

The Doubling Theory Corrects the Titius-Bode Law and Defines the Fine Structure Constant in the Solar System

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Abstract. The fundamental movement of the "doubling theory", developed in our preceding papers, is applied as a model of the dynamics of the solar system. It is shown that this model justifies and corrects the distances of the planets given by the Titius-Bode law, and predicts new planets between the Kuiper Belt and the Oort Cloud. Indeed, the empirical Titius-Bode law defines in an approximate way the distances of the planets to the sun, and becomes totally false for the most distant planets (Neptune and Pluto) and does not include the Oort Cloud and Kuiper Belt. The doubling theory is based on successive embedded finite structures of space-time domain at different scale levels. The cycle of the doubling movement in the solar system corresponds to 25920 years. It is shown that this cycle defines the fine structure constant.

Keywords: doubling movement, spinback, horizon, particle, radial, tangential.

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1. INTRODUCTION

In the 18th century, two astronomers, Johann Titius and Johann Bode, reported a numerical sequence into which the sizes of the planetary orbits fit.

By using the radius of the Earth orbit (AU) as a standard, astronomers recalculate the other orbital sizes in proportion to it (Table 1).

TABLE 1. The empirical Titius-Bode Law, compared to the average distance to the sun (AU) [30]

Planet name	Average distance to the Sun	n	Titius-Bode distances "a"	Absolute Error
Sun	0			
Mercury	0.387	$-\infty$	$0.4 = (4+2^{-\infty}\times3)/10$	0.013
Venus	0.720	0	$0.7 = (4+2^0\times3) /10$	0.023
Earth	1	1	$1.0 = (4+2^1\times3) /10$	0.000
Mars	1.519	2	$1.6 = (4+2^2\times3) /10$	0.076
Asteroids	2.770	3	$2.8 = (4+2^3\times3) /10$	0.030
Jupiter	5.188	4	$5.2 = (4+2^4\times3) /10$	0.003
Saturn	9.530	5	$10.0 = (4+2^5\times3) /10$	0.461
Uranus	19.170	6	$19.6 = (4+2^6\times3) /10$	0.420
Neptune	30.030	7	$38.8 = (4+2^7\times3) /10$	8.740
Pluto	39.330	8	$77.2 = (4+2^8\times3) /10$	37.800

The modern formulation of the empirical Titius-Bode law (1766-1778), is given by the following relation:

$$10a = 4 + 3 \times 2^n \quad (1)$$

with $n = -\infty, 0, 1, 2, 4, 8, \dots$

where "a" is the mean distance from the planet to the Sun, in Astronomical Units (AU).

At the time of Titius-Bode, the asteroid belt, Uranus, Neptune and Pluto were not yet discovered. With the discovery of asteroids, this rule was almost considered like a rigorous law. But, it could never explain the position of Neptune and Pluto.

With the fundamental movement of the "doubling theory", it is possible to correct the Titius-Bode's rule and to understand the explanation of this empirical law as well as the variation between the aphelion and the perihelion of the planetary orbits. It is also possible to explain the exact position of Neptune and Pluto. At last, the doubling theory gave me, ten years ago, the possibility to predict the new planets (or planetoids) between Pluto and the Oort Cloud. This prediction is now perfectly justified by the discovery of Sedna, 2003UB₃₁₃,.... We'll see that these curious planets are associated with the well-known asteroids between Mars and Jupiter. This association that connects the telluric planets to the giant planets and the asteroids belt to the planetoids belt (Kuiper Belt) can be explained by the doubling theory [8].

This association of planets is a consequence of the fundamental doubling movement that connects each space to a horizon: this horizon becomes in its turn a particle within another horizon. This movement finds its justification in the solar system and it can explain the association of elementary particles of the solar system. We'll see that this solar elementary particle is the electron and that the speed of this solar elementary particle is the speed of light. In fact this speed is the speed of elementary particles, connected by the fundamental doubling movement. This connection explains this curious speed that depends neither on the observer, nor the source. We'll see also that the doubling movement explains the precession of the orbit of Mercury [31] that the theory of relativity explains too.

So it was logical to think that the doubling theory could compute this speed c in the solar system [8].

It also seems logical to connect a constant of the doubling movement α with this speed of light c . And this connection can define a property of the electron, since we'll see at last that this constant corresponds to the structure fine constant ($\alpha = 1/137$).

2. THE FUNDAMENTAL MOVEMENT

2.1. Particles and Horizons

In previous papers, I have proposed a new paradigm that does not use the classical space-time concept. Instead of one infinite continuous referential frame (with one time direction), which is associated to an observer who has a clock, this new paradigm requires a high level system of theoretical observers who are related to several embedded finite structures of space-time domain of different scale levels.

Any physical observable is related to a theoretical observer of the same scale level. All scale levels can be all possible embedding levels from the quantum level to cosmological levels. At each scale level, a theoretical observer has a finite horizon of observation that is the limit of his associated finite space-time structure. The horizon of any observer is supposed to be circular into a plane moving in the space. It is a "dynamical circular" horizon. Observers are not independent of the studied system, like in quantum mechanics (Niels Bohr), and therefore, the chosen embedded structures are always relative to the studied system. So each theoretical observer is dependent on the observed subspace within his horizon.

These embedded finite "dynamical circular" structures are dynamically built as a geometric construct, using a particular geometric transformation from level to level, which is named "*fundamental doubling movement*". Theoretical observers successively appear while building the geometric construct, thus they all have different initial conditions. Each embedded finite structure has its own dynamical "circular" limit that is named the "*horizon*". Each embedded finite structure of any level is built with the same fundamental doubling movement and this principle is a new type of *scale invariance*.

In this new paradigm, the word "*particle*" designates an embedded circular and dynamical structure moving in the embedding circular and dynamical structure of the next upper level. At a given scale in a system of embedded structures, let's consider a dynamical circle Ω containing the dynamical circles $\Omega_1, \Omega_2, \dots, \Omega_n$ of the next lower

scales. In this theory, $\Omega_1, \Omega_2, \dots, \Omega_n$ are considered as "*particles*" in the domain Ω which is their dynamical horizon, and we can say "*the particle Ω_1 in its horizon Ω* ". From a semantic point of view a particle in the Doubling Theory may be either an elementary particle of quantum physics, a planet in a solar system, or a galaxy in the universe, depending on the considered scale level. This doubling movement is built from a geometry similar to the geometry of relativity [23]. A particle Ω_n in its horizon Ω is geometrically transformed through a "*double movement*": one is a radial movement of $(\Omega_n)_r$ inside the dynamical and circular Ω and the second is a tangential movement of $(\Omega_n)_t$ along the dynamical circle Ω . The radial movement of $(\Omega_n)_r$ is always going through the centre of Ω : it is not rectilinear at all, but it slightly fluctuates on the circumferences of chained smaller circles Ω_n which are a dynamical and circular horizon of a lower scale level. So the radial movement of Ω_n in its horizon Ω can be considered as a tangential movement of particles along the horizon Ω_n . And so on at each level.

In this paper, we shall see again the definition of this fundamental movement, called the "spinback" [8, 9 and 10]: after a rotation of the horizon Ω of an angle π , $(\Omega_n)_r$ meets $(\Omega_n)_t$: it is the "*end of the movement*", where $(\Omega_n)_r$ and $(\Omega_n)_t$ can exchange information by the exchange of their path. In the Doubling Theory, time depends on the observer because it is related to his horizon, and the time flow is discrete, i.e. stroboscopic as explained in ref. [10] with periodic "*openings*" of time windows with a duration Δt which is unperceivable to the observer, although these "*openings*" can be perceived by an other theoretical observer who experiences another time flow with a shorter $\Delta t'$.

The fundamental doubling movement has been justified and verified for the solar system [8]. It concerns any particle evolving within its horizon, which is its space of interaction and observation. Each horizon, or space, is also considered, in its turn, as a particle within its own, larger horizon. The solar system is modeled as an anticipatory system of seven embedded horizons. As in all stellar systems, this fundamental doubling movement provides to the observers evolving within it, a doubling of space and a doubling of time. Six planetary spaces which are embedded in the same doubling transformation define three flows of time: these time flows are accelerated [8] between flow of "time 1" (past), flow of "time 4" (present) and flow of "time 7" (future). Each time flow corresponds to a possibility of observation and defines therefore an observer within its horizon of observation.

The fundamental movement defines a succession of imperceptible instants for the observer in the time flowing between two perceptible instants and thus defines the duration of the observers' imperceptibility. During this imperceptible instant there is an acceleration of the fundamental movement between two successive flows of time. This acceleration is such that the observation becomes impossible. Thus, due to the doubling movement, time is stroboscopic: periodic "*openings*" of time windows (also called temporal openings) in its flow remain imperceptible for the observer of the space defined by this time flow. For this observer, the flow of time seems continuous but in fact, it contains imperceptible "*openings*" where this time flow is accelerated.

A particle – as defined by the fundamental doubling movement and called "doubling particle" – evolves simultaneously in the space of the observer and in the "temporal openings" of this space, as two complementary parts having the same identity but evolving in two different time flows.

An information exchange between the two parts of the doubled particle takes place through the imperceptible time openings. In other words, a particle in the time of the observer (tangential movement) always possesses the information of its doubling part that evolves in an accelerated time flow (radial movement). With this exchange (radial-tangential) and its reverse exchange (tangential-radial), both in an imperceptible time (opening of temporal window), the radial particle gives to the tangential particle the information of several spinbacks before the first tangential spinback. That corresponds to the definition of an anticipation between "time flow 1" (past) and "time flow 4" (present) or between "time flow 4" (present) and "time flow 7" (future). Thus, the fundamental movement provides an even more rapid anticipation between "time flow 1" and "time flow 7". Thereby, it is possible for the particle moving in "time flow 1" (past) to memorize a transformation of the particle moving in "time flow 7" (future) before even the particle moving in the intermediate "time flow 4" (present) begins to undertake this transformation. An exchange of information between the particle in "time flow 1" and the particle in "time flow 4" gives to the particle in "time flow 4" the possibility to memorize the potential of the particle in "time flow 7" before any action is taken in "time flow 4". Thus the observer in "time flow 4" (present) is able to memorize in "time flow 1" (past) a potential created in "time flow 7" (future) without ever having to experiment it. We can say that, within the present of the particle, its past is in fact the memory of a future which was not tested by itself: in other words, through the "temporal openings" the fundamental doubling movement gives to the particle the possibility of anticipating an action before undertaking it.

2.1. Radial and Tangential Movement

The doubling transformation [8] corresponds to three simultaneous rotations φ (Figure 1). The embedded finite structures of space-time are built with geometric constructs and their rotations are defined in a 3 dimensional configuration space. This configuration space is defined with the 3 orthogonal directions Ox, Oy, Oz.

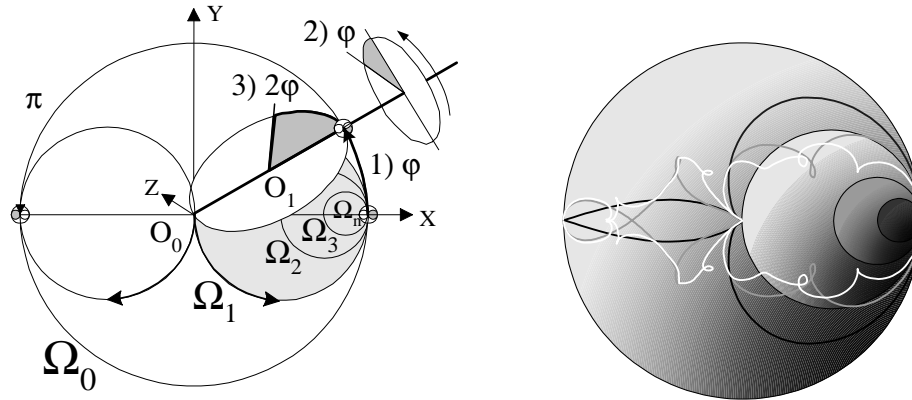


FIGURE 1. The three simultaneous rotations of the fundamental doubling movement in the initial plane.

It uses simultaneously both a radial and a tangential movement (Figure 2). The radial path of a particle is going through the center of its horizon. The tangential path is moving around its horizon.

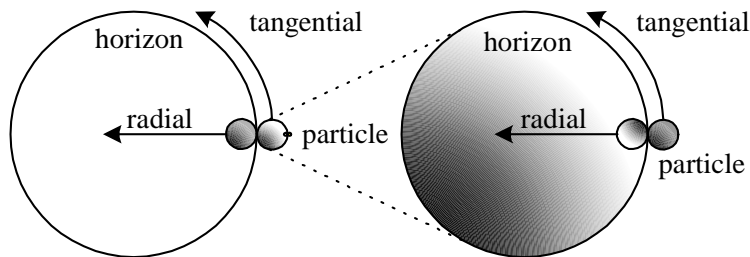


FIGURE 2. The radial and tangential movement: $0 \leq \varphi \leq 2\pi$.

This horizon-particle embedding is also found in the elliptic Kepler movement of the solar system again (Figure 3). The distances are then given by the fundamental movement of the particle through (radial) and around (tangential) its horizon. For a rotation π , this movement is called *spinback*.

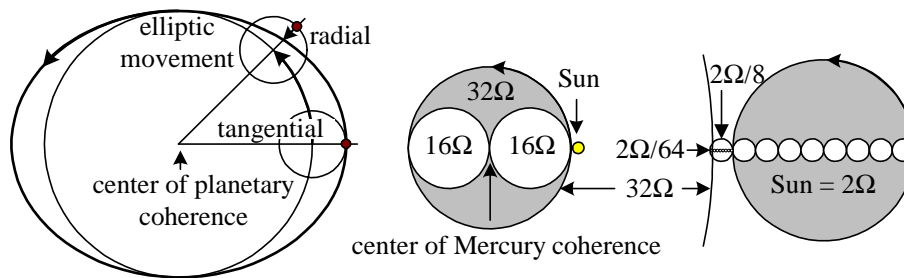


FIGURE 3. The center of planetary coherence [8].

This doubling transformation continues by associating each telluric planet to one giant planet and the doubling theory explains for the first time the why of the empirical Titius-Bode law (Figure 4).

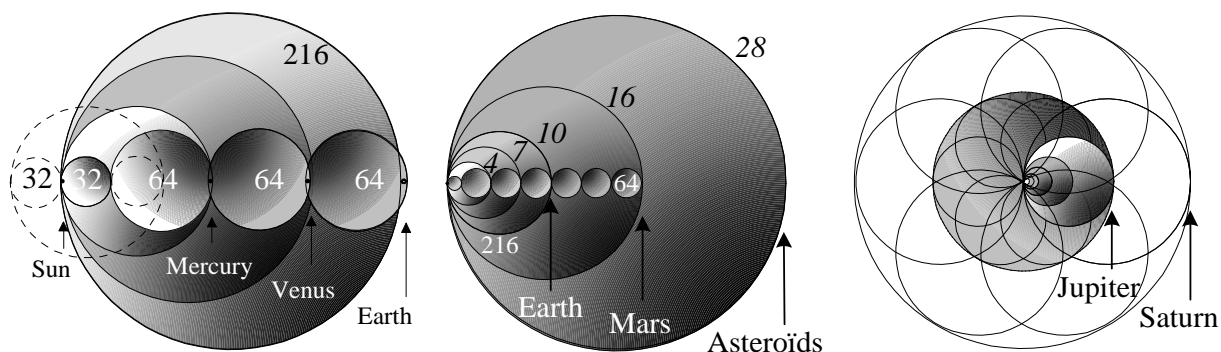


FIGURE 4. The dynamical circular horizons of the embedded spaces in the initial privileged plane.

This approximate relationship used so far (Titius-Bode) ignores the existence of horizons, for planets that, in their turn, can be considered as particles in their own larger horizons.

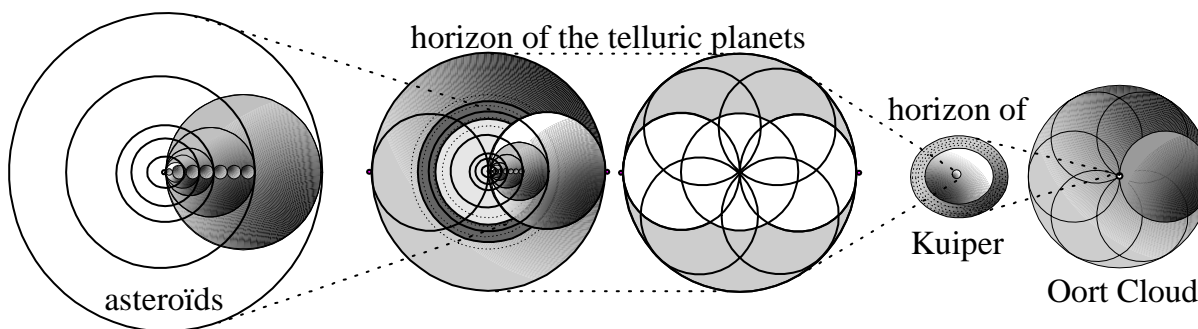


FIGURE 5. The embedded horizons in the initial privileged plane.

These horizon-particles undertake a tangential path during the radial path of the planet-particle within this horizon (Fig. 3, 4, 5).

The fundamental doubling movement explains equally the Oort Cloud, last horizon of the solar system, which is also a particle within the horizon of the galaxy.

The doubling movement [8] implies the radial movement of the horizon of the particle.

It also explains the difference between the aphelion and the perihelion. It seems that this corresponds to anticipation but it is the consequence of the radial movement of the horizon into its own larger horizon during the radial movement of the particle through this horizon.

Thus, the 10th spinback of the particle is the first into the second horizon. It corresponds to an acceleration of the movement of 1 to 10 during the spinback of the first horizon (Fig. 6).

The 9th movement is not observable for an external observer: it defines the duration of the imperceptible instant into the time flow.

The fundamental movement shows that this imperceptible temporal opening corresponds to an angle of $\pi/8$.

The cycle of the doubling transformation can be determined by the relationship between the radial spinbacks and the tangential spinbacks, without forgetting that a tangential path in a horizon is also a radial path in another, larger horizon.

The doubling transformation ends when the radial movement becomes tangential and conversely.

This end (Fig. 6) makes coincide the spinbacks multiple of 3 (seen from the exterior) and the spinbacks multiple of 2 (seen from the interior):

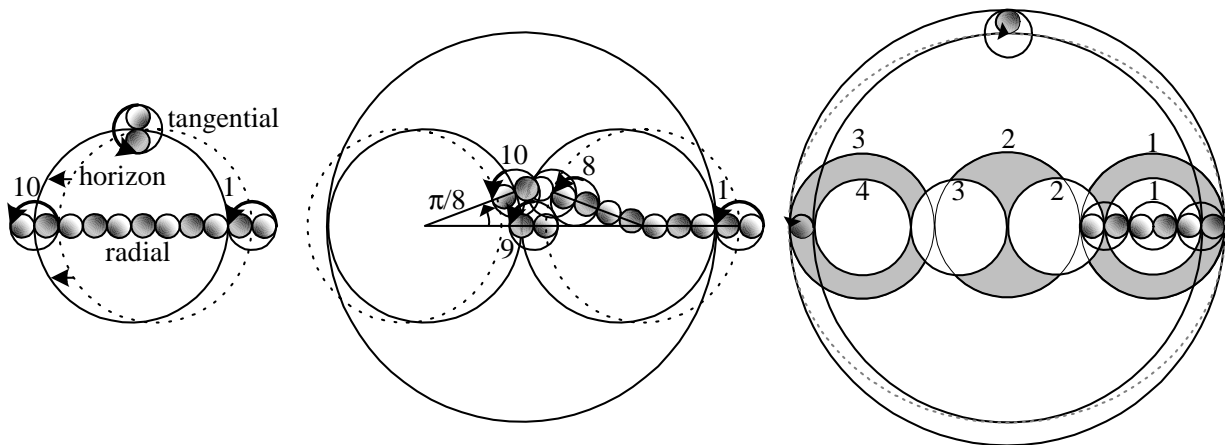


FIGURE 6. The imperceptible time (spinback 9 between 8 and 10) and 2/3 ratio.

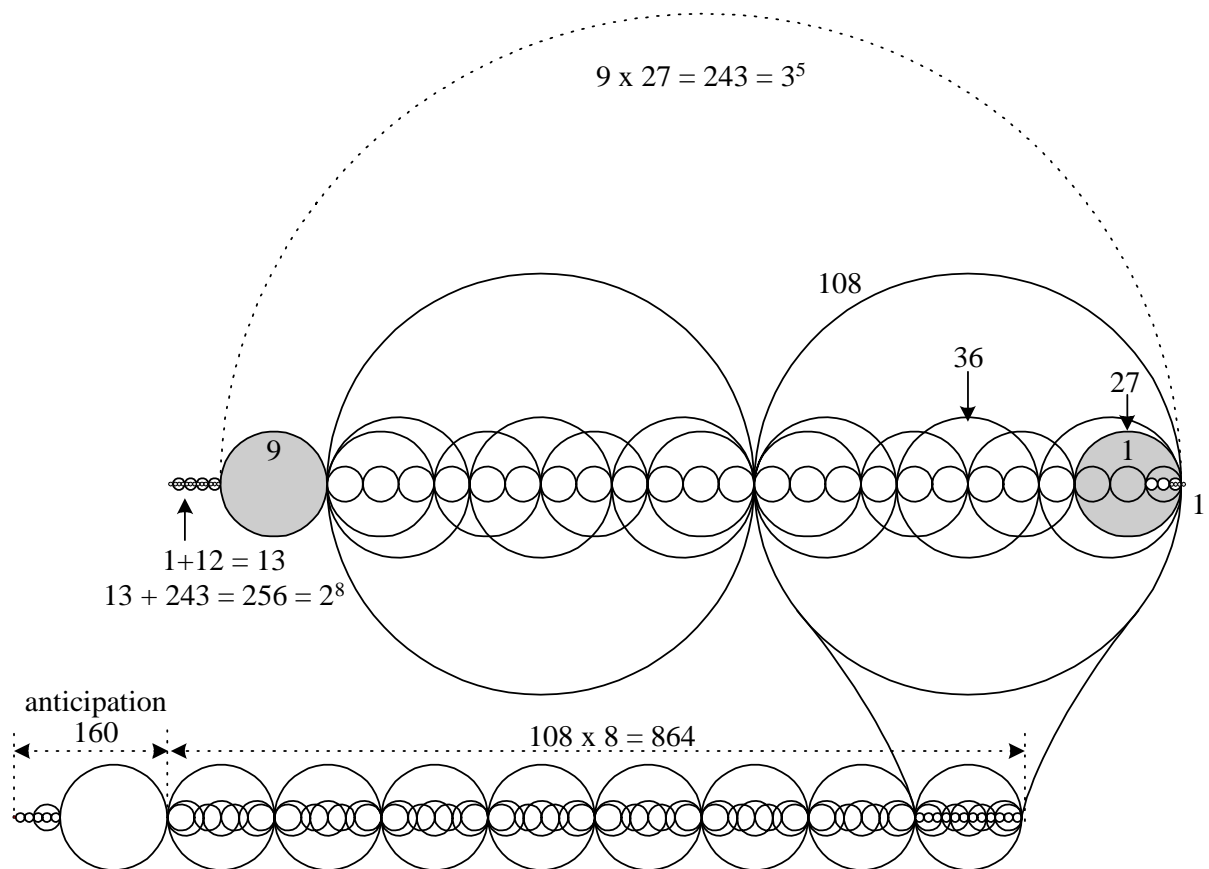


FIGURE 7. The 2/3 ratio.

The complete doubling cycle [8] will end when a power of 2 and a power of 3 will have a gap which corresponds to the due anticipation to the movement (Fig. 7):

$3^3 2^5 = 216 \times 4 = 864$, corresponds to an anticipation of $(27+12+1) 4 = 10 \times 16 = 160$, and
 $216 \times 4 \times 25 = 21600$, corresponds (Fig. 8) to an anticipation of $25 \times 160 = 3600 + 400$.

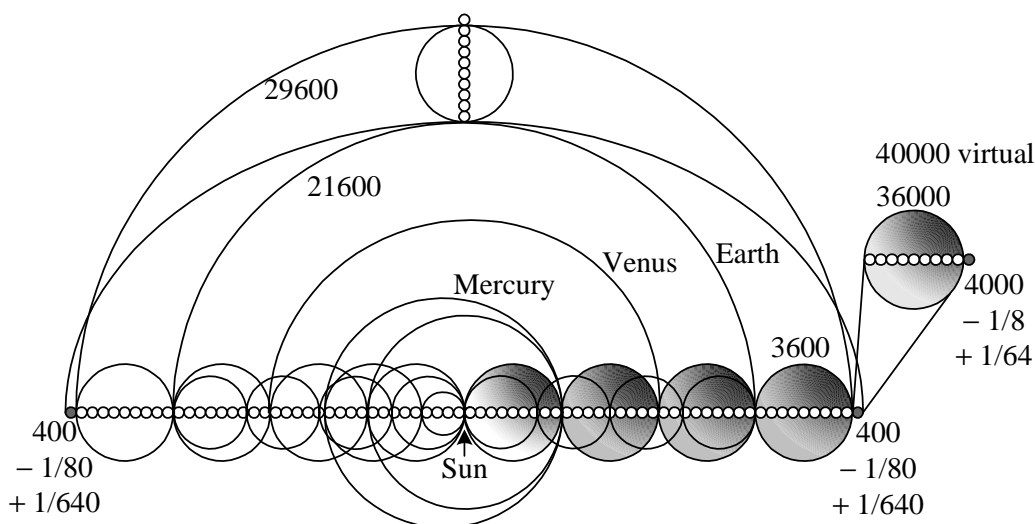


FIGURE 8. The horizons of telluric planets in the privileged initial plane and our space: the Earth.

3. NEWS PLANETS AND THE CORRECTION OF THE TITIUS-BODE LAW

3.1. Three Horizons Within the Solar System

With the doubling theory, the existence of the horizon 1 (see Table 2) can explain and correct the Titius-Bode empirical law. Indeed, this reality of horizons does not exist in the Titius-Bode law that thus becomes approximate for the giant planets.

TABLE 2. The correction of Titius-Bode law for the planets by the Doubling Theory [30, 31].

Horizons and planets	Average distance to the Sun (AU)			Computation with the Doubling Theory	
	mini	maxi	medium	(radial spinbaks)	
Sun				1	(10 - 9)
Horizon 0					
Mercury	0.307	0.466	0.387	4	(10 - 6)
Venus	0.713	0.726	0.720	7	(10 - 3)
Earth	0.981	1.014	1	10	(10 ± 0) (Fig.10)
Mars	1.380	1.660	1.519	16	(10 + 6)
Asteroids belt			2.770	28	(10 + 6 + 12)
Jupiter	4.933	5.440	5.188	52	(10 + 6 + 12 + 24
Horizon 1				100	(10 + 6 + ... + 48 = 100)
Saturn	8.98	10.01	9.53	96	(10 + 6 + ... + 96 = 196) - 100 (Fig.10)
Uranus	18.28	20.05	19.17	192	(10 + 6 + ... + 192 = 388) - 196
Neptune	29.76	30.29	30.03	284	(10 + 6 + ... + 384 = 772) - 388 - 100
Pluto	29.53	49.33	39.33	380	(10 + 6 + ... + 768 = 1540) - 772 - 388
Kuiper belt	32.00	52.00	42.00		
2003UB ₃₁₃	38.00	97.00	67.00	764	(10 + 6 + ... + 1536 = 3076) - 1540 - 772
Sedna	73.00	93.00	83.00		
Horizon 2				1532	(10 + 6 + ... + 3072 = 6148) - 3076 - 1540

Without Neptune (38.8 instead of 30.03), this law would be almost right for Pluto (38.8 for 39.33).

With the Earth as reference (1AU=10), the observed planetary distances correspond very well to the different spinbacks of the different horizons of the solar system as they are given by the Doubling Theory

The Earth horizon corresponds to 216 spinbacks (Fig. 3) and we see in Table 2:

- From horizon 0 to horizon 1, there are: 216 radial spinbacks + 1
- From horizon 0 to horizon 2, there are: 16×216 radial spinbacks + 10 - 1

So, the first spinback (+1) corresponds to the last spinbacks (-1) and the doubling movement corresponds to 16 tangential spinbacks of the Earth horizon which is 10 times more rapid than the horizon 0 (solar horizon) .

3.2. New Planets: 2003UB₃₁₃, Sedna, ...

Between Pluto and the horizon 2 (border of Oort Cloud), we find several asteroids and planetoids [30]:

- Kuiper Belt (32 and 52 AU),
- Sedna (orbit: 76 and 93 AU - Diameter: 1700 km.),
- 2003 UB₃₁₃, (orbit: 38 and 97 AU - Diameter: 2700 km.).

All these asteroids and planetoids must be separated by 12 horizons as the observable solar system, from Sun to Kuiper Belt (connected to the asteroids Belt in the doubling movement).

If the radius of the Sun is R_s , the radius of the horizon 0 is $8R_s$ (figure 12), and the radius of the tangential Earth horizon is 216 R_s (figure 10).

We can see in the table 2 the radial spinbacks within

- the horizon 1, $1 + 4 + 7 + \dots + 100 = 216 + 1$, and
- the horizon 2, $1 + 4 + 7 + \dots + 1532 = 16 \times 216 (10 - 1)$

The real 217th spinback of the horizon 1 gives a reality to the first virtual spinback of the horizon 0 (Figure 11). The last ten spinbacks of the horizon 2 give to the next transformation a virtual spinback (10 - 1). That is justified and explained by the theory [8, 9, 10]. For the giant planets, the law is no more the same. The horizon 1 becomes the initial horizon instead of the horizon 0 and we have to suppress 100 spinbacks for Saturn. For the following planets, we have to suppress the spinbacks of the precedent giant horizons according to the table 2 and the paper [8]. The radial movement of the horizon 2 within the galaxy (as the horizon 1 within the solar system) implies several modifications (Fig. 9) and precisions (aphelion and perihelion), and shows that the approximate Titius-Bode law for the telluric planets is completely wrong for the giant planet.

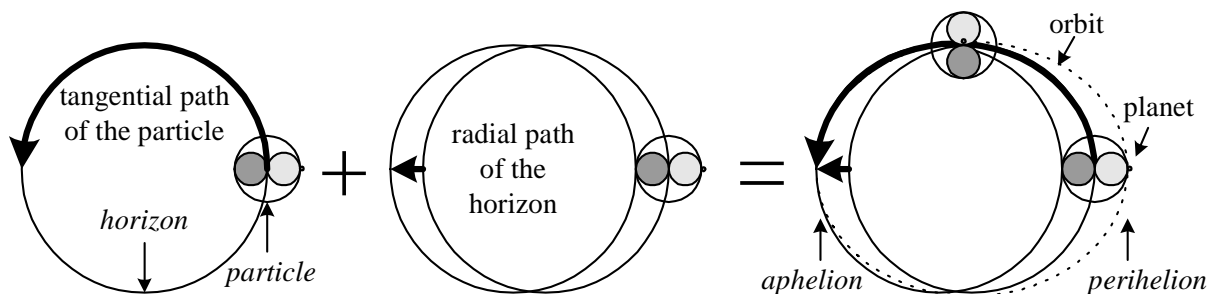


FIGURE 9. The radial path of the horizon during the tangential path of the particle gives the aphelion and the perihelion.

Moreover, each giant planet is connected with a telluric planet. Thus, the Saturn horizon (associated with the Earth horizon) corresponds to $216 \times 8 \times (0.1 + 0.01 + 0.001 + \dots) = 192$ spinbacks

The calculation of the aphelion and perihelion of the planets are provided by the following associations between telluric planets and giant planets (consequences of the fundamental movement) [8]:

Sun - Pluto, Mercury - Neptune, Venus - Uranus, Earth - Saturn, Mars - Jupiter, and Asteroids Belt (Ceres, Vesta, Davida, ...) - Kuiper Belt (Sedna, 2003UB₃₁₃, ...).

So, we can see for example the association Earth-Saturn (Figure 10).

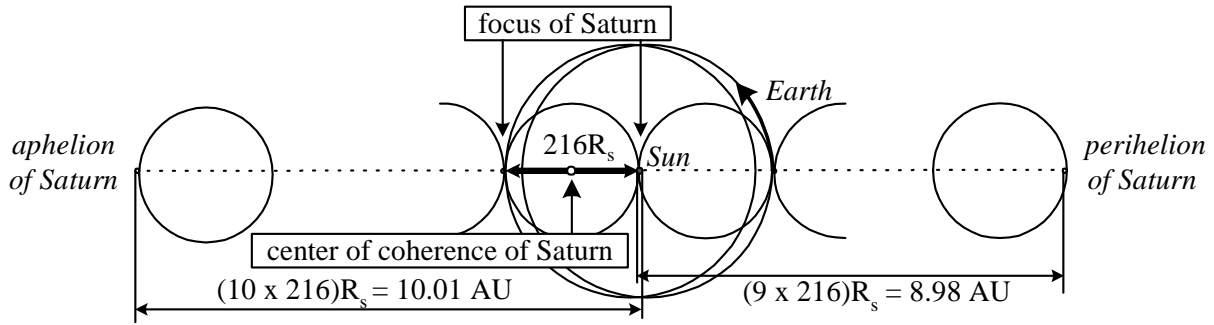


FIGURE 10. The association Earth - Saturn.

The terrestrial year (365.25 days and 216 spinbacks) corresponds to the year of Saturn (29.450 observed years) during a spinback of the horizon ($100/2=50$) and during a spinback of Mercury ($1/2$ year = 43.2 days):

$$(50 \times 216) - 43.2 = 10800 - 43.2, \text{ is } (10800 - 43.2) \times (365.25)^{-1} = 29.45 \text{ years.}$$

The radial distance of the Earth (from aphelion to perihelion) corresponds to $216 + 1$ solar radii R_s , (that is $216 + 1$ solar spinbacks). One astronomic unity corresponds to 108 solar spinbacks. Thus, 10 years on Earth correspond to 100 rotations of the solar horizon: that corresponds to 100 rotations of Pluto around the Sun, that is 24840 years.

However, during this time, the solar horizon adds 10 times $216/2$ spinbacks to obtain 10 additional spinbacks, that give 1080 years. Thus, the doubling solar cycle is $24840 + 1080 = 25920 = 24 \times 1080 = 12$ periods of 2160 years. These 12 periods are necessary for the doubling movement. They correspond to the 12 planetary spaces which are associated two by two.

The movement of the solar horizon, which is a particle in Jupiter horizon, adds some $216 + 1$ spinbacks. It will add some 100 times more for a total of 21600 solar spinbacks. These spinbacks give 4000 additional and radial spinbacks (Fig. 8 and 10) which corresponds to a tangential path (Fig. 3) during the radial trajectory of 29600 spinbacks.

4. THE FINE STRUCTURE CONSTANT α

With the doubling movement, we can explain the connection between a solar particle (the Earth) and an enormous horizon (the Oort Cloud). It is normal to think that we can explain the connection between an Earth particle (the electron) and an enormous horizon (the horizon of the Earth = 1 AU).

Why the Earth horizon?

In the table 2, we can see the privileged role of the Earth: its horizon does its spinbacks 10 times faster than the horizon 0 and 10 times shorter than the horizon 2. But the horizons 0 and 2 are not observable. The horizon of the Earth (its orbit) within its privileged solar plane (the elliptic) is the only observable horizon. The horizons 0 and 100 are not observable.

Why not the Sun horizon?

The radius and the orbit of the Earth are well known whereas the radius and the galactic orbit of the Sun are approximate. Moreover, with the doubling theory, we can define and compute the ratio of the radius (Sun/Earth) [8] with the 216 spinbacks of the horizon 1 (figure 10 and table 2):

$$R_s / R_E = (216/2) + 1 \quad (2)$$

This corresponds to the multiple observations (108.97: the moon implies a small correction).

Moreover, the doubling movement for the Earth corresponds to 216 spin backs (Figure 11 and Table 2).

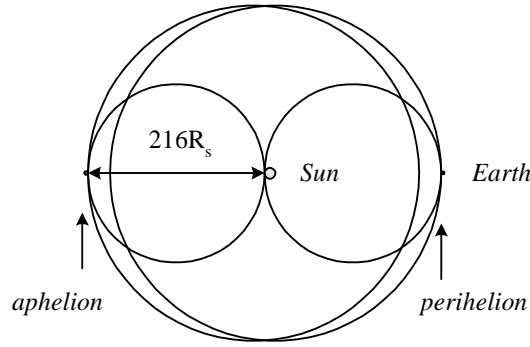


FIGURE 11. The doubling movement for the Earth.

Because of this well-known dimension that the doubling theory can explain, it is possible to define and to compute with precision the speed of the radial doubling movement with the Earth horizon instead of the solar horizon. This speed is defined by the tangential rotation of the Earth particle around its horizon and by the radial rotation of the Earth within its particle (Figure 9). The Earth horizon in the ecliptic depend on the Moon so that [8] the rotation $1000\pi/8$ is doing by the Earth (93%) and by the Moon (7%). This implies :

$$(93/100)(1000\pi/8) + (7/100)(1000\pi/8) = 365.21 + 27.45 \approx 1 \text{ year} + 1 \text{ lunation} \quad (3)$$

We must notice that these above relation are dimensionless.

This approximate result can be always explained by the doubling movement of the Sun. Because of the well-known relation between the dimension of the Sun and the Earth, we can compute the speed of the doubling movement by using our terrestrial dimension (year, day, second and kilometer). But, we don't forget that this speed concerns the solar system and that this speed is the speed of light c corresponding to [8] :

$$c = (216R_E)(Y_E/8)^{-1}\pi^{7/2}10^6 = 299\,792 \text{ km/s.} \quad (4)$$

where R_E is the Earth radius (6376 km), Y_E is the time of 2 tangential spinbacks of the Earth ($365.25 \times 24 \times 3600$ sec).

The Mercury precession can explain the connection between c and the solar system. When it was discovered, the slow precession of the Mercury orbit around the Sun could not be completely explained by Newtonian mechanics, and for many years it was hypothesized that another planet might exist in an orbit even closer to the Sun to account for this perturbation (other explanations considered included a slight oblateness of the Sun). In fact, this hypothetical planet (for which a name was given: Vulcan) corresponds to the centers of coherence of Mercury [8], center of focus of the Mercury ellipse (figure 11). This center of coherence is moving around the Sun.

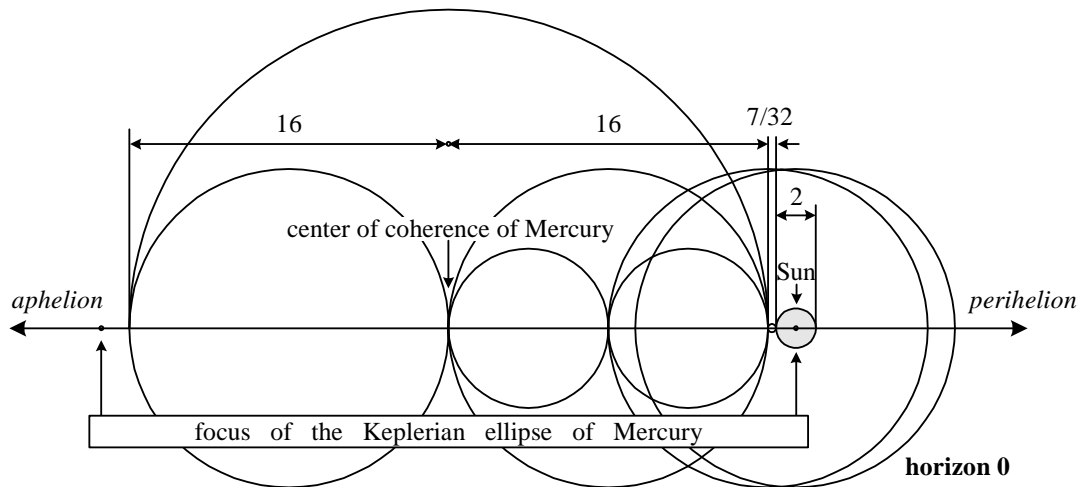


FIGURE 12. The center of coherence of Mercury (focus of its ellipse).

In fact (Table 2), because of the existence of the horizon 1 (corresponding to 216 spinbacks and to an acceleration of the movement from 1 to 100) and of the horizon 2 (corresponding to 16 times 216 spinbacks), and during 100 years, the doubling movement corresponds to $(1/1000)(\pi/16)$ radial spinbacks of the first Sun horizon (Orbit of Mercury) and to $(1/1000)(\pi/16 \times 16)$ spinbacks of the Sun [8]:

$$(1/1000)(\pi/16 + \pi/256) = 0.0000664\pi \quad (5)$$

This corresponds to a rotation of 43.02 arcseconds of the orbit of Mercury during 100 years.

With all the above remarks, it is possible to understand that the speed of light can be computed in the solar system by using the relation of the Sun with the Earth.

So, in the solar system, we consider an initial particle (Figure 7). This particle has therefore to do 29600 radial spinbacks during a tangential spinback that corresponds to 1000 times 216 radial spinbacks of the Earth (Table 2).

We already saw (at the end of the paragraph 1.2) that the complete doubling cycle [8] will end when a multiple of 2 and a multiple of 3 have a gap corresponding to the due anticipation to the movement (Fig. 8):

$3^3 2^5 = 216 \times 4 = 864$ corresponds to additional and radial spinbacks: $(27+12+1)4 = 10 \times 16 = 160$

$216 \times 4 \times 25 = 21600$ corresponds to additional and radial spinbacks: $25 \times 160 = 3600 + 400$.

The initial particle will be an "elementary" particle if it can go through the horizon by the radial path with the speed of the doubling movement that is explained and computed by the doubling theory: this speed is the speed of the light [8]. A virtual radial spinback within the tangential horizon $2\Omega_E$ becomes real after the tangential rotation $(\pi - \pi/8)$ of this horizon when a real radial spinback is going inside $2\Omega_E$ (Figure 13).

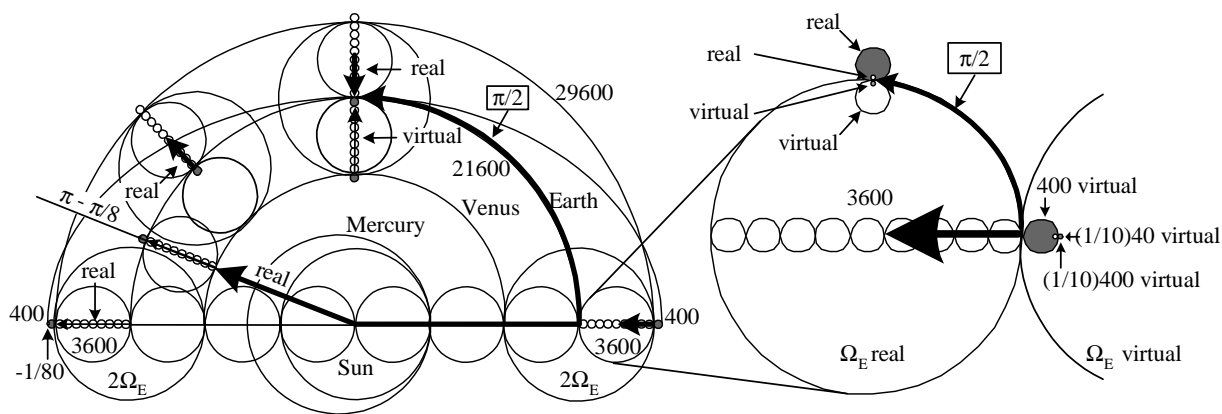


FIGURE 13. The virtual radial spinbacks into $2\Omega_E$ becomes real radial spinbacks after a rotation $\pi/2$ of $2\Omega_E$.

After the rotation $\pi/2$ of the horizon $2\Omega_E$, we must consider that the future real spinbacks are the consequence of past virtual spinbacks. This initial elementary particle has to undertake a virtual trajectory $(1/10) \times (-1/8)$ to obtain additional and radial spinbacks [8, 9, 10] corresponding to $(1/10) \times (+1/64)$. The tangential and radial doubling movement of this initial elementary particle of our solar system is therefore characterized by the ratio α_0 of the spinbacks:

$$[29600 - (1/4 - 1/160) + (1/32 - 1/1280) - (...) + (...)] \alpha_0 = 216 \quad (6)$$

$$(\alpha_0)^{-1} = 137.0360 \quad (7)$$

The dimension of the initial elementary particle depends on the dimension of the solar system and therefore, it depends on the dimension of the Earth, and this allowed computing the speed of light c [8, 9, 10].

This constant α_0 of the doubling movement corresponds to the fine structure constant α and this is not a coincidence. This famous constant α is a dimensionless number [12, 13], introduced by A. Sommerfeld in 1916. However, Sommerfeld's theory could explain the electron spin. In 1928, the relativistic theory of the electron by Dirac solved the main aspects of the problem concerning the hydrogen fine structure α keeping its value as in Sommerfeld's theory. Finally, this constant gives a connection between the electron charge e , the speed of light c and the Planck constant $h = 2\pi\hbar$:

$$\text{in CGS :} \quad e^2 = \alpha(\hbar c) \quad \text{or} \quad 2\pi e^2 = \alpha(\hbar c) \quad (8)$$

$$\text{in MKS :} \quad e^2 = \alpha(4\pi\epsilon_0\hbar c) = \alpha(2\epsilon_0\hbar c) \quad (9)$$

where ϵ_0 is the vacuum permittivity

$$\alpha^{-1} = 137.03599916 \quad (10)$$

The fine structure constant α is connected with the gravitational fine structure constant α_g by the ratio:

$$\alpha/\alpha_g = F_e/F_g = 4\pi f \quad (11)$$

where F_e the electrodynamic force and F_g is the gravitational force [19]. The constant f is adimensional (see from [24] to [29]). Thus, it is logical to have a connection between the fundamental doubling movement, the electronic charge and the gravitational forces.

Unexpectedly galaxies and quasars redshifts are quantized [24] and the same quantization ratio appears in orbital parameters of planets in the solar system. Oliveira Neto et al. [25], Agnese and Festa [26], L. Nottale et al. [27, 28] and A. and J. Rubècié [29, 30] have shown some similarities with the Bohr atom. This can only be explained with a theory of scale invariance such as the Doubling Theory. Moreover, the relation (8) puts at stake the speed of light c which in fact characterizes the speed of perception in the observer present. In 1997, this speed of light c was computed by the Doubling Theory for the first time ever [8], see the equation (4).

The mode of calculation is the same for c and α . That proves the identity between the elementary particle of the cyclic doubling movement and the electron. The exchange of information between the two particles (radial and tangential) uses the speed c . The circulation of the information by the electron uses the same speed c . Thus, the necessary initial energy for this doubling movement must correspond to an elementary energy, determined by Planck's constant h and the frequency of the exchange (between radial and tangential paths). This frequency corresponds to $(\alpha_0)^{-1}$ during the cyclical doubling movement. However, at the end of this cycle, this frequency must change. Many recent observations seem to already show this change. The Doubling Theory makes it possible to explain the characteristics of the elementary particle by supposing the existence of an elementary radius R which determines an elementary spinback (Fig. 9), and by introducing a new constant κ such that:

$$\kappa(\alpha c) = 2\pi R \quad \text{with } R = e^2\hbar^{-1}. \quad (12)$$

The definition of the doubling movement (spinback) provides the possibility to consider α and 2π as elementary constant frequencies. Thus, αc and $2\pi R$ can be considered as a length, which corresponds to a radial distance $2R$. This distance is covered during the time of the tangential spinback π (Fig. 14).

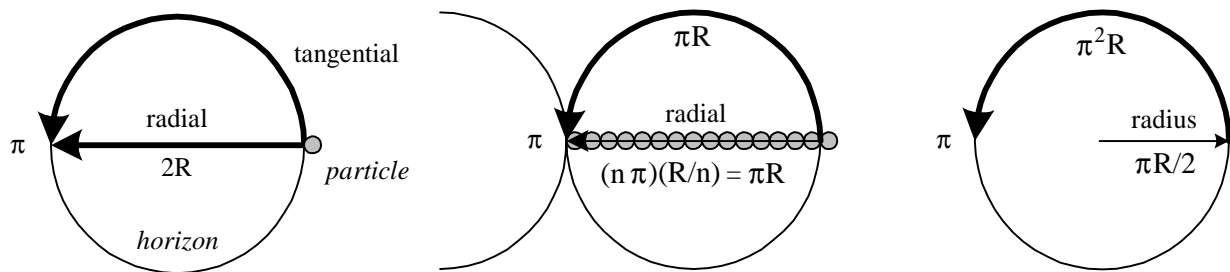


FIGURE 14. The radial path $n\pi R/n = \pi R$ is the tangential path πR [8].

The Doubling theory considers an internal observer within the horizon and an external observer who consider this horizon as a particle.

For the internal observer, the tangential path is $\pi^2 R$. For the external observer, the same path is πR . If the external observer considers R as a unit radius ($R=1$) in its observation, the tangential path $\pi R = \pi$ of the internal observer becomes the radial path $\pi^2 R = \pi^2$ of the external observer. Time of the external observer is thus given by the square of the time corresponding to the internal observer. According to these ideas [8], the exchanges of scale show that time of the radial path (radius R) of the external observer becomes the time of the tangential path (spinback π).

Like π of the internal observer becomes π^2 of the external observer. So, the distance R covered inside a horizon becomes a distance R^2 covered outside it [8, 9].

This is a very important consequence of the doubling theory. In other words, a distance R becomes the square of this distance through this change of observation standpoint. Therefore, a potential ($1/R$) for the particles of a horizon becomes a force ($1/R^2$) in the horizon of these particles.

This new notion of "distance covered" gives the possibility to define and compute [8] the three speeds of information exchange between the three successive levels, in particular the speed of light c , and finally the electric charge of an elementary particle of the doubling transformation.

3. CONCLUSION

Several laws have tried, in vain, to explain and correct the Titius-Bode law. Nevertheless, for almost a century now, we admit (Max Wolf, 1918) that there is an essential difference between telluric and giant, gaseous planets, and thus an impossibility to derive a satisfactory unique law.

According to the Doubling theory, we certainly find again this difference between planets and we understand above all that planetary distances are the very accurate result of the fundamental doubling movement:

- 216 + 1 spinbacks for telluric planets, and
- $16 \times 216 + (10 - 1)$ spinbacks for all planets.

Coming from the Doubling Theory, this new law reveals the existence of new planets that are already observable. By computing radial and tangential spinbacks, it is possible to have the aphelion and the perihelion of all planets [8].

Since the time of Titius and Bode, numerous researchers (see from [17] to [22]) have tried to approach this result without ever understanding that the rigorous link between telluric and giant planets prohibited the establishment of a unique law. By taking account of these differences between planets, some of these researchers were able to find correct relationships in the distribution of planets, without understanding the reason behind them.

An explanation of the Titius-Bode law from a gravitation quantization has been proposed by Jaume Giné [22] and from the Scale Relativity by Laurent Nottale [20].

As the Doubling Movement can be applied at any point of a particle trajectory, each point of a trajectory contains a similar trajectory at a lower scale. The reiterations of the doubling movement generate a fractal structure in all particle trajectories. As the doubling movement is the same at any scale, the theory has scale invariance.

The Scale Relativity of Laurent Nottale [20], who also tried to build a quantization of the Solar system in order to provide an explanation of the Titius-Bode law, is a similar approach.

The fundamental doubling movement that proves the necessity of planets (or planetoids) after the Kuiper belt, as Sedna, 2003 UB₃₁₃, finally explains these two groups of planets and it also provides the understanding of their role in the doubling of space and time. The latter is absolutely necessary so that each particle (planet) benefits from three different time flows (past, present, future).

By memorizing potential futures, a particle benefits from an information exchange. This instantaneous memorization takes place within imperceptible time openings in the time flow of the particle "present" and provides the particle with a "past", anticipating thus an action. By dissociating these three main time flows (past, present, future) in our solar system, the fundamental doubling movement ensures the coherence of initial elementary particles (planets) during the doubling cycle. It is thus normal, by analyzing the solar system, to derive the fine structure constant that is related to the electron charge and ensures the coherence of atoms. The doubling movement is cyclic and the end of the 25 920-year cycle which will finish soon [8], would change the ratio (α_0) and thus the fine structure constant α will also change [14, 15, 16].

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