The Mathematical Theory of the Revolving Cartesian Co-ordinate system

On the Theory of the Physical basis of the Laws of Bode, Inverse-square and of Hubble's Gravitational Red-shift

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***Abstract*—Treating a rectangular co-ordinate system as a Revolving system and utilizing the needed Mathematics reveals some things quiet unusual. This treatment leads to obtaining an equation of the form of a Vector field. Motion enters naturally, establishing distances x, y and z as functions of motion. Therefore, the Law established here is that, space (x, y, z) is a function of motion (which could be uniform or not). The equation then suggests by itself the origin of Perpetual angular momentum observed in all celestial objects and the Brownian motion in gases. This means that, any object composed of mass in space must be in motion. Therefore, every object that is surrounded by Space should be in perpetual motion, corresponding to the conclusions done by Professor Einstein in 1905. The axes of our co-ordinate system are rigid straight lines. However, equations suggest that the passage of any vector is a curved trajectory. Therefore, the equations just obtained generalize the Inverse-square law of Vector phenomena such as Gravitation, Magnetic forces, electric forces and the Molecular forces of Attraction and Repulsion. It is further suggested here that, a straight line is a curved line, and as according to the same equations the curved line is described by a Quadratic function.**

The absence of time in all these equations suggest that the law established is independent of time, i.e., all objects must according to this law, be in states of perpetual motion relative to one another. Having spoken of relative, it may also suffice to mention that, the law established does not in any way contradict the requirements of the Principles of Relativity.

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I. INTRODUCTION

All objects in space are in continuous relative angular motion. Physicists established this fact a long time ago. Mr. Einstein (1905) put it nicely that, phenomena of electrodynamics as well as of mechanics possess no properties corresponding to the idea of absolute rest. Take for example gas particles, planets, stars, galaxies, asteroids, etc., they are all in perpetual relative motion. Physicists in the World have greatly attempted to explain the answer to the question, why is every object in space in perpetual relative angular motion. Most of the explanations to answer this question have not been very satisfactory. Kepler with the 3 laws of planetary motion modeled the motion of planets. However, this model does not give the reason as to why celestial objects are in perpetual angular motion. The first simple explanation suggests that Objects in space are in continuous motion because of the first law of motion as postulated by Sir Isaac Newton, i.e., the gravity in space is negligible to counteract inertia. With the help of Clausius it was in early 1800s realized that, the kinetic energy possessed by gas particles is equivalent to the Heat energy content of the Gas. In his 1857 paper, Clausius equates heat and the kinetic energy of the gasses. However, up to now, there has been no means or explanation to link the behavior of gases to that of the objects in space in general.

Mechanical approaches in the interpretation of how nature works may hinder advancements in physics. For example, mechanical interpretations have been used to explain the phenomenon of floatation and rise based on densities. In this case, low density objects rise while high density objects get down. These interpretations have a bearing on the advancement of Physics as a field. This is because, future advances in this field rely upon the already known facts about the phenomenon. This stems from the fact that, applied knowledge is used to further understand and interpret newly observed Physical phenomena. There is, however, no way to run away from shortcomings associated with mechanical interpretations. Mechanical interpretations in most cases, explains the current problems, often making the interpretation and understanding of newly observed phenomena difficult. For example, expansion of the Universe is intriguing a lot of Physicists around the world. The theory to be developed here suggests that, space is a function of motion also. These difficulties arise because Physicists rely upon mechanically interpreted known facts about the phenomena. This problem calls for constant review and replacement of even reliable hypotheses in Physics today.

The Mathematical theory of the Revolving Cartesian Co-ordinate system was developed for the sole reason of explaining some of the puzzling phenomena about the Solar system planets. Phenomena like distances between the Sun and individual planets and angular momentum can be explained easily. Moreover, this simple mathematical theory can be extended to give the physical basis for the inverse square law, Bode's law of planetary distances and Hubble's law. Finally and most importantly, this theory renders an undisputable explanation for the source of perpetual angular momentum.

II. Revolving Cartesian Co-ordinate system by means of Simple Mathematics

A. *Space as a function of Uniform relative Motion*

Let there be a Cartesian co-ordinate system defined by its perpendicular x-, y- and z-axes. Let these axes be define a closed sphere, i.e., let the system form a closed ball of radius r, described by

$$\{(x,y,z): (x-x_0)^2 + (y-y_0)^2 + (z-z_0)^2 \le r^2 \quad (1)$$

where, the ball is centered / origin is at (x_0, y_0, z_0)= (0,0,0) . This description is borrowed from Grossman (1995, p 147), as he attempted to explain limits and Continuity. Let this ball be rotated about a line passing through its origin. This motion should be in such a way that, the sphere rotates in all the planes. This motion, regardless of its nature, should be uniform motion-say uniform velocities in the Planes. Since this motion is uniform, the amount of time which is the period, to complete one turn should be constant for all points on the 3-axes. Let this period be denoted by dt and by using $V(T,r',t)$, $V(T,x',t)$, $V(T,y',t)$ and $V(T,z',t)$ to represent the net uniform motion in x-, y- and z-axes, respectively, we obtain,

$$V(T,r',t) = V(T,x',t)i + V(T,y',t)j + V(T,z',t)k. \quad (2)$$

Note here that, $V(T,r',t)$ is written as such to show that, the Motion depends on temperature T, a certain distance r' and time t. Due to uniform motion, we denote a small change in displacement in the x-axis by dx, in the y-axis by dy and finally the z-axis by dz. Therefore, we have,

$$V(T,x',t) = \frac{d^i x}{dt^i},$$

$$V(T,y',t) = \frac{d^i y}{dt^i} \; and \quad (3)$$

$$V(T,z',t) = \frac{d^i z}{dt^i}$$

where, i=1,or 2 or 3 or….n which is any counting number. Assuming that, the sphere revolves about the Origin, V (T, r, t) represents the resultant uniform motion. When i=1, or when i=2, the uniform motion describes a velocity or an acceleration, respectively. Since, however, i can be any counting number, describing this motion is difficult.

Now, let, $dx = x - x_0$, $dy = y - y_0$,$dz = z - z_0$ and $dt = t - t_0$. The latter being the small change in time and not any other variable. In the neighbourhood of (x_0, y_0, z_0), we may have another sphere with the upper limits set by the points x', y' and z'. In this case, x_0<x'<x, y_0<y'<y and z_0<z'<z. Within the same period of time dt, we describe,

$$V(T,x',t)' = \frac{d^i x'}{dt^i}, \quad V(T,y',t) = \frac{d^i y}{dt^i}$$

$$and \quad V(T,z',t) = \frac{d^i z}{dt^i}, \quad (4)$$

By employing the motions in the x-axis alone, we shall investigate the nature of the equations due to this scenario. We shall only show the corresponding results in the remaining 2 axes, since the investigations are repetitive in nature.

We begin by choosing any 3 points x, x' and x'' on the x-axis and write,

$$dx = x - x_0, dx' = x' - x_0 \; and \; dx'' = x'' - x_0$$

Therefore, also write,

$$\frac{d^i x}{V(T,x',t)} = \frac{d^i x'}{V(T,x',t)',} = \frac{d^i x''}{V(T,x',t)''} = dt^i \quad (5)$$

We write equations (5) as,

$$\frac{d^i x}{V(T,x',t)} = \frac{d^i x'}{V(T,x',t)'},$$

$$\frac{d^i x}{V(T,x',t)} = \frac{d^i x''}{V(T,x',t)''}$$

$$\frac{d^i x'}{V(T,x',t)'} = \frac{d^i x''}{V(T,x',t)''} \quad (6)$$

We also write,

$$V(T,x',t)' = \frac{d^i x'}{d^i x} V(T,x',t), \quad (7)$$

Where, $d^i x'$ =(x-x_0) =x' and dx= (x-x_0) =x when x_0=0. Whence, we obtain the following 3 equations:-

$$V(T,x',t)' = \frac{x'}{x} V(T,x',t)$$

$$V(T,x',t) = \frac{x}{x} V(T,x',t)$$

$$V(T,x',t) - V(T,x',t)' = \frac{x-x'}{x} V(T,x',t) \quad (8)$$

Now equations (8), represents the motion of point x, relative to point x' on the x-axis. If we set, V (T, x', t) - V(T, x', t)' = dV (T, x', t) and x-x'= dx, we obtain,

$$\frac{dV(T,x',t)}{dx} = \frac{V(T,x',t)}{x}$$

$$0 = \frac{dV(T,x',t)}{dx} - \frac{V(T,x',t)}{x} \qquad (9)$$

The re-arrangements leading to eq. (9) communicates a strong and important message, that, there exists a function of both the motion and the displacements x. This is an important realization for it will be harnessed in the effort to arrive at our equation of space. Similarly, we may write,

$$V(T,x',t) - V(T,x',t)' = \frac{x - x'}{x'} V(T,x',t)'. \qquad (10)$$

We may write,

$$\frac{dV(T,x',t)}{dx} x' = V(T,x',t)',$$

And by integration we obtain

$$V(T,x',t)\, x' = \int_{x'}^{x} V(T,x',t)' dx. \qquad (11)$$

The integral just obtained is common one. It represents a Vector field where the vector is motion. This is the first characterization of the term $V(T,x',t)x'$. Mathematicians and Physicists in world are familiar with the equations for vector fields. These Vector field equations have only been shown for Work done in a gas and weight. Our primary task is to establish the meaning of the term or the above integral.

In this task, we begin by writing,

$$\frac{dx}{dV(T,x',t)} = dt^i$$

$$\frac{dx}{dV(T,x',t)} - dt^i = 0$$

$$\frac{dx - dV(T,x',t).dt^i}{dV(T,x',t)} = 0.$$

But,

$$dV(T,x',t) = \frac{x - x'}{x} V(T,x',t) = \frac{x - x'}{x'} V(T,x',t)'.$$

Using this equality and simple substitution, we obtain the following equation,

$$\frac{dxx}{(x - x')\, V(T,x',t)} - dt^i = 0 \qquad (12)$$

For the same change in time dt, we come up with an identical equation for the points x' and x'', as,

$$\frac{dx'x'}{(x' - x'')\, V(T,x',t)} - dt^i = 0\,. \qquad (13)$$

Equating eq. (12) and (13), gives us the following proportionality,

$$\frac{(x - x')V(T,x',t)}{(x' - x'')\, V(T,x',t)'} = \frac{dxx}{dx'x'}.$$

Eq. (13) is an important step in the process, although is still with a proportionality.

In order for us to remove this proportionality, we employ eq. (10) and resort back to the fact that, there exists a function $\boldsymbol{f}$, of both $V(T,x,t)$ and x. Let such a function be denoted by $\boldsymbol{f}$. One of such functions would be,

$$f = \frac{dx}{dV(T,x',t)} - \frac{x'}{V(T,x',t)} = 0. \quad (15)$$

For the **2** variables, we define the Arc-length dS for the function above as,

$$dS^2 = dV(T,x',t)^2 + dx^2 \qquad (16)$$

By employing equations (10), (14) and (16), with simple substitutions and re-arrangements, we obtain the following equation:-

$$\left(dxx\frac{x' - x''}{x - x'}\right)^2 = [V(T,x',t)dx']^2 \left[\frac{dS}{dV(T,x',t)} - 1\right]^2 \quad (17)$$

This is the law we sought. Note here that, the Arc-length is a function of both motion $V(T,x,t)$ and the displacement x. Since, $\frac{x'-x''}{(x-x')}$ is the scalar = n_0, we write the same equation for the other 3 axes.

$$(dxxn_0)^2 = [V(T,x',t)dx']^2 \left[\frac{dS}{dV(T,x',t)} - 1\right]^2$$

$$(dyyn_1)^2 = [V(T,y',t)dy']^2 \left[\frac{dS}{dV(T,y',t)} - 1\right]^2$$

$$(dzzn_2)^2 = [V(T,z',t)dz']^2 \left[\frac{dS}{dV(T,z',t)} - 1\right]^2$$

These are quadratic equations. They imply that a point on the rigid axis under uniform motion of rotation traverses a trajectory which is curved.

B. *Solution to Equations (17) of Space*

At certain point along the curve of f,

$$\frac{dS}{dV(T,x',t)} = 0.$$

Then, let $dx = x - x'$, giving us

$$dx\, x = -V(T,x',t)dx' \;.$$

With a simple expansion we have

$$x^2 - xx' + V(T,x',t)dx' = 0,$$

And so obtain, the roots as,

$$x = \frac{-1 \pm \sqrt{1^2 - 4\,\boldsymbol{V(T,x',t)}n_0 dx'}}{2}$$

Therefore,

$$x^2 = -n_0 \int_0^{x'} V(T,x',t)dx' \quad (18)$$

The same result is true for the other 2 axes. As earlier noted, this is a common equation representing the equation of a Vector field. As such, we run into the following conclusions:-

(i) In both results, eq. (18) and (17), motion enters naturally, establishing distances x, y and z as functions of motion. Therefore, the Law established here is that, space (x, y, z) is a function of motion (which could be uniform or not). The equation then suggests by itself the origin of Perpetual angular momentum observed in all celestial objects and the Brownian motion in gases. This means that, any object composed of mass in space must be in motion.

We must establish, whether, phenomena in nature work according to these equations. Careful manipulation of the Kinetic Theory of Gases has to a lower extent suggested that, equation (18) obtained can. Therefore, every object that is surrounded by Space should be in perpetual motion, corresponding to the conclusions done by Professor Einstein in 1905. I further, conjecture that by considering the Co-ordinate transformation in special relativity, one may arrive at the conclusion that, uniform motion corresponds to the 5th dimension of Space. This would make a point in space to be located by 5 objects, 4 from the space time continuum and the last one from the motion of space itself. For if we want to obtain the volume of space, we have,

$$(xyz)^2 = -n_0 n_1 n_2 \int_0^{x'}\int_0^{y'}\int_0^{z'} V(T,x',t)\,V(T,y',t)\,V(T,z',t)\,dx'dy'dz', \quad (19)$$

suggesting that, the volume is in motion relative to the origin.

(ii) The axes of our co-ordinate system are rigid straight lines. However, eqs.(17), suggests that the passage of any vector is a curved trajectory. This conclusion corresponds to the conclusion that Space-time is curved. Although, we cannot show the mathematical resemblance of the 2 curvatures, atleast they do not contradict each other. This curvature suggests that, the energy of any vector phenomenon is distributed over, the curved distance-this curved distance approximates the area. Therefore, the equations just obtained generalize the Inverse-square law of Vector phenomena such as Gravitation, Magnetic forces, electric forces and the Molecular forces of Attraction and Repulsion. Moreover, eqs.(17) and (18) are equivalent, suggesting that, a straight line is a curved line, and as according to the same equations the curved lines is described by a Quadratic function.

(iii) The absence of time in eqs.(17) and (18), suggests that the law established is independent of time, i.e., all objects must according to this law, be in states of perpetual motion relative to one another. Having spoken of relative, it may also suffice to mention that, the law established does not in any way contradict the requirements of the Principles of Relativity.

III. Theory of the Physical Basis for the Law of Bode, for Solar System Objects

Eq.(18) suggests Bode's law of Planetary distance from the sun. However, this theory does not restrict itself to planetary objects alone, but to all solar system objects. Since the motion in the equation is relative, it becomes clear that, even space is relative. Let there be an object of radius $\mathbf{r_0}$, hovering at a certain speed $\mathbf{V_0}$ relative and around the major central object. We have,

$r_0 = \sqrt{x_0^2 + y_0^2 + z_0^2}$ and $V_0 = V_x + V_y + V_z$. The distance R, between the 2 objects becomes,

$$R = -\sqrt{(V_x x_0 n_1)^2 + (V_y y_0 n_2)^2 + (V_z z_0 n_3)^2}$$
$$R = -V_0 r_0 n_0 \quad (20)$$

Eq. (20) is the physical basis for Bode's mathematical law of planetary distances.

Based on the equality mentioned at (20), we can estimate the values of the scalar n_0 in equation (19) for the Planets Mars, Mercury, Venus and Earth. See the table 1 below. As you explore the table you will see that, the value of n_0 for Mercury and Venus is about 0.5. For the planet Mars, the value of n_0 is 0.9936 if we take the position of the Satellite Phobos as the total radius of the planet. The same goes for the planet Mars whose Space is approximately 0.5 AU, suggesting that, its mass is approximately half that of our planet Earth.

Planet	Radius, r (m)	Angular Velocity relative to the Sun (V) (m/s)	$V\,X\,r$ (m)	$V\,X\,r$ (A.U)	Space between it and the Sun (A.U.)	n_0
Mercury	2,439,000	47,906.36557	$1.168436256 X 10^{11}$	0.7811	0.3871	0.4956
Venus	6,052,000	35,045.8105	$2.120972451 X 10^{11}$	1.4178	0.7233	0.5102
Earth	6,378,000	29,804.46291	$1.900928644 X 10^{11}$	1.2707	1.0000	0.7870
Mars	9,380,000	24,146.57414	$2.26494865 X 10^{11}$	1.5140	1.5237	0.9936
	3,396,000	24,146.57414	$8.200176578 X 10^{10}$	0.5481	1.5237	0.3597
Jupiter	71,492,000	13,067.57077	$9.342267695 X 10^{11}$	6.2449	5.2028	0.8331

IV. AN EXPLANATION FOR THE GAP BETWEEN THE PLANET MARS AND JUPITER/ ASTEROID BELT

The theory of Space-Mass systems suggests that, a definite amount of space surrounds a definite amount of Mass:-

$$\left.\begin{aligned} s(x) &= \int_0^{x'} \frac{m}{N(N+1)}dx \\ s(y) &= \int_0^{y'} \frac{m}{N(N+1)}dy \\ s(z) &= \int_0^{z'} \frac{m}{N(N+1)}dz. \end{aligned}\right\} \quad (21)$$

By using the x-axis alone and applying the (18), to (21), we obtain-

$$s(x) = -\int_0^{x'} \frac{m}{N(N+1)} V(T,x',t)'dx''$$

We see that, since $\frac{m}{N(N+1)}$ is a number of sets of elements on an object, the total space of the object can be given as

$$s(x) = -n_0 \int_0^{x'} V(T,x',t)dx \quad (22)$$

Where, $V(T,x',t)$ is its velocity and dx its radius. If we compose the 3 equations for the 3 axes we obtain (20). Applying the theory of Space-mass systems here suggests that an object of mass must have a definite amount of space. The space requirement for planet Earth is an Astronomical unit cubic, for Mars is about $0.5AU^3$. For the planet Jupiter, 5.2028-1.5237= $3.6791AU^3$. If this hypothesis is about true, then Jupiter has about 4 AU^3 space requirements, suggesting immediately that its space influence reaches the position of Mars. This can be proven or disapproved by measuring the radius of the Core of the planet. Therefore, the Gap between the planet Jupiter and Mars is part of the Space requirements for the former. This is why no planet can form in this area.

V. THEORY OF HUBBLE'S LAW OF GRAVITATIONAL RED-SHIFT

If we write,

$$\frac{dx}{V(T,x',t)} = \frac{dx'}{V(T,x',t)'} = \frac{dx''}{V(T,x',t)''} = dt^i \,,$$

We know that, the time is constant for changes in distances x. But, if we write,

$$\frac{V(T,x',t)}{dx} = \frac{V(T,x',t)'}{dx'} = \frac{V(T,x',t)''}{dx''} = \frac{1}{dt^i},$$

gives a result which is constant also. The result is the reciprocal of time. Let us set $\frac{1}{dt^i} = K$. By using one of the terms above, obtain,

$$V(T,x',t) = \int_{x'}^{x} K dx \quad (21)$$

If we set K=H, where H is Hubble's constant, the equation above becomes a generalization of the law of Hubble's Gravitational Red-shift. It is generalization since V (T, x', t) can be any motion and that, the equation stems from a more general formulation.

VI. CONCLUSION

We have seen why objects are in perpetual motion in space. The physical basis of both laws of Bode and Hubble has been given. The mechanical interpretations mentioned in the introductory remarks satisfy the present situation but hinder the development of explanations for newly discovered phenomena. It is because of such reasons that mechanical interpretations of physical phenomena must not always be relied upon. A careful analysis of the Kinetic theory of Gases suggests that, nature works according to the eq.(17). Moreover, in other papers, it can be shown that any object of mass in space has a definite amount of space and mass. It can also be shown that, gravity is not a force of attraction only, as postulated in the General theory of Relativity and Newtonian gravitation. Along the same line of thinking, finally, it can be shown that all objects in space are gaseous by nature. Finally, it is proposed that, distances determined by way of equations (17) and (18) are denoted by $S(x),\ S(y)\ and\ S(z)$, better description and for the sake of differentiating this system from the Space-time and other rigid co-ordinate systems.

A. *Abbreviations and Acronyms*

Some of the Abbreviations used are as follows:-

Abbreviation:	Definition:
Eq.	Equation
AU	Astronomical Unit

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