Einstein's Special Principle of Relativity and the Translation of Physical Laws

Author: Rudolf Fullybright. Department of Applied Research. Applied-Research Center for True Development. 4016 rue Prefontaine, Montréal, Québec H1W 0A3, Canada. Email: fullybright@gmail.com

ORCID ID: 0000-0001-8150-4881

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 scientific laws. However, the principle holds an inherent capacity to translate scientific laws and, in so doing, speeds up our understanding of and strengthens our capacity to control physical reality. Such a translation of laws leads to the faster discovery of other scientific 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 and pest resistance in agriculture. The ability of Einstein's special principle of relativity to translate scientific 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 scientific laws of one frame of reference in other parallel frames of reference. This process opens the door to our faster discovery of the scientific 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 and strengthens our understanding and capacity to control physical reality.

Keywords: relativity; special principle; translation; reference frame; law.

Introduction

Contrary to what had been 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, 2, 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 physical inertial frames of

reference. The principle remains valid beyond those traditional inertial reference frames because the parallelism of frames is an integral part of the design 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 about and a better understanding of the behavior of matter in the new frame under consideration, as well as how 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 strengthens and speeds up our understanding and capacity to control 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 Medicine reference frame points to one of the major steps that must be taken to finally overcome antibiotic/drug resistance [6].

Methods

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

Results and Discussion

To begin with, we ought to reckon that physical laws tend to find analogies in fields other than their original areas 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 one moves from one area of scientific investigation to another. The applicability of laws in areas other than their original areas 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* ***same*** *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 physical reference frames while it, in fact, finds applications in more than just physical reference frames. However, as we acknowledge that the "reference frames" Einstein referred to are not just *physical* frames of reference but include multiple types 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 parallelism 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 electricity 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 principle has always been understood to describe only *space-time* reference frames, it does describe more than just space-time reference frames. Beyond space-time frames, the "reference frames" the principle refers to also take, among others, the form of 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 replication of all 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 *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 replication of *all* the defining characteristics of one *experimental* reference frame into another *experimental* reference frame. *Translation* means that there occurs a *replication* of the defining experimental characteristics of one reference frame in the other reference frame, and the translation is *uniform* because it involves *all* the defining characteristics of the initial 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 electrons flow 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; but beyond the analogies observable in their mathematical expressions, the construct or design of those two experimental frames does show analogies, as discussed 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 points *a* and *b* over a given length of the medium traveled [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 points a and 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 through the conductor

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 through the magnetic element

F = magnetomotive force across a 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 First 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 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* reference frames: water and soil in one, and 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* of one reference frame in relation to the other reference frame, is met: here, flowing water in the first reference frame is replicated in the second reference frame and becomes flowing electrons, soil medium in the first is replicated in the second and becomes wire medium, soil particles in the first are replicated in the second and become atom particles, soil pores in the first are replicated in the second and become space within atom lattices, and resistance offered by the soil medium to the flow of water in the first is replicated in the second and becomes 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 satisfied 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, there is replication of the soil particles of the first reference frame as atom particles in the second reference frame but let us assume that *nothing* flows 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 are met; and 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, *"holding good"* 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 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:*

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

"*We can therefore draw the following analogies:*

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

"*The electric[ity]-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. Essentially, it is *one fundamental*

expression of a law which "mutates" as it gets displaced/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 (a wave) and the motion of a particle (a solid) [18]. Here, 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 potentially applies. Then, it can be observed that the two conditions 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 in 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 first condition (*translation*) is met. However, the said translation is *uniform* because the replication involves *all* of the defining characteristics (all three listed) of each reference frame. So, 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 (attraction force) and the one in Coulomb's Law of Electrostatic Interaction (attraction/repulsion force).

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

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* the defining characteristics (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 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

κ = 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 the existence of a replication of the defining characteristics of one frame in 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 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*. As a result, 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 made possible by Einstein's special principle of relativity. 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 causes the laws of one experimental reference frame to stay valid in the other experimental reference frame—barring coefficients. Although the replication feature takes the form of what Einstein called *uniform translation* in the space-time reference frame he investigated, *parallelism* is perhaps a better terminology for experimental reference frames. The analogies observed in the series of laws discussed above show that the principle remains valid in experimental reference frames, beyond traditional space-time reference frames. Consequently, we interpret Einstein's special principle of relativity specifically for experimental reference frames and present the interpretation that follows:

Interpreted Special Principle of Relativity for Experimental Reference Frames

"Parallel experimental reference frames obey 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 multiple manifestations of the physical universe. Illustrating this, the ability of the principle to translate laws, with its associated capacity to accelerate the discovery of other laws, is manifest in the reference frames made up by the solar system (Astronomy) and atoms (Atomic Physics).

1.1. 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., $p^2 = kr^3$. The constant k is the same for any planet." [28, 29].

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 to 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 in 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 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 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 are not yet known. However, the ability of the special principle to translate laws, concomitant with its inherent capacity to predict the existence of laws in other parallel reference frames, makes possible the prediction 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 present 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 out equal areas in equal intervals of time, 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 form of the Law; although the translation of the Newton-modified version 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 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 predicted 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 verified and proven that the revolution of electrons around the atomic nucleus is *elliptical* [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. Therefore, the translation of Kepler's First Law into the atomic reference frame using 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 / creation of the universe and could have been discovered a long time ago (!). This means that although the evidence was unknown before and has now surfaced for it become available only recently [37 – 39], *prediction of the Law could still have been made*. This is an excellent example of the prediction of laws that the special principle of relativity, once interpreted, makes possible. We can see how powerful the

principle and its interpretation are.

The above 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 Medicine 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 *Medicine* reference frame, which we are trying to understand and control. 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 [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:

$$\boldsymbol{i} = -\boldsymbol{i}'$$

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 *Medicine* reference frame are parallel, the interpreted special principle of relativity applies, and both frames therefore obey the same law. It is observable that the special principle of relativity effectively translates Newton's Third Law from the *Classical Mechanics* reference frame to the *Medicine* reference frame.

1.2. The Predictive Power of the Principle and our Strengthened Capacity to Understand and Control 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 known to exist, we are a step closer to understanding and successfully controlling the physical phenomenon taking place in that reference frame along with the physical matter involved in that phenomenon. This is because once

we know the laws, we know the course of action to take to successfully control the phenomenon governed by those laws.

As an illustration, the translation of Newton's Third Law into the *Medicine* reference frame gives rise to the Third Law of Resistance which tells us the central step we have to take to finally successfully overcome drug / antibiotic resistance [6]. This is because knowledge of the laws guides us, as they tell us how to act to avoid accidents. The interpreted special principle of relativity, therefore, speeds up our understanding and capacity to control 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. 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 reference frames. Practically, that means that before the discovery of Darcy's Law in 1856 [9], Ohm's Law, which was already known to exist [42] and which belongs to the *Electrical Resistance* reference frame, could have been translated into the *Fluid Dynamics* reference frame using the interpreted special principle, and the existence of 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 reference frames in other fields of science, such as Kepler's Laws in the *Planetary / Atomic* reference frames and Newton's Law in the *Classical Mechanics / Medicine* reference frames.

The foregoing analysis on the earlier discovery of a law by means of the translation process allowed by the principle also holds true for Newton's Law of Universal Gravitation and Coulomb's Law of Electrostatic Interaction: 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, for security purposes, from indoor public spaces, 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 individuals 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 science 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 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 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 issues. As seen, the interpreted special principle is what makes possible the translation of Kepler's Laws from the *Astronomy* reference frame to *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 Law holds important ramifications for the successful control of drug / 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, 2, 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 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 drug / 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 crisis. Indeed, the principle shows the central step we have to take for finally bringing the drug / antibiotic resistance crisis to an end [6].

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