THEORETICAL COSMOLOGY-CELESTIAL MECHANICS CONSIDERING ECCENTRICITY OF THE PLANETARY MOTIONS, PATHS, OF PLANETS, AND EXOPLANETS AND MERCURY'S PARTIAL IRREGULAR RETROGRADE-PATH

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Abstract: Context- In the current formulas for astronomical application to the movement and orbital paths of not only planets and planets in our own solar system is based upon concept of circular motion, and Kepler's three Laws of Planetary Motion. Therefore a new theory is needed to improve the current understanding of kepeler's Laws and how they truly apply, not only in Earth's own solar system, but across the universe in like manner. Aims/Goals/Results- However, little thought is given to a relation of the circular orbits in relation to the theoretical elliptical motion of celestial bodies and the wider analysis of the known laws which govern the movements of celestial bodies around not only Earth's sun, but in theory would be applicablke to other stars, in other star systems across the universe as well. Which demands that this be taken into consideration when considering any type of astronomical phenomenon and that a derived theoretical formula for calculating the eccentricities of a planet, planetary body, in our own solar system, or beyond applies equally as well pertaining to all star systems. Within each star system there is also the theoretical probability that at least one planet/exoplanet could have a partial irregular retrograde path as is also

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seen within our own solar system when it comes to the displaced irregular movements of the planet Mercury. Therefore, theoretically such will be discussed in existing and new theoretical and mathematical formulas of such processes as an astronomical invariant with respect to the planets, in our own solar system and application in theory to exoplanets in other star systems in like manner in which evidence is also made in current bibliographical references as well.

Key words: Cosmology, Solar System, Planetary Bodies, Mercury, Exoplanets.

1 Introduction

An introductory path in understanding connection concerning this paper may well be best explained in "Theoretical Celestial Mechanics" [1], "which gives both theoretical and mathematical computations, and bibliographical references, as to why there possibly exists numerous star systems that could have at least one planet and/or planetary body (such as a minor planet),which in theory could have a partia and/or fulll irregular retrograde path as is also seen within our own solar system, when it comes to the displaced irregular movements of the planet Mercury. This is explained further in this logic line:

PLANETARY MOTION

1. a is the major semi-axis (velika poluosa ellipse)
2. b is the minor semi-axis (mala poluosa)
3. c is the focal distance (fokusna udaljenost)
4. p is the focal parameter (fokusni parameter)
5. t is the orbit tangent line (tangenta)
6. n is the orbit normal (normala)
7. φ is the polar angle of of the radius vector r, mesure from the axis x in counter-clockwise direction ro the radius vector r (polarni ugao radiusvektora r, mjeren od ose x u suprotnom smjeru kazaljke na satu do radiusvektora r)
8. ε is the numerical eccentricity (numericki ekscentricitet)

From the kinematics of the point M in Fig.1 and Fig.2 can be written following relations:

$$p = \frac{b^2}{a} = a(1-\varepsilon^2) \tag{1}$$

$$r_1 = a + \varepsilon x \tag{2}$$

$$r = a - \varepsilon x \tag{3}$$

$$r + r_1 = 2a \tag{4}$$

$$r = \frac{p}{1+\varepsilon cos\varphi} = a(1-\varepsilon cosu) \tag{5}$$

$$S = \pi ab \tag{6}$$

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \tag{7}$$

$$tg(\frac{\varphi}{2}) = \sqrt{\frac{1+\varepsilon}{1-\varepsilon}} tg(\frac{u}{2}) \tag{8}$$

$$tg(\gamma) = \frac{1+\varepsilon cos(\varphi)}{\varepsilon sin(\varphi)} \tag{9}$$

$$v_r = p\varepsilon\omega_0 sin(\varphi) \tag{10}$$

$$v_\varphi = p\omega_0(1+\varepsilon cos(\varphi)) \tag{11}$$

$$v = p\omega_0\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi))} \tag{12}$$

$$\omega_\varphi = \frac{d\varphi}{dt} = \omega_0(1+\varepsilon cos(\varphi))^2 \tag{13}$$

$$\omega_0 = \frac{C_2}{p^2} = \sqrt{\frac{kM}{p^3}} \tag{14}$$

$$C_2 = \sqrt{kpM} \tag{15}$$

$$cos(\gamma) = \frac{\varepsilon sin(\varphi)}{\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi)}} \tag{16}$$

$$sin(\gamma) = \frac{1+\varepsilon cos(\varphi)}{\sqrt{1+\varepsilon^2+2\varepsilon cos(\varphi)}} \tag{17}$$

From derived is (Iz izvedenog je):

$$\omega_\varphi = \frac{d\varphi}{dt} = \omega_0(1+\varepsilon cos(\varphi))^2 \tag{18}$$

There is (Odavde se nalazi) $t_\varphi = f(\varphi)$

$$t_\varphi = \frac{1}{\omega_0}\int_0^\varphi \frac{d\varphi}{(1+\varepsilon cos(\varphi))^2} \tag{19}$$

$$t_\varphi = \frac{1}{\omega_0}[\frac{2}{\sqrt{(1-\varepsilon^2)^3}} arctg(\frac{(1-\varepsilon)tg(\frac{\varphi}{2})}{\sqrt{1-\varepsilon^2}}) - \frac{\varepsilon sin(\varphi)}{(1-\varepsilon^2)(1+\varepsilon cos(\varphi))}] \tag{20}$$

If we take (Ako se uzme da je)

$$\frac{1-\varepsilon}{\sqrt{1-\varepsilon^2}} = \sqrt{\frac{1-\varepsilon}{1+\varepsilon}} \tag{21}$$

will be obtained (dobice se):

$$t_\varphi = \frac{1}{\omega_0(1-\varepsilon^2)}[\frac{2}{\sqrt{1-\varepsilon^2}} arctg(\sqrt{\frac{1-\varepsilon}{1+\varepsilon}} tg(\frac{\varphi}{2})) - \frac{\varepsilon sin(\varphi)}{1+\varepsilon cos(\varphi)}] \tag{22}$$

From equations (13) and (14) (Iz (13) i (14) je):

$$\omega_0 = \frac{kM}{p^3} = \sqrt{\frac{4\pi^2 a^3}{T^2 a^3 (1-\varepsilon^2)^3}} = \frac{2\pi}{T(1-\varepsilon^2)\sqrt{1-\varepsilon^2}} = \frac{2\pi\sqrt{1-\epsilon^2}}{T(1-\epsilon^2)^2} \tag{23}$$

2 Planets, Planetary Bodies, Affected By Our Sun, and Exoplanets Affected By Their Parent Stars

In astronomy, Kepler's Laws of planetary motion are three scientific laws describing orbital motion, originally formulated to describe the motion of planets around Earth's Sun.

Kepler's laws are:

1). The orbit of every planet is an ellipse with the Sun at one of the two foci. 2). A line joining a planet and the Sun sweeps out equal areas during equal intervals of time.] 3). The square of the orbital period of a planet is proportional to the cube of the semi-major axis of its orbit. Kepler's Laws and his analysis of the observations on which they were based challenged the long-accepted geocentric models of Aristotle and Ptolemy, and generally supported the heliocentric theory of Nicolaus Copernicus . Although the implementation of Kepler's Laws continued to support the fundamental generalized theories of Nicolaus Copernicus.

For example; in relation to and what is consistent with the (original paper paper written by this author in both Serbian and in a limited translation of English),the original paper's theoretical calculations are also consitent with the laws of physics, and of the currently understood explanations, and descriptions, expressed in detailed calculations regarding the orbit of the planet Mars. Which was first indicated to Kepler its elliptical shape, and he inferred that other heavenly bodies, including those farther away from the Sun, have elliptical orbits too. It was in such like assertions of Kepler's laws and his analysis of the observations on which they were based, challenged the long-accepted geocentric models of Aristotle and Ptolemy. However, Kepler's laws also did away with Copernicus's circular orbits and epicycles), by asserting that the Earth orbited the Sun, proving that the planets' speeds varied, and using elliptical orbits rather than circular orbits with epicycles.

Since bibliographical references are needed in any scientific research paper, in order to comapre and show the difference between the knowledge on a subject that is currently known and how the new paper-(like the one you are now reading) in the English language textual explanation may be able to explain as best as possible in written text how the new theories may apply as an improvement past the current theories and knowledge. In correlation with this in a previous paper [1], by Gregory and Fischer (2010), when this paper also considers the current thinking on planetary motion the authors of this paper propose that when considering the aspect of planetary motion the eccentricity from this equation cannot calculate the true value of eccentricity because it is an equation with two unknown factors. However, this paper a new in theory proposes that the calculations may find important relationships for calculating the surface segment of the ellipse corresponding to the angle of a planet and/or planetary body when it is in motion in rotational orbit around its sun. However, a second variant is applicable when pertaining to the eccentric rotation and movement of planets, and planetary bodies especially in our own solar system. In theory, this may also include exoplanets in other star systems in our universe as well. When the formulas are further studied beyond this paper, what is revealed is in theory that when the Sun is intensely involved in its function of movement the angle of a planet's movement is in relation to its direct influence by its sun, and the closest planets to the sun most likely (in theory) like Mercury's partial irregular retrograde path is directly related to it being the closest planet to our sun.

3 Radial Velocity and Circulating Components Follow The Relationship To Kepler's Law

However, when it comes to Kepler's second law for example; a planet would move faster near the Sun so the same area is swept out in a given time as at larger distances. This would also mean; that where the planet moves more slowly, would be a representation of the planet's proposed velocity and the force on the planet as well. This would be consistent with the first existence in conjuction with the laws of physics. Especially, in relation to the technology known as (RV). Or the radial velocity method which is also used as a primary technology in the detection of exoplanets.

For the angled orbital rotational path for planets in our own solar system and for exoplanets in other star systems as well, the relationship for the angle for the orbital rotational path for a planet or planetary body in any star system is conducive and obeys Kepler's Law in also in relation to its radial velocity and circulating component velocities in relation to its parent star.

As expressed before [1], as also discussed in the paper by Gregory and Fischer,(2010) although this paper primarily discusses this same type of subject in relation to exoplanets However, this paper proposes that the evidence is seen in our own solar system as it could be in other star systems involviung exoplanets as well. The evidence is in the fact, how this also applies in evidence to Earth's own solar system. Where the planet Mercury's irregular planetary movement is also a good example of that. Current thinking has come to the conclusion the first two of Kepler's Laws relate to an ellipse , and claims to be the path of a celestial body mass. However, not only does this paper propose evidencein theory that is somewhat different. This paper also proposes that the center of mass also includes all satellites. Such as minor planets, asteroids, and moons. Whether they are either stationary or revolving in orbit around their larger centers of mass like a planet/ exoplanet as well. This applies whether it be in our own solar system and/or another star system.

Isaac Newton also gave evidence to kepler's law in:"Principle Mathematics". Further meaning; " That if an instantaneous force is considered on the planet during its orbit, the area of the triangles defined by the path of the planet will be the same, for any fixed time interval. When the interval tends to zero, the force can be considered continuous".

Whereas in this paper in theory it is proposed that an angle of a planet in motion to its star that the angle of the ellipse is one-quarter to that of its eccentricity as well.

Therefore the author of this paper, and especially in the original paper written in the Serbian language as well emphasizes the strong use of calculations to propose that the center of mass in planetary systems is its barycenter. That a planet has completely different actual path. This range gives the mean radius of inertia of the body, measured from that barycenter and/ or from the rotation of all masses around a planet or in a planetary system, the current value of the radius of inertia or radius of movement of the planets being around their center. Equating to our sola system's sun.

The planetary system radius of inertia, and movement around its parent star/ sun could also be expressed in the following abbreviations. This is as follows: t_s is own time rotation; T is the time of revolution; a is the major axis of the ellipse; ε is the eccentricity of orbit and ϕ is the right anomaly-angle between the alignment of its parent star; in relation to its planets/ exoplanets.

4 Planetary Mass Moving In An Ellipse In A Clockwise Directional Motion

Therefore, accordingly the Center of this radius the ellipse of a planet/ exoplanet moving in an elliptical orbit around its own parent star/sun, moves in a clockwise direction.

For example: in theory in our own solar system in relation to how the planet Mercury revolves in an irregular orbit and round our own sun. In like manner, elliptical orbits of exoplanets around their parent star/sun could have some similar irregular movements around their parent stars as well. Just like Mercury in our own solar system moves around our sun in also an irregular orbit in like manner.

In this theoretical case whether it be mercury in our own solar system, or an exoplanet in another star system, both of these situations could both also have retrograde motion around their stars/suns in like manner.

However,some forms of orbital rotation cannot be calculated because of at least two or more unknown factors. However, what may also find important relationships for calculating the surface segment of the ellipse corresponding to its angle. This also is consistent and corresponds to the circulation movement. Which also involves moves from the radius of this angle in proportion to the movement of the body. Coming from the fact that the orientation and that the velocity is circumferential in relation to also the product vector.

This possibly could also mean that while Einstein's theory of relativity, is correct, it also applies to other variable orbits as we see for most of the planetary/sun orbit relationships in our own solar system. That is; except for Mercury and how it likely also has an irregular retrograde orbit around our own sun as well. Einstein's theory may have similar applications regarding this in other star systems and their exoplanets in the universe as well.

However, when the concept of Mercury's partial irregular movements are taken into consideration what conclusion can be drawn from the paper [1] by Gregory and Fischer, (2010) involving: "Theoretical Celestial Mechanics"?

The discussion derived from the theoretical proposals drawn from that paper conclude that planet, planetary bodies, exoplanets in other star systems and likely much of other astronomical phenomenon in our own solar system and other star systems propose that the these terms can be calculated eccentricity using the gradual approach , and for the known value of the eccentricity of the Earth.

However what this paper does not also take into consideration is, that the known value than is calculated within an equation and the accuracy of these equations may be projected to an accuracy within five decimal places. Being z equal to 0.0167112.

This may also be expressed in the elliptical eccentricity orbit of a either a planet in our solar system and/or an exoplanet in another solar system.

Research papers have to relate to and promote new hypotheses and theories based upon previous research . Therefore when considering the eccentricity of planetary motion and bodies in our own solar system, this is best expressed in being able to relate the new theory to curent/ recent discoveries where the previous current scientific thinking in a one tailed hypotheses can be improved upon in a new two tailed theory which presents and demonstrates new

evidence in either astronomy, or in cosmology. Therefore, bibliographical references on recent discoveries that have been made are essential in comapring current knowledge on palnetary motion comapred to the theories expressed and translated into English text in this paper, and/or to express in deeper detail in this author's orginal paper as an additional bibliographical reference in this paper as well. In which a URL reference at the end of the conclusion of this paper will be provided to refer to the original paper published on this subject in Serbian and limited English in like manner.

Such as is also expressed in the bibliographical reference in the paper by Gregory and Fisher [2] by P.C. Gregory, (2011). Whereas although he refers to and discusses the planetary motion in the Gliese 581 star system and its exoplanets, the point is that there are also similarities to the irregular path seen in the palnet Mercury in our solar system in some respects as this paper also discussed to a limted respect in application to the Gliese-581 star system as well. Gregory, (2011) also expresses the importance of the possibilities of not only circular orbital eccentricities as some other researchers and scientists believe may be the only orbital situation for the exoplanets in the Gliese 581 star system. This duplicates many similarities as is also seen in our solar system when it comes to the irregular movements/motions of Mercury as well. So, the theory of this paper may transcend past the boudaries of our own solar system according the Gregory, (2011) paper. However, he also explores the possibilities in his 2010 paper that elliptical eccentricities possibly could apply in the Gliese 581 star system as well.

However, in his second research paper [2] Bayesian Re-Analysis of the Gliese-581 Exoplanet System, Gregory, (2011), again discusses in greater depth as to whether or not only circular orbits could apply to the Gliese-581 star system and to its exoplanets, but he also specifically discusses if not only circular orbits and elliptical orbits could also apply in the Gliese-581 star system as well. Including the fact that if this could happen in the Gliese-581 star system it is a possibility it could happen not only in other star systems, but the evidence is clear of this happening in our own solar system with the irregular movements of the planet Mercury.

In Figure 1, is relevant to the center of rotation on that an elliptical orbit of a planet, planetary body, and/or exoplanet rotates around this center of its mass, which would be its parent star/sun. Secondly, in theory a proposed other alternative elliptical orbits affecting a that planet, planetary body, and/or exoplanetary orbits could follow around a center point of mass, in

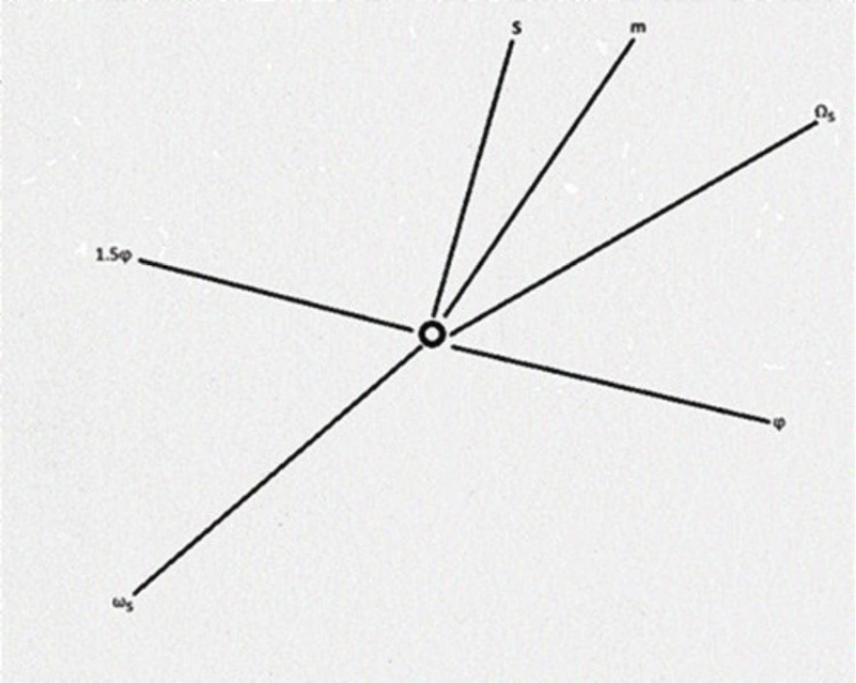

Figure 1: **Planetary Motion (Source: Author)**

similar ways how the planet Mercury revolves in orbit around Earth's sun. Another example has to do with an exoplanet about the size of Saturn discovered in 2003 and in 2006 a brown dwarf star was also discovered to have very oblong and irregular egg shaped like elliptical eccentric orbits in a star system 33 light years from Earth known as: "HD 3651".

5 Conclusion

In conclusion from the standpoints of theoretical cosmology, astronomy, and astrophysics, this paper has considered that current known thinking stipulates that some current formulas for astronomical applications pertaining to the orbital rotational paths of either planets, planetary bodies, and satellites that have to do with any and all other astronomical phenomenon in Earth's solar system and/or in other star systems primarily should have only circular orbital paths to the movement and application in the universe. However, because in earth's own solar system the planet mercury is unlike any other planetary orbital rotational path as a planet around the sun that this paper proposed and contended that if such irregular movements according to the retrograde orbital path of Mercury exists in Earth's solar system

where mankind also lives, than such like retrograde elliptical orbital paths could exist else where in other star systems with the exoplanets as well.

Therefore, this paper has presented an demonstrated not only theoretical mathematical equations that propose and offer additional explanations that both circular and elliptical retrograde orbits more likely than not exist not only pertaining to the planet Mercury in not only Earth's solar system, but in also other star systems as well. Therefore, the current mode of understanding that circular orbit are not the only orbits that exist not only in earth's solar system and not only other star systems in the our Milky way galaxy, but most like throughout the entire universe instead.

5.1 Exceptions to this paper

The original paper was written in both the Serbian and English languages. However, there are some Serbian mathematical formula symbols in the Serbian language that will not allow some of these mathematical formulas to be translated into English with the correct interpretations. Therefore, a full interpretation of the author's original paper and mathematical formulas cannot be fully interpreted into the ultimate goal of my the author's research and work. Which in theory the author the author's original paper in theory has a goal of correcting Kepler's laws, and perhaps that which is also related to the theory of relativity. In theoretical terminology that specifically relates to, and explains and describes the irregular movement not only concerning Mercury, but also all the planets (less than that of the Mercury). Therefore, in this paper although an English translation is made to explain as best as possible how the author's original theories may be better understood in English, this paper does not an cannot fully express in the English language how the author's theories original paper makes these theories and mathematical formula equations fully known.

5.2 Observation

The author also does not delete/ eliminate any of the Serbian language explanations and/or descriptions from the original paper sketches, illustrations, or diagrams, so that the full interpretation of both the author's theories and mathematical formula equations do not invalidate real understandings and insights into the evidence.

5.3 Important Reference to Full Original Paper

You may find the original version of this paper in both the Serbian and English languages at http://www.stewart-research-consulting.com/2-cosmology.html.

5.4 Acknowledgements

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5.5 Financial Statement

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