discharge per unit area (m/s), is obtained by dividing Q by the cross-sectional area:

$$q = -K\nabla P$$

where ∇P is the pressure gradient vector.

Ohm's Law

Ohm's Law [12] relates the current between two points of an electrical conductor to the potential difference across those two points. It states that the current is directly proportional to the potential difference across the two points and inversely proportional to the resistance between them:

$$I = V/R$$

where:
I = current
V = voltage or potential difference across the conductor
R = resistance of the conductor
NB: The negative sign is absent but is incorporated into the direction of the potential difference i.e., the potential difference between two points a and b is such that $(V_b - V_a) = -(V_a - V_b)$.

Hopkinson's Law

Hopkinson's Law [13] relates the magnetomotive force across a magnetic element to the magnetic flux through the element by means of the magnetic reluctance of that element:

$$\emptyset = \frac{F}{R_m}$$

where:
Ø = magnetic flux
F = magnetomotive force across the magnetic element
R_m = magnetic reluctance (or resistance) of the element

Fourier's Law

In Fourier's Law [14], the local heat flux density is equal to the product of thermal conductivity and the negative local temperature gradient, $-\nabla T$:

$$q = -K\nabla T$$

where:
q = local heat flux
K = conductivity of the material
∇T = temperature gradient

Fick's Law

In Fick's First Law [15], the diffusion flux is related to the concentration, with a magnitude proportional to the concentration gradient:

$$J = -D\frac{\partial \emptyset}{\partial x}$$

where:
J = diffusion flux
D = diffusion coefficient
Ø (for ideal mixtures) = concentration
In two or more dimensions, *J* becomes:

$$J = -D\nabla \emptyset$$

As can be seen, the five laws, through their respective equations, are isomorphic / analogous with each other.

Let us now zoom into just Darcy's and Ohm's Laws. Here, we are in the presence of two *experimental* frames of reference: water and soil in one, and then electrons and wire in the other. Because we are in the presence of two reference frames, Einstein's special principle of relativity will apply if the dual conditions of *uniformity* of *translation* are met. In fact, the first condition, that of the *translation* (or *replication* of the key features) of one reference frame into the other reference frame, is met: here, *flowing water* in the first reference frame is replicated in the second reference frame as *flowing electrons, soil medium* in the first is replicated in the second as *wire medium, soil particles* in the first are replicated in the second as *atom particles, soil pores* in the first are replicated in the second as *space within atom lattices,* and *resistance* offered by the soil medium to the flow of water in the first is replicated in the second as *resistance* offered by the wire medium to the flow of electrons. So, the first condition (*translation*) is met because we are in the presence of two *experimental* reference frames in which there occurs a *replication* of the defining features of one into the other.

However, the second condition, that of *uniformity* of the translation, is also met because the translation involves *all* of the defining features of any one reference frame into the other reference frame—meaning that if the replication or translation had been partial and had involved just a few of the defining features [for example, if there is replication of the soil particles of the first reference frame as atom particles in the second reference frame but *nothing* is flowing in the second reference frame], then there would be translation but then that translation would *not* have been *uniform* and, therefore, Einstein's principle would not and cannot apply. However, in this case, *all* of the defining characteristics of one reference frame are *translated* (*replicated*) into the second reference frame. Therefore, both conditions (*uniformity* of *translation*) are met. Both conditions being met, the special principle of relativity applies and the same law *'holds good,'* as Einstein put it, in *all* of those reference frames—barring an adjustment of coefficients where necessary. In fact, the English phrase *'holds good'* as used in the enunciation of Einstein's principle [7–9] does mean that the law in question might not remain exactly the same in the second reference frame as it is in the first and that some adjustments, as in the case of coefficients, may be necessary.

The foregoing analysis between Darcy's Law and Ohm's Law applies equally to the other laws in the set listed above. As another illustration, let us compare Ohm's Law and Fourier's Law:

Observations of an analogy between Ohm's Law and Fourier's Law have also been reported by other observers, as follows:

*"Ohm's principle predicts the flow of electrical charge (i.e. current) in electrical conductors when subjected to the influence of voltage differences. Jean-Baptiste-Joseph Fourier's principle predicts the flow of heat in heat conductors when subjected to the influence of temperature differences. The **same** equation describes both phenomena, the equation's variables taking on different meanings in the two cases. Specifically, solving a heat conduction (Fourier) problem with temperature (the driving "force") and flux of heat (the rate of flow of the driven "quantity", i.e. heat energy) variables also solves an analogous electrical conduction (Ohm) problem having electrical potential (the driving "force") and electric current (the rate of flow of the driven "quantity", i.e. charge) variables."*   [16] —Emphasis added.

Furthermore, the following additional observation is also made:

"By comparing the steady state heat flow equation with Ohm's Law for current flow through a resistor, we see that they have similar forms:

$$q = \frac{KA}{\Delta x}(T_1 - T_2) \qquad \longleftrightarrow \qquad I = \frac{1}{R}(V_1 - V_2)$$

"We can therefore draw the following analogies:

Heat Flow, Q	$\longleftrightarrow$	[Electron flow =] Current, I
Temperature Difference, T_1 - T_2	$\longleftrightarrow$	Voltage Difference, V_1 - V_2
Thermal Resistance, $R_T = \Delta x/K*A$	$\longleftrightarrow$	Electrical Resistance, $R_E = \Delta V/I$

"The electric-to-heat conduction analogy allows one to apply laws from circuit theory to solve more complicated conduction problems, such as heat flow through conducting layers attached in parallel or series." [17].

Similar analogies can be observed between Fick's Law and any of the remaining laws, and, generally, between any two of the five laws. Furthermore, similar analogies exist between other scientific laws whose *experimental* reference frames share design analogies. Essentially, it is *one fundamental expression* of a law which 'mutates' as it gets displaced or translated, taking on various forms from one experimental reference frame to another parallel experimental reference frame.

This principle is further illustrated in physics with the classical mechanics and quantum mechanics duo. Here, the Hamilton–Jacobi equation is known to allow the motion of a solid particle to be represented as the motion of a wave—although a wave is not a solid particle. As such, the Hamilton–Jacobi equation establishes an analogy between the propagation of light (which is a wave) and the motion of a particle (which is solid) [18]. Here as well, we are in the presence of two phases: a dense, solid phase and then a subtle, ethereal phase. Those are two experimental reference frames to which the principle can apply if they are parallel with each other. Then, it can be observed that the two conditions required for the principle to apply are met: a) the reference frames are in *translation* one in relation to the other and b) the said translation is *uniform*.

There is *translation* because there is a replication of the features of one reference frame into the other reference frame: 1) an object is involved in each reference frame: a solid particle in one and a photon in the other, 2) travel/motion occurs in both frames, and 3) the motion occurs in 3-D in both

frames. So, the defining features of each frame are replicated in the other frame, and the first condition (*translation*) is therefore met. However, the said translation is *uniform* because the replication does involves *all* of the defining features (all three listed) of each reference frame. As a result, the second condition (*uniformity*) is also met, and we therefore have a *uniform translation*. Consequently, the special principle of relativity applies and the same equation holds true in both the Classical Mechanics and Quantum Mechanics reference frames [19,20].

A further illustration is found in attractive/repulsive forces. Here, two types of forces are in presence: the one in Newton's Law of Universal Gravitation and the one in Coulomb's Law of Electrostatic Interaction.

Newton's Law of Universal Gravitation states: *"Every point mass attracts every single other point mass by a force pointing along the line intersecting both points. The force is proportional to the product of the two masses and inversely proportional to the square of the distance between them."* [21]. That means that any two bodies 1 and 2, respectively of mass M_1 and M_2, attract each other with a force F given by:

$$F = g\frac{M_1 M_2}{r^2}$$

where:
g = gravitational constant
M_1 = mass of object 1
M_2 = mass of object 2
r = separation distance

On the other hand, Coulomb's Law states: *"The magnitude of the electrostatics force of interaction between two point charges is directly proportional to the scalar multiplication of the magnitudes of charges and inversely proportional to the square of the distances between them."* [22]. That means that any two electrical point charges 1 and 2, respectively with charges Q_1 and Q_2, attract or repulse each other with an electrostatic force F' given by:

$$F' = k\frac{Q_1 Q_2}{r'^2}$$

where:
k = proportionality constant
Q_1 = magnitude of point charge 1
Q_2 = magnitude of point charge 2
r' = separation distance

In those two experimental reference frames, there is evident analogy between the two equation laws. This analogy, also called *parallelism* between the electrostatic and gravitational fields, has also been reported by other observers [23].

Here, there is *uniform translation* of one experimental reference frame in relation to the other. The first condition, the *translation* condition, is met because there is replication of the defining characteristics of one experimental reference frame in the other experimental reference frame: 1) two objects are involved in both frames, 2) a distance separates both objects in either frame, 3) interaction is taking place between the two objects involved in either frame, and 4) force is present in both frames. As a result, the *translation* condition is met. But the translation is *uniform* because the replication involves *all* of the defining features (all four listed) of each reference frame. Consequently, the second condition, the *uniformity* condition, is also met, and there is therefore *uniform translation*. As a result, the special principle of relativity applies and, as can be observed, the law of each reference frame holds in the second reference frame.

In particular, the force F_1 exerted on an object of mass *m* in a gravitational field *g* is given by [24]:

$$F_1 = mg$$

while the force F_2 exerted on an electrical charge q in an electric field E is given by [25]:

$$F_2 = qE$$

As before, there are two experimental reference frames: one characterized by a mass and the other characterized by an electrical charge. Because two frames are in presence, the principle will apply if the dual conditions of *uniformity* of *translation* are met. Indeed, there is *uniform translation* of one frame in relation to the other. There is *translation* because there is a replication of the defining characteristics of one experimental reference frame in the other experimental reference frame: 1) an object is involved in both frames, 2) the attribute of each object is involved: *mass* in the first and *charge* in the second, 3) a field is present in either frame, 4) force is exerted on each object in both frames. Therefore, the first condition (*translation*) is met. And the translation is *uniform* because the replication involves *all* of the defining characteristics (all four listed) of each frame. As a result, the second condition (*uniformity*) is also met, and we do have *uniform translation*. Consequently, the special principle applies and, as can be observed, the law of each reference frame holds in the other one.

Let us consider yet another illustration: Springs.

In the experimental reference frame made up of a linear spring and an applied force which compresses it, the potential energy stored in that spring is given by [26]:

$$E_s = \frac{1}{2} kx^2$$

where:
E_s = energy
k = spring constant
x = linear displacement

In the experimental reference frame made up of a torsion spring and an applied force which deploys a torque twisting it, the potential energy stored in that spring is given by [27]:

$$U = \frac{1}{2} k\theta^2$$

where:
U = energy
k = torsion constant
θ = angular displacement

Here again, there are two experimental reference frames: one characterized by a torsion spring and the other characterized by a linear one. Because two frames are in presence, the principle will apply if the dual conditions of *uniformity* of *translation* are met. Indeed, there is *uniform translation* of one frame in relation to the other. There is *translation* because of there is replication of the defining characteristics of one frame into the other frame: 1) a spring is involved in both reference frames, 2) energy is stored in both reference frames, and 3) displacement occurs in both reference frames: angular in one and linear in the other. Therefore, the first condition (*translation*) is met. However, the translation is also *uniform* because the replication involves *all* of the defining characteristics (all three listed) of each frame. As a result, the second condition (*uniformity*) is also met, and there occurs a *uniform translation*. Consequently, the special principle of relativity applies and, as is observable, the law of each reference frame holds in the other reference frame.

The isomorphism between the above laws is encapsulated in Einstein's special principle of relativity. In fact, the special principle of relativity has already been found to be such that multiple meanings and interpretations can be derived from it for various conditions [9 and references therein]. Here, we introduce an additional interpretation of Einstein's special principle of relativity as it specifically pertains to *parallel* experimental reference frames. In that regard, in the above discussed laws, one experimental reference frame is a *uniform* replicate of the other reference frame, however

in another experimental 'dimension.' This phenomenon of *uniform replication* of features causes the laws of one experimental reference frame to stay valid in the other experimental reference frame—barring coefficients. Although the replication process takes the form of what Einstein called *'uniform translation'* in the *space-time* reference frame that he investigated, *'parallelism'* is perhaps a better terminology for *experimental* reference frames. The analogies observed in the series of laws discussed above (and in others not discussed here) show that the principle remains valid in *experimental* frames of reference, beyond the traditional *space-time* frames of reference. Consequently, we interpret Einstein's special principle of relativity specifically for *experimental* reference frames and submit the interpretation that follows:

➢ **Interpreted Einstein's Special Principle of Relativity for Experimental Reference Frames**

   "Parallel experimental reference frames are governed by the same or similar laws."
   This pattern of applicability of the laws of a given experimental reference frame to other parallel reference frames is observable through the various manifestations of the physical universe. Illustrating this phenomenon, the ability of the principle to translate laws, with its associated capacity to accelerate the discovery of other laws, is manifest in the experimental reference frames made up by the solar system (Astronomy) and atoms (Atomic Physics).

1.2. The Special Principle of Relativity and the Laws of Electronic Motion

   Johannes Kepler introduced three laws characterizing the motion of planets around the Sun:
   First Law: *"The orbit of a planet is an ellipse, with the Sun at one of its foci"* [28,29].
   Second Law: *"The line joining the Sun to a planet sweeps over equal areas in equal intervals of time, regardless of the length of the line"* [28,29].
   Third Law: *"The square of the period of any planet is proportional to the cube of its mean distance from the Sun, i.e., $p^2 = kr^3$"* [28,29]. (k being the same for any planet).
   Beyond the Solar system, Kepler's Laws have been observed to remain valid in describing the orbital motion of the Moon around planet Earth, the orbital motion of Jupiter's satellites around Jupiter, and even the orbital motions of binary stars [30]. It can be seen that all of those planetary reference frames are parallel with each other. This parallelism explains why Kepler's Laws remain valid and applicable in each one of those frames.
   In the Rutherford-Bohr planetary model of the atom, the structure of the atom is understood to be a small-scale replication of the structure of the Solar system, with the Sun represented by the nucleus and the planets by the electrons [31,32]. Those are two experimental reference frames. In addition to the replication of the Sun and planets into the atomic reference frame, there is also a replication of the revolution process, in the sense that the electrons revolve around the nucleus, as well as a replication of the specificity of the orbit on which each revolution occurs. Furthermore, gravitational force of attraction in the planetary frame is replicated as the electrostatic force of attraction in the atomic frame [31]. Therefore, all of the defining features of one frame are reproduced in the other frame. The two frames are therefore *parallel.* The two frames being *parallel,* the implication is that the interpreted special principle of relativity applies, and the laws of one frame shall be the same or similar with those of the other frame.
   As of this writing, laws governing the motion of electrons around the atomic nucleus have not yet been discovered. However, the ability of the special principle to translate laws, concomitant with its inherent capacity to <u>predict</u> the existence of laws in other parallel reference frames, makes possible the <u>prediction</u> of the existence of three laws of electronic motion. By virtue of the interpreted special principle, the three Laws of Electronic Motion must be the same or similar with those of planetary motion. Consequently, we *predict* and submit the Laws of Electronic Motion as follows:

   First Law of Electronic Motion

   "The orbit of electrons is elliptical, with the nucleus at one focus of the ellipse."

Second Law of Electronic Motion

"The line joining an electron to the nucleus sweeps equal areas in equal times, regardless of the length of the line."

Third Law of Electronic Motion

"The square of the period of any electron is proportional to the cube of its mean distance from the nucleus, i.e., $p^2 = kr^3$; constant k being the same for all electrons."

Sir Isaac Newton did modify Kepler's Third Law in order to make it applicable to any two-body motion regardless of the location of the center of mass of the said two-body system [33]. However, the mass of the planets in the Solar system is negligible in relation to the mass of the Sun, and the center of mass of any Sun-planet pair is therefore located within the Sun [33]. As a result, although Newton's modification of Kepler's Third Law is accurate, the modification does not affect calculations pertaining to the Solar system, and this, consequently, allows the original form of Kepler's Third Law to remain valid in the said system [33]. This means that Newton's modification of Kepler's Law can be approximated by the original form of the Law [33,34]. Because the planetary and atomic reference frames are parallel, the Newton-modified Kepler's Third Law translates into the atomic reference frame just as the original form of the Law does. However, as in the case of the planets, the mass of the electron is also known to be negligible in relation to the mass of the nucleus [31], and this causes the center of mass of the electron-nucleus system to equally be located within the heavier object, which is the nucleus [34]. Therefore, we can expect the translation of the original form of Kepler's Third Law to remain valid in the atomic reference frame, just as the translation of the Newton-modified version of the Third Law does. The foregoing results in the Third Law of Electronic Motion above which reflects the original form of Kepler's Law, instead of the Newton-modified version of the Law; although the translation of the Newton-modified version of the Law is also accurate.

Although quantum mechanics describes electrons as a wave which, as a result, would not have a definite linear trajectory, the dual nature of the electron as being capable of behaving as a wave or as a particle allows their particle nature to make the existence of a definite linear trajectory possible. In that regard, in the Rutherford-Bohr model of the atom, the orbits of electrons around the nucleus are thought to have discrete radii and to be circular—not elliptical [32]. However, the First Law of Electronic Motion, translated from Kepler's First Law of Planetary Motion, indicates that the orbits of the electrons *are* (and *must be*) elliptical—not circular. More recently, the Bohr-Sommerfeld model was proposed, suggesting that electrons travel along elliptical orbits (instead of Bohr's circular orbits). But this proposal was wrongly ignored because of *supposed* inconsistencies which, in fact, were later proven not to have been inconsistencies at all [35,36]. However, that the orbits are elliptical and that the nucleus is located at one focus of the ellipse could have been <u>predicted</u> from the translation of Kepler's First Law into the atomic reference frame, regardless of the *supposed* inconsistencies—which, again, were later proven not to have been inconsistencies in the first place [35,36].

Fortunately, it has now been experimentally <u>verified</u> and <u>proven</u> that the revolution of electrons around the atomic nucleus is <u>elliptical</u> [37,38]—which is the first condition partially validating the First Law of Electronic Motion. Furthermore, the nucleus is now known to be located at one focus of the ellipse [39,40]—which is the second condition fully validating the First Law of Electronic Motion. Those two conditions (an *elliptical* orbit and a member of the pair *occupying one focus* of the ellipse) satisfy Kepler's First Law of Planetary Motion. Therefore, the translation of Kepler's First Law into the atomic reference frame using the interpreted Einstein's special principle of relativity is *real* and *effective*. Because the conditions supporting the Law are factual and have been around since the birth/creation of atoms (which is same as the birth/creation of the universe), the First Law of Electronic Motion has existed since the birth of the universe and could have been discovered *a long time ago* (*!*). This means that although the evidence was unknown in the past and has surfaced for it to become available only recently [37–39], <u>prediction of the existence</u> of the First Law of Electronic Motion *could still have been made.* This is an excellent example of the *prediction of laws* that the special

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principle of relativity, once interpreted, makes possible. We can thus see how powerful the principle and its interpretation are.

The foregoing means that even if those experiments had not been conducted, the First Law of Electronic Motion *exists* and *should have been predicted.* However, it is great news that those experiments were conducted because they *prove* and *confirm* the prediction made by the interpreted principle.

In spite of the fact that no law similar to Kepler's Second or Third Law is yet known to exist in the atomic reference frame, we can still predict, by virtue of the special principle of relativity, the existence of the Second and Third Laws of Electronic Motion, as presented above. As additional experiments are conducted to test these predictions, they should be found to be the case.

In particular, and zeroing in on drug resistance in medicine, Newton's Third Law of Motion, a law of Classical Mechanics, holds in the Medical reference frame. This is because Einstein's special principle of relativity is applicable to both frames. In fact, we are in the presence of two experimental reference frames: the *Classical Mechanics* reference frame, to which Newton's Law belongs, and the *Medical* reference frame, which we are now trying to understand and subdue. Here, the dual conditions of *uniformity* of *translation* are met between the two frames. First, *translation* occurs in the sense that Action comes from the pathogen while Reaction comes from the doctor (see Chapter 3 of reference [6]). Second, this *translation* goes beyond 'Action' and 'Reaction' and also takes place through the equality of the intensity of the forces in presence. In fact, Newton's Third Law states that Action and Reaction have to be equal. But as seen in the process leading to the development of infinite quantities of resistance [41], the need to neutralize the initial oncoming force of resistance intensity i from Entity 1 requires the development of a force of resistance intensity i' from Entity 2. Only after that neutralization phase has been completed can Entity 1 or Entity 2 launch a new attack against the other member of the pair. However, at the time that the new attacking force has not yet been generated and we are at the precise point of neutralization, the intensities of both the initial resistance and the response are equal: $i = i'$. Furthermore, the said *translation* displays a third feature in the sense that, at the point of neutralization, the initial resistance i from the pathogen and the response i' from the doctor combine to destroy each other, meaning that they function/act in *opposite directions*. Representing that state mathematically, in vector form, we have:

$$i = - i'$$

Therefore, all the defining features of the first experimental reference frame (Classical Mechanics) are replicated in the second experimental reference frame (Medicine). As a result, the second condition (*uniformity*) is also met, causing the dual conditions of *uniformity* of *translation* to be met. Consequently, the *Classical Mechanics* reference frame and the *Medical* reference frame are *parallel,* the interpreted special principle of relativity applies, and both frames therefore obey the same law. As can be seen, the special principle of relativity effectively translates Newton's Third Law of Motion from the *Classical Mechanics* reference frame to the *Medical* reference frame.

1.3. The Predictive Power of the Principle and our Strengthened Capacity to Understand and Control/Subdue Physical Reality

Generally, the special principle of relativity allows the translation of physical laws from one experimental reference frame to another parallel experimental reference frame. This process involves multiple fields of science or multiple domains of this physical reality. Translating laws between multiple domains of this physical reality has the implication that if a law is not yet known to exist in a given field of science, characterized by its particular frame of reference, but if such a law is already known to exist in another field of science, characterized by its own particular frame of reference, then the special principle of relativity allows the prediction of the existence of an equal or similar law in the former field of science whose frame of reference is parallel with the second one and whose law is not yet known or discovered. This amounts to displacing (translating) laws from one reference frame to another reference frame once the frames are parallel with each other. In practice, once we can forecast the existence of a law in a given frame of reference in which the law was not yet known to exist, we are a step closer to understanding and successfully subduing the phenomena taking place

in that reference frame along with the physical matter involved in those phenomena. This is because once we know the laws, we know the course of action to take to successfully control the phenomena governed by those laws.

As an illustration, the translation of Newton's Third Law into the *Medical* reference frame gives rise to the Third Law of Biological Resistance which tells us the central step we have to take to finally successfully overcome antibiotic resistance in medicine [6]. This is because knowledge of the laws guides us, since they tell us how to act to avoid accidents. The interpreted special principle of relativity, therefore, speeds up our understanding and capacity to subdue the phenomena of this physical reality by allowing us to realize, ahead of time, how that physical reality works. The potential of the principle to allow the *forecasting of laws,* thereby speeding up our understanding and successful control of the phenomena of this physical reality, is illustrated by Darcy's Law, Fick's Law, Fourier's Laws, and the other analogous laws seen earlier as well as other analogous laws not mentioned here. The allowance made by the principle to translate laws from one reference frame to another parallel reference frame explains why Darcy's Law, Fourier's Law, Ohm's Law, etc. are analogous with each other although they belong to different experimental frames of reference. Practically, that means that before the discovery of Darcy's Law in 1856 [9], Ohm's Law, which was already known to exist (having been discovered in 1827) [42] and which belongs to the *Electrical Science* reference frame, could have been translated into the *Fluid Dynamics* reference frame using the interpreted special principle of relativity, and Darcy's Law could have therefore been predicted and discovered *before* 1856. This analysis applies to the other members of this set of laws, as well as to the laws of other experimental reference frames in other fields of science such as Kepler's Laws in the *Planetary* reference frame with translation into the *Atomic* reference frame, and Newton's Third Law in the *Classical Mechanics* reference frame with translation into the *Medical* reference frame.

The foregoing analysis about the *faster discovery* of a law by means of the translation process as allowed by the special principle of relativity also holds true for Newton's Law of Universal Gravitation and Coulomb's Law of Electrostatic Interaction.

In fact, Coulomb's Law, discovered in 1783 [43], could have been predicted and discovered from Newton's Law which was discovered much earlier, in 1687 [21]. This is because their frames are parallel. The predictions might not maintain the same coefficients, if any; however, the existence of the general form of the law in the second frame of reference could have been predicted from the known law of the first frame of reference. Furthermore, the translation and applicability of Coulomb's Law to situations of crowd evacuation from indoor public spaces for security purposes, with the goal of guiding people out to safety, has already been confirmed with supporting mathematical algorithms [43]. The foregoing means that Coulomb's Law can be translated from the *Electrostatic* reference frame into the *Crowd Evacuation* reference frame for the safe management of the safety of th epublic in emergency situations [43].

As we exploit to the fullest the potential of the principle to facilitate the discovery of laws through the translation of known laws from one frame of reference to another parallel frame of reference, criss-crossing physical reality from one area of scientific investigation to another, we will find that our capacity to control the phenomena around us increases severalfold because of the faster discovery of the laws governing those phenomena—and our capacity to control the matter involved therein also increases severalfold as a result.

Our strengthened capacity to control physical phenomena is made possible by our keener understanding of the processes underlying those phenomena in the frame we are considering. However, this understanding is facilitated by our knowledge of the laws which govern those phenomena. Although Einstein introduced his principle more than 100 years ago, the principle has not been used to the fullest. Its interpretation now takes us a step closer to that. As we make full use of it, we may eventually find that various components of the physical universe are in fact *one*, and that differences are only superficial. At any rate, by speeding up the discovery of the laws governing various phenomena, it is interesting how this principle sheds light on a wide range of unrelated questions. As seen, the interpreted special principle is what makes possible the translation of Kepler's Laws from the *Astronomy* reference frame to the *Atomic Physics* reference frame, as it does the

translation of Newton's Third Law from *Classical Mechanics* to *Medicine*. And the translation of Newton's Third Law from *Classical Mechanics* to *Medicine* holds important ramifications for the successful control of antibiotic resistance in medicine [6].

Conclusion

Theoretical mathematicians have shown Einstein's special theory of relativity to be more profound than had traditionally been thought. In fact, his theory has only recently been proven to hold true for speeds even greater than the speed of light in a two-dimensional space-time reference frame [1–3]. In particular, his special principle of relativity, initially introduced to address the relationship between the motion of bodies moving independently of each other, is equally more profound than has traditionally been thought. Here, we have interpreted the principle and have shown it to be valid beyond its traditional scope. Through this interpretation, the special principle of relativity takes on a subtle dimension which makes it applicable to reference frames of an experimental nature—beyond the space-time reference frames traditionally assigned to it. As a consequence, the principle makes it possible to predict the existence of laws governing the behavior of matter in various experimental frames of reference and, thereby, speeds up our understanding and capacity to successfully control the phenomena taking place in those frames of reference. In particular, and meaningfully so, the special principle, once interpreted, opens the door to understanding what is fundamentally wrong with our current approach to antibiotic resistance control in medicine and why every effort we have been deploying for the past 100 years has been failing with a continually-aggravating threat. Indeed, the principle shows the central step we have to take in order to finally bring the antibiotic resistance threat to an end [6].

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