Equilibrium And Orbital Dynamics Of The Solar System And Beyond

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Abstract: This theory deals with "Equilibrium and Orbital Dynamics of the Solar System and beyond". In this paper, at first, I will give all the calculations and equations for how the equilibrium of all the planets in our solar system is achieved without flying out of the orbit. Secondly, this paper deals with the reasons why the planets orbit in elliptical path. This paper derives all the calculations and equations needed for the Ellipticity of the orbit and the laws that govern this nature which extends to all the stars, planets and the moons in the universe. Finally, I will specify new universal constants "Sun and planet constants" specifying how the orbits of solar planets and moons of all the planets orbits can be predicted in the whole Universe. Earth-moon history and data will be studied at length. I will extrapolate similar theory to other elliptical orbits of massive bodies in our solar system and beyond.

1. Introduction

a. EQUILIBRIUM FORCES

Ever since Newton, gravitation became a household word. But it is still a mystery how the gravity works on the planets or massive bodies in the universe and how and what opposing forces keep these planets in equilibrium. There are still a lot of unknowns because till now there is no real value assigned to these forces that bring the planets into equilibrium. This theory assigns a value that can be easily understood and how this gravitational force is kept in check to keep the universe in working smoothly.

To start with enormous amount of kinetic energy is generated by earth's rotation and orbital around the sun. This kinetic energy was given to earth and all the massive bodies in the universe at the beginning of their formation. Because of this initial energy due to Big bang, the objects like earth and other planets in the solar system are rotating, orbiting or spinning. This phenomenon keeps going as long as there is no force acting on it to stop it.

This energy in turn produces a centripetal force (C-Force)[(Ref. 4)] which is always directed towards its center. The centripetal force exists for all orbiting and rotating bodies and this force is always directed towards its center. This radial force is distributed all throughout the surface of the earth and directed towards the center of the earth. This means, C-Force is always in line with the gravitational force acting from any direction and opposes the gravitational force from the Sun or forces from all massive bodies nearby. This C-Force is generated by both orbiting and rotating earth. But rotational C-Force is small compared to orbital motion.

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This C-force can be compared to a moving train and if any force tries to stop it, unless the opposing force is greater than the train's force, no action ensures. This force is the root cause for balancing act it does from changing either speed or direction of its motion from the forces like gravitational and other forces. Newton's 3rd law comes into play here "to every action there is an equal and opposite reaction", this means any force that attempts to change the existing energy like the earth's C-Force or direction of motion, it counteracts that opposing force until it is depleted of that energy. Otherwise, our earth and other universal bodies would have been usurped by the stars or travel randomly and dangerously in the universe.

The C-Force still resists all other forces, but remains dormant until otherwise some force appears in the horizon like gravitational or rogue planet crashing or if an object tries to move or elevate. Then only this C-Force comes into play and acts by opposing or resisting.

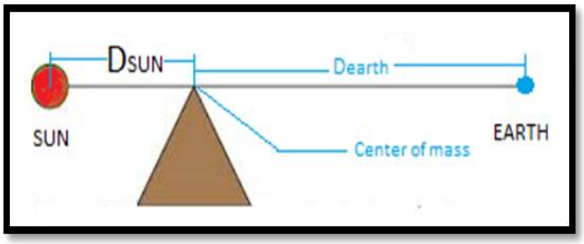
The equilibrium of all the stars, planets and moons in the universe is achieved by the C-Force of the planet which interacts with gravitational attraction or pulls between massive bodies. This theory explains how Centripetal force (The C-Force) of massive bodies like earth trying to balance the opposing forces when needed and interestingly enough exert only when and what is needed, and being dormant when not needed. This is the reason you do not feel these forces in daily life. When you move, you only need to expend small amount of energy that is needed for your motion against this force.

b. ELLIPTICAL ORBITS

This theory also explores the planet's orbital mechanics. In this paper, I will also talk about how the orbital of our planets are elliptical in nature and this extends to all the massive bodies of the universe. In our solar system all the planets revolve around the Sun more or less in elliptical orbits. Sun being the dominant of all the planets in our solar system and if Sun had an even mass close by (like a binary or twin-star system) they revolve around each other with their common center of mass (CM). This orbital path constitutes an ellipse with these masses located in each of the foci. This brings balance and stability to the whole system. This type of orbital characteristics is followed in the whole Universe. This is somewhat like the law of the lever [(Ref. 11)] or center of mass (CM). [(Ref. 2)]

The stability of earth-Sun system works by the principle of center of mass (CM [ref.2]) although they are unequal masses.

The center of mass is the unique point at the center of a distribution of mass in space that has the property that the weighted position vectors relative to this point sum to zero. In analogy to statistics, the center of mass is the mean location of a distribution of mass in space [(Ref. 2)]. For example, Sun mass * distance to CM = earth mass * distance to CM [(Refer to drawing 1)]. Satisfying this equation will give enough stability to the system. This formula is applicable to unequal masses also. CM depiction is shown below for Sun and earth.



DRAWING 1 (CM Depiction)

In the universe, it is common that two massive bodies revolve around each other with common Center of Mass (CM) [(1)] and their orbit is elliptical in nature. The CM principle is followed by binary stars in the whole universe [(2)]. A binary, or twin-star system, consists of two masses that revolve around each other with common CM. If their body masses are equal, they will be located at same distance from the center of their elliptical orbit. This center is called CM and the points where the masses are located is called Foci. The masses being at their respective foci bring balance and stability to the whole system. Same CM principle is followed in our solar system although orbiting planets masses are unequal compared to sun. Since sun is much more massive than its orbiting planets, according to CM principle, sun's focal distance is closer to the center of mass (Dsun) whereas the less massive planet's distance (dearth) is farther away (Drawing 1). However at present, the distance calculations for planets in our present solar system do not follow the CM principle although sun's position tally's with CM. In the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci by the principle of Center of Mass (CM). Interestingly enough once the foci and orbital distance of the planet are established, the orbital distance determines the orbital velocity according to the equation $G*Ms = V^2*d_{earthsun}$ ($G*M_s$ is constant) [section 2d equation 7]. Once the foci and the equilibrium of the both the masses are established, the orbital distance is locked in. Then, the initial value of the foci remains the same irrespective of the changing mass of the orbiting planet. Since mass component is in both the equilibrium equations [(Image 3 Eq. A5 and A6)] (C-Force and gravitational force (G-Force)), the equilibrium of the system stays intact. Once the velocity of orbit is determined by the orbital distance, foci are locked in and remain the same. This is true even if there is a change in the mass of the orbiting body as long as the C-Force of the mass of the orbiting planet exceeds or equals gravitational force of the main or primary mass. I will give more explanation in Planet Constants section [Intro section c] and Appendix C.

This explanation in the above paragraph is a very important because in appendix A (elliptical orbit - foci calculations) I will explain that all the planets went through large mass changes in their history. I want to emphasize here that once planet orbit is established, mass change won't affect the orbit or the foci.

At present our Sun-earth mass system does not follow the mathematical CM calculations. The Sun is at one of the foci of the elliptical orbit of earth and the other focus lies at $5*10^9$ meters from the Sun. This system seemed to be unbalanced because the calculated CM of the present Sun-earth system is at $4.498*10^5$ meters. Therefore the real focus comes to be twice this I. e. $8.996 * 10^5$ meters instead of $5*10^9$ meters.

This variation in foci calculations show that something happened to earth's past. This theory postulates that the mass of earth was much bigger in the past I.e. earth-mass was $3.324*10^{28}$ kg. This number balances the current Sun – earth CM calculations placing the foci at $5*10^9$ meters. I will show that this is the right amount of mass according to the mathematical center-mass calculations.

Because of this reasoning, this paper also predicts that when the earth was much larger, it was hit by another big planet (probably 4.4 billion years or so ago). This crash caused the mass of the earth to decrease to the present mass (m) = $5.97219*10^{24}$ kg [(1)]. Because of the earth's centripetal force which combats any crash as long as it is less than the earth's C-force, the orbit continued in the same path. But the mass of the earth decreased to the present mass despite the orbit CM features stayed the same I.e. Sun stayed at the same place in one of the foci. I will explain in detail later in this paper why this is so.

This is when the Moon was formed. At this time of the crash the earth's mass decreased tremendously in years to come I.e. earth's mass decreased by $5.559 *10^3$ times than the mass of old earth. From this earth's spilled dust eventually coagulated into a sphere to form moon.

Similar to earth, moon has gone thru changes during its course also. Moon's mass was also higher in the beginning as it gained its mass when it gained earth's debris. I will give all the calculations needed to substantiate this theory.

Old Moon mass was much higher, $3.283*10^{23}$ kg in the beginning of orbital formation. This mass eventually reduced by attrition by the present moon mass of $7.3477*10^{22}$ Kg. Similar to earth, moon's orbital characters stayed the same although some mass parameters changed during the course.

This reasoning confirms an old existing theory (*The Ejected Ring Theory:* A planetesimal the size of Mars struck the earth, ejecting large volumes of matter. A disk of orbiting material was formed, and this matter eventually condensed to form the Moon in orbit around the Earth [(Ref. 13)]) that some rogue planet hit the earth around 4.4 billion years ago. This paper predicts that it is then the earth lost some of its weight during this process while moon was being formed. I will do the same analysis for all the planets of the solar system, earth moon and one of the moons (Europa) of Jupiter.

This paper gives all the reasons and CM calculations involved in this process and gives insight into how the earth's and moon's orbits came into play.

c. Constants:

Once the gravitational force and the C-Force values are shown to be equal, these equations give very interesting results. I will analyze these equations and give very interesting insights. We can infer a lot of information from this and planet constants can be derived in calculating all the planets moons orbital information.

From the elliptical orbital section I mentioned that in the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci according to the principle of Center of Mass (CM). Orbiting planet's mass is also useful in resisting gravitational force according to equilibrium equations. Then when we combine these equilibrium equations [section 2 iii Eqns. 15, 16, 17 and18] we can extrapolate interesting information like orbital distance alone determines the orbital velocity according to the equation $G*Ms = V^2*d_{earthsun}$ ($G*M_s$ being constant) [Eqn. 16].

In Appendix B, I will show that foci calculations of all the planets in our present solar system are all over the place and do not follow the CM principle. Because of this, in my calculations I predicted in all the planets in our solar system lost mass and this fits well with the present foci values. Foci determine the orbital distance. By the combining equilibrium equations in Appendix C, we also infer that orbital distance alone determines the velocity (Section 3 C and Appendix C). Thus I concluded that after the foci were formed, orbital distance alone determine the velocity of orbit. Planets stayed in the same orbit from then on or locked in. Because of this lock-in, although all the planets in our solar system lost mass later the foci remained the same. Since mass component is in both equilibrium equations (C-Force and G-Force) it didn't affect or disturb the equilibrium of the system. Equilibrium stays intact as long as the C-Force of the changing mass of the secondary planet can equal gravitational force of the primary mass. This is the reason for the discrepancies in the present foci calculation in the present solar system. I will give more explanation in Planet Constants section and Appendix C.

This explanation in the above paragraph is a very important because in appendix B (elliptical orbit - foci calculations) I will explain that all the planets went through large mass changes in their history. I want to emphasize here that once planet orbit is established, mass change won't affect the orbit or the foci.

Now looking at section 2 C iii 8, equation18 gives a Constant $G*M_s$ [Ref. 27]. This constant can be used to calculate all the planet orbital characteristics in our solar system. In Appendix C, I will give details. Similarly, I give other planet constants like earth, Jupiter etc. that can be used to calculate all the moons or all the satellite orbits of the particular planet. These constants are very important and easily calculate the orbital characteristics.

2. Existing history and calculations

a. Equilibrium Forces:

First I will start with equilibrium forces between earth and Sun, and then moon and earth. I will give calculations in Appendix A for rest of the solar planetary equilibrium equations including Jupiter's moon Europa.

i. Nomenclature, Known values:

This information is repeated in Appendices A, B and C also:

1. Constant G - Universal Gravity
2. m_{pearth} = mass of present earth
3. $d_{earthsun}$ = Orbital distance between sun and earth
4. F_{crot} = Centripetal force of earth due to earth's rotation
5. F_{corbit} = Centripetal force of earth due to earth's orbit around the Sun
6. $F_{ccombined}$ = Combined Centripetal force of earth due to earth's rotation and orbital
7. $F_{cmaximum}$ Force extended by earth into space due to its centripetal force of earth due to its rotation
8. $Fg = Gravitational\ force\ between\ earth\ and\ Sun$
9. $Fc = Centripetal\ force\ of\ earth$ (C-Force)
10. $Ms = mass\ of\ Sun = 1.9891 * 10^{30}$ kg [Ref. 8]
11. $m_{pe} = present\ mass\ of\ earth = 5.97219 * 10^{24}$ kg [Ref. 1]
12. $G = Universal\ gravity\ constant = 6.67383 * 10^{-11} \frac{m^3}{kg*s^2}$ [Ref. 7]
13. $Velorbit_{earthsun} = Orbit\ velocity\ of\ earth\ around\ the\ Sun = 2.9785 * 10^4 m/s$ [Ref. 6]
14. $d_e = Orbital\ distance\ of\ earth\ to\ Sun$ $=1.486*10^{11}$ meters
15. Rotational speed of earth--- velrot = 465 m/s [Ref. 3]
16. $F = ma_c = mv_{orbit} / r^2$ [Ref. 4]
17. Radius of earth $r = 6.371* 10^6$ m [Ref. 5]

b. Existing History

Now I will calculate the force of gravity affecting the earth (attractive force) because of the Sun.

i. Force of gravity due to Sun F_g :

1. Earth's distance from Sun = $1.496*10^{11}$ m [Ref. 6]
2. Sun's Mass $1.9891*10^{30}$ kg [Ref. 8]
3. Universal Gravitational Constant $G = 6.674*10^{-11}\ m^3 / kg*s^2$ [Ref. 7]
4. $F_g = G*m_{earth}*M_{Sun} / d^2_{\ Sun\&earth}$ [ref. 7] Equation 7
5. Force of gravity due to Sun $F_g = 3.547*10^{22}$ N Equation 7A

ii. Earth's centripetal Force due to Orbital velocity:

1. This equation can be written as follows:

2. Earth mass $m_e = 5.97219*10^{24}$ kg (Ref. 1)
3. Centripetal force F = ma_c (Ref. 3) Equation 8
4. ∴Centripetal Force $F_{c\text{-}orbit} = ma_c = m*v_{orbit}^2/r$ (where $a= v^2/r$) (where $a_c = v_{orbit}^2/r$) (Ref. 4) Equation 9
5. **∴Centripetal Force due to rotational velocity $F_{c\text{-}rot} = m*a = m* v_{rot}^2/r = 2.03*10^{23}$ N** Equation 10
6. Orbital speed of earth or velocity velobit = $29.8*10^3$ m/s (Ref. 5)
7. radearth = $6.371* 10^6$ m (Ref. 6)
8. **∴Centripetal Force due to orbital velocity $F_{c\text{-}orbit} = m*a = m* v_{orbit}^2/r = 8.237*10^{26}$ N Equation 11**

iii. Force of gravity due to Moon:

1. Mass of Moon = $7.3477*10^{22}$ kg (Ref. 9)
2. Earth's Distance from moon: $d_{moonearth} = 3.844*10^8$ m (Ref. 9)
3. Force of gravity due to Moon $Fg_{moon} = G*m_{pe}* m_{pmoon} / d_{moonearth}^2 = 1.985*10^{20}$ N Equation 12
4. Force of gravity of rest of the other planets is in Appendix A. (Ref. 18)

3. New Theory

i. Equilibrium theory:

1. The magnitude of the kinetic energy generated by the orbiting earth is enormous. This in turn creates centripetal force. Below are the calculations for the centripetal force generated by earth due to orbit, rotation, combined effect and the extended length of this centripetal force into the universe(Images 1 and 2).
2. **Calculation screenshots**:

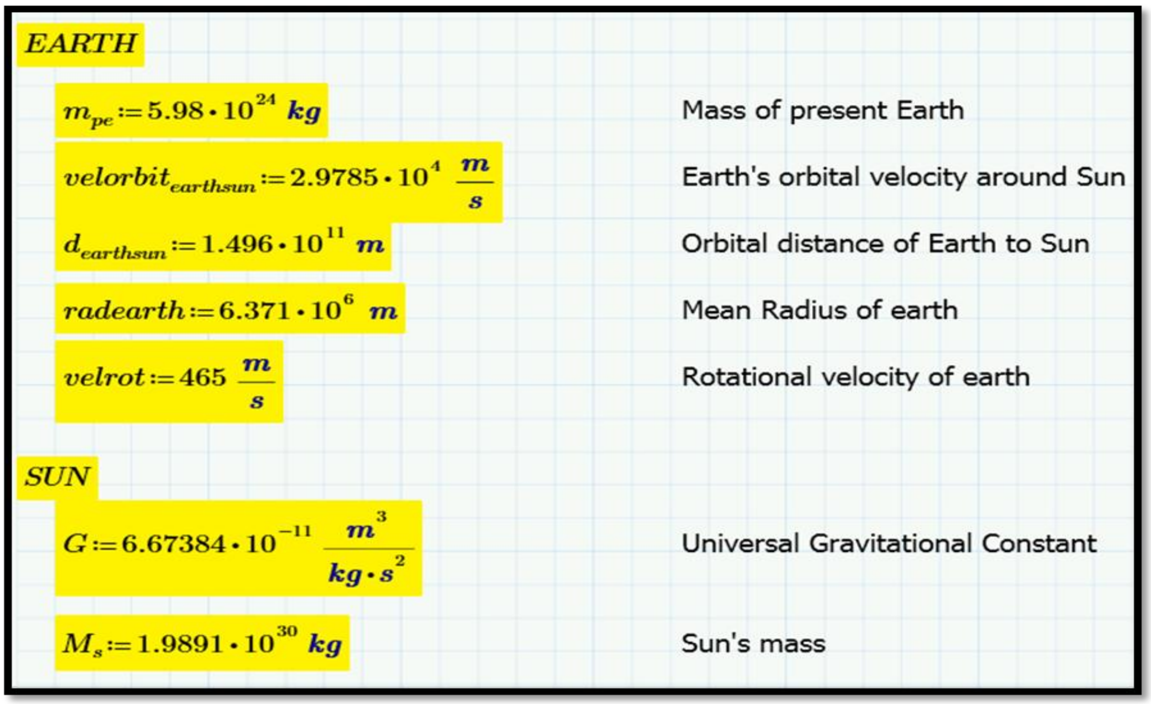


IMAGE 1 (EARTH, SUN PARAMETERS-From Appendix A)

$$Fcorbit := m_{pe} \cdot velorbit_{earthsun} \cdot \frac{velorbit_{earthsun}}{radearth} = \left(8.327 \cdot 10^{26}\right) N$$ EQUATION A1

Notice that this force IS CALCULATED AT THE SURFACE OF THE EARTH. This is NOT THE equilibrium force. @ the earth's surface

CENTRIPETAL FORCE DUE TO ROTATION

$$Fcrot := m_{pe} \cdot velrot \cdot \frac{velrot}{radearth} = \left(2.03 \cdot 10^{23}\right) N$$ EQUATION A2

COMBINED CENTRIPETAL FORCE DUE TO ORBIT AND ROTATION

EQUATION A3

$$Fccomb := Fcrot + Fcorbit = \left(8.329 \cdot 10^{26}\right) N$$

This is almost same as Fcorbit

This is the minimum force required to MOVE EARTH from its present location.

Now I will calculate how much this orbital force extends into universe for curiosity sake. Again this force is dormant, only resists if opposed by an external or applied force.

This force extends to a distance as follows:
Assuming the extended length is

$$extendlength := 10^{34}\ m$$

$$Fcmaximum := m_{pe} \cdot velorbit_{earthsun} \cdot \frac{velorbit_{earthsun}}{extendlength} = 0.531\ N$$ EQUATION A4

This C-Force at this extended length is about 1/2 Newton I.e. if 1/2 a newton force is applied from this length on to earth, earth still resists that force.

IMAGE 2 (Earth's Centripetal force)

3. As can be seen from the above images, the centripetal force generated is enormous, especially due to orbital velocity.
4. Earth's Equilibrium equations:
5. Now, I will calculate the gravitational force of Sun on earth and Centripetal Force (C-Force) generated due to earth's orbital distance $d_{earthsun}$:

EQUILIBRIUMEQUATIONS

EARTH

$$Fg_{earthsun} := G \cdot m_{pe} \cdot \frac{M_s}{d_{earthsun}^{\ 2}} = \left(3.543 \cdot 10^{22}\right) N$$ EQUATION A5

This is the Gravitational attraction between Sun and Earth

$$Fcatdistd_{earthsun} := m_{pe} \cdot \frac{velorbit_{earthsun} \cdot velorbit_{earthsun}}{d_{earthsun}} = \left(3.542 \cdot 10^{22}\right) N$$ EQUATION A6

Important

This is the force that tugs with gravity of the sun. Notice that this C-Force IS CALCULATED AT ORBITAL DISTANCE. NOT ON THE SURFACE OF EARTH. THE EARTH EXTENDS THIS FORCE TO THE CENTER OF THE SUN AND THIS IS THE VALUE OF THE C-FORCE THAT keeps the planets attached to large mass objects and not flyaway. THIS IS THE EQUILIBRIUM FORCE.

IMAGE 3- Equilibrium Equations (Gravitational and Earth's Centripetal)

6. The Fc at orbital distance $d_{earthsun}$ is the key. This is the centripetal force of earth value that is acting at the center of the Sun.
7. Fc in equation A6 from Image 3 and Fg in equation A5 from Image3 is equal. Fc at $d_{earthsun}$ is the force that tugs in equilibrium with gravity. This is keeping the planets attached to large mass like our Sun without flying away.
8. As we can see from the equation A1 from Image 2, the C-Force at the earth radius is a very large number. There is plenty of C-Force still left to take care of any other forces that may try to change the existing motion or direction of earth. Equations A2, A3 and A4 (Image 2) give the extent of force and how far it extends (a distance of 10^{34} meters) into the universe.
9. Moons Equilibrium forces:
10. Moon's centripetal Force due to orbital velocity at orbital distance $d_{moonearth}$ is given below:

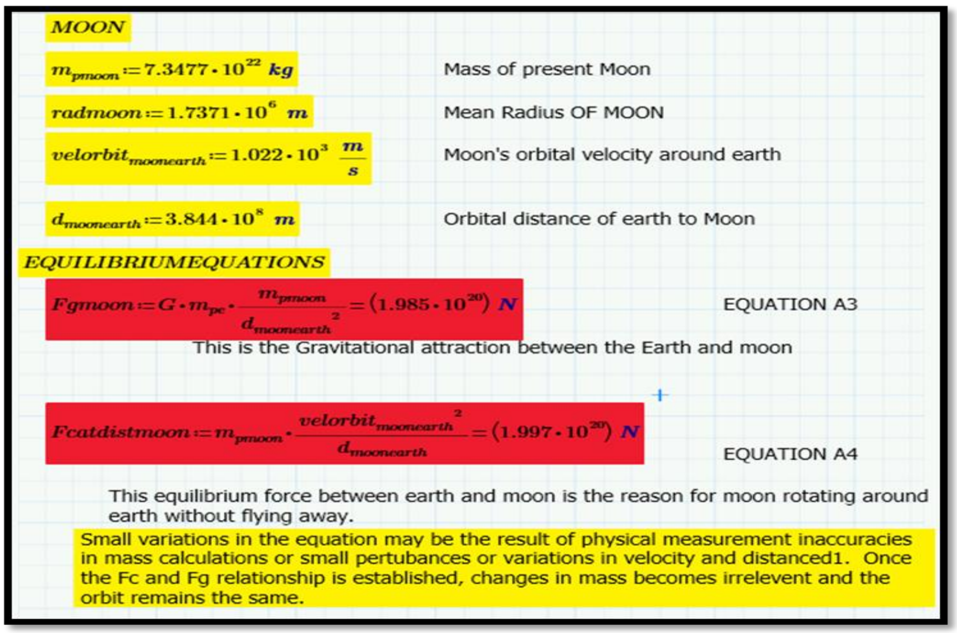


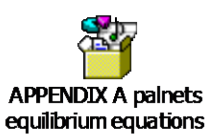
IMAGE 4 (Equilibrium (forces between Earth and moon))

11. The Fc of moon at its radius is:

$$Fcatradmoon := m_{pmoon} \cdot \frac{velorbit_{moonearth}^{2}}{radmoon} = (4.418 \cdot 10^{22})\ N$$

Equation 13

12. As you can see that C-Force that is protecting moon above is greater than the Gravitational force of earth on moon, so equilibrium of earth and moon are ensured.
13. Equilibrium equations for all other planets and one of the moons of Jupiter (Europa) are given in Appendix A: (Ref. 18)



ii. ELLIPTICAL ORBIT THEORY

Our solar system and the whole universe have lot of uneven mass combinations. In order to satisfy this scenario, the bigger mass is always located in one of the foci more or less in a standstill manner and the smaller mass body revolves around the center mass (CM). The CM is where the fulcrum would be if these masse were balanced on a seesaw. The seesaw formula would be mass1 (m1)*distance (d) = mass2 (m2)*distance (d2). The stability of the orbit is attained only if the equation is satisfied. The orbits of all the planets in our solar system are ellipses with the Sun at one focus.

At present our Sun and its planets, and all the planets and their moons do not follow the mathematical CM calculations. I will calculate the inequalities stemming from these orbits and extrapolate the logical reasons for this discrepancy and give solutions. All the 9 planets of our solar system will be studied at length and earth moon treatise will be given. Earth-moon history and data will be studied in length. I will extrapolate similar theory to other elliptical orbits of massive bodies in our solar system.

The stability of earth-Sun system works by the principle of CM. Two unequal masses acting on each other at a distance are best balanced if they rotate around the center-mass for a stable system. It is a fact that the Sun is at one of the Foci of the earth's elliptical orbit.

Let us take orbit of the earth. At present, Sun is at one of the foci of the elliptical orbit of earth and the other foci lies at $5*10^9$ meters from the Sun. The other focus is $5*10^9$ meters away from the Sun and CM lies $2.5*10^9$ meters away from the Sun. The calculated CM of the present Sun-earth system is $4.498*10^5$ meters. For a balanced orbit, the Sun should be at the foci of (twice this number) I. e. $8.996 * 10^5$ meters instead of $5*10^9$ meters.

1. CM calculations for Sun and earth are given below (Images 5 and 6):

$a_{earth} := 1.52098232 \cdot 10^{11}\ m$ Earth's orbital periapsis distance from the Sun

$b_{earth} := 1.47098290 \cdot 10^{11}\ m$ Earth's orbital apoapsis distance from the Sun

The formula for Center of Mass (CM) Calculations is as follows:

Ms*Sundistance to CM=mpe*earth's orbital distance to CM *Equation1*

I will calculate the required CM for a balanced mass system:

$$EarthsunCMshouldbe := \frac{(m_{pe} \cdot d_{earthsun})}{M_s} = (4.498 \cdot 10^5)\ m$$ EQUATION B1

But the present CM is:

$$focii_{earth} := a_{earth} - b_{earth} = (5 \cdot 10^9)\ m$$ EQUATION B2

$$presentearthsunCMis := \frac{focii_{earth}}{2} = (2.5 \cdot 10^9)\ m$$ EQUATION B3

This is the Present CM of earth Sun mass system. This is too far away from what it should be. The reason for this is when orbit of the earth was forming, earth had a LARGER MASS.

$$ratioearth := \frac{presentearthsunCMis}{EarthsunCMshouldbe} = 5.559 \cdot 10^3$$ EQUATION B4

This above ratio gives how many times mass of the earth was bigger in the past.

IMAGE 5 (Center of mass (CM) calculations (Sun & Earth System)

$$oldearthmass := m_{pe} \cdot ratioearth = (3.324 \cdot 10^{28})\ kg$$ EQUATION B5

If we recalculate the focii using this old earth mass in equation B1:

$$oldCM := oldearthmass \cdot \frac{d_{earthsun}}{M_s} = (2.5 \cdot 10^9)\ m$$ EQUATION B6

This is also the present CM of earth-Sun.

This means the earth's foci and orbit was formed when the earth was more massier.

To validate Equation 1:

$$M_s \cdot presentearthsunCMis = (4.973 \cdot 10^{39})\ kg \cdot m$$ OK EQUATION B7

$$oldearthmass \cdot d_{earthsun} = (4.973 \cdot 10^{39})\ kg \cdot m$$ OK EQUATION B8

The above equations show mass distribution Sun and earth in space is balanced using old earth mass. The center of mass equation is satisfied. Using present earth mass equation below shows an imbalance.

$$m_{pe} \cdot d_{earthsun} = (8.946 \cdot 10^{35})\ kg \cdot m$$ NOTOK EQUATION B9

A SPECIAL NOTE: In the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci according to the principle of Center of Mass (CM). Orbiting planet's mass is useful in initial foci formation and in resisting gravitational force. Once the foci and the equilibrium of the both the masses are established, initial value of the foci remains the same irrespective of the changing mass of the orbiting planet. Since mass component is in both equilibrium (C-Force and G-Force) it won't affect the equilibrium of the system. This is true as long as the C-Force of the changing mass of the secondary planet exceeds or equals gravitational force of the primary mass.

IMAGE 6 (Center of mass (CM) calculations (Sun & Earth System) Cont'd

2. Foci calculations from this image 5 show that the present foci are different from the calculated foci derived from the CM principle. This variation in foci calculations show that something happened in the earth's past. This theory postulates in the (Image 60) that the mass of earth was much bigger in the past I.e. earth-mass was $3.324*10^{28}$ kg (Image 6-Eq. B5). This number balances the current Sun–earth CM calculations placing the foci at $5*10^{9}$ meters (Image 6-Eq. B6).
3. Because of this reasoning, it is safe to assume that the earth had a larger mass before and was hit by another big planet (probably 4.4 billion years or so ago). This crash caused the mass of the earth to decrease to the present mass of (m_{pearth}) = $5.97219*10^{24}$ kg [(1)]. Because of the earth's centripetal force combats any crash as long as it is less than the earth's C-force (Image 2-Eqs. A1&A3), the orbit continued in the same path. But the mass of the earth decreased to the present mass despite the orbit CM features stayed the same I.e. Sun stayed at the same present location at one of the foci ($5*10^{9}$ meters). Remember in the introduction that I mentioned that once foci and orbital distance of the planet are established, orbits are locked-in and only orbit distance determines orbit velocity and the orbiting planet's mass changes do not affect the orbital characteristics or the foci anymore.
4. This is when the Moon was formed. At this time of the crash the earth's mass decreased tremendously in years to come I.e. earth's mass decreased by $5.559 *10^{3}$ times than the mass of old earth. Then all the loose mass formed into a disc. The earth's decreased mass spilled the dust to form a disk around the earth and eventually the moon was formed and coagulated into a sphere from this dust.
5. Images 7 and 8 give all the calculations for moon.

MOON

$m_{pmoon} := 7.3477 \cdot 10^{22}\ kg$ — Mass of present Moon

$radmoon := 1.7371 \cdot 10^{6}\ m$ — Mean Radius OF MOON

$velorbit_{moonearth} := 1.022 \cdot 10^{3}\ \frac{m}{s}$ — Moon's orbital velocity around earth

$d_{moonearth} := 3.844 \cdot 10^{8}\ m$ — Orbital distance of earth to Moon

$amoon := 405503000\ m$ — Moon's orbital periapsis distance from the earth

$bmoon := 363295000\ m$ — moon's orbital apoapsis distance from the Sun

$fociimoon := amoon - bmoon = (4.221 \cdot 10^{7})\ m$ EQUATION B10

$avgmoon := \frac{fociimoon}{2} = (2.11 \cdot 10^{7})\ m$ EQUATION B11

moon ellipse midpoint Midpoint

$presentfociimoon := (405503\ km - 363295\ km) = (4.221 \cdot 10^{7})\ m$ EQUATION B12

IMAGE 7 (CM calculations (Earth & Moon System)

$presentmoon'sCMis := \frac{presentfociimoon}{2} = (2.11 \cdot 10^{7})\ m$ EQUATION B13

This is the Present CM of earth moon mass system. This is far away.

$earthmoonCMshouldbe := \frac{d_{moonearth}}{m_{pe}}\ m_{pmoon} = (4.723 \cdot 10^{6})\ m$ EQUATION B14

$ratio := \frac{earthmoonCMshouldbe}{presentmoon'sCMis} = 0.224$ EQUATION B15

This ratio gives how many times the moon was bigger in the past.

$oldmoonmass := \frac{m_{pmoon}}{ratio} = (3.283 \cdot 10^{23})\ kg$ EQUATION B16

Recalculating the focii with this old moon mass:

$m_{pe} \cdot presentmoon'sCMis = (1.262 \cdot 10^{32})\ kg \cdot m$ OK EQUATION B17

$oldmoonmass \cdot d_{moonearth} = (1.262 \cdot 10^{32})\ kg \cdot m$ OK EQUATION B18

$m_{pmoon} \cdot d_{moonearth} = (2.824 \cdot 10^{31})\ kg \cdot m$ NOTOK EQUATION B19

A SPECIAL NOTE: I will show in my last constants section of the main paper that earth's orbit or orbit charactersticks is not effected by the changes in the mass. Fg and Fc values are still satisfied irrespective of the changes in the planet mass because mass component is in both the Fc and Fg equations. After the foci is formed and orbit distance is determined, velocity of the orbiting planet is determined by the orbital distance.

IMAGE 8 (CM) calculations (Earth & Moon System) Cont'd

6. Similar to earth, moon has gone thru changes during its course. Moon's mass was higher in the beginning as it gained its mass when it gained earth's disk debris.
7. Equation B6 in Image 8 shows that old Moon's mass was much higher, $3.283*10^{23}$ kg in the beginning of orbital formation. This mass eventually reduced by attrition by the present moon mass of $7.3477*10^{22}$ Kg. The orbital characteristics of earth moon system suggest that by the time moon was formed and started the orbit, earth was already reduced to the present mass (Eq. 17 &18).
8. Appendix B shows all the calculated CM values for all other planets in our solar system including Europa. [(Ref. 18)]

Appendix B Foci
6-29-2014.xps

9. From Appendix B, following interesting observations can be made:
10. By the time moon was formed, earth lost its old mass and became present earth mass. Present mass is $5.98*10^{24}$ kg. Earth and moon masses were not that far apart. Old Moon's mass was $4.283*10^{23}$ kg. This may be the reason for earth-moon tidal lock [(Ref. 20)].
11. Present mass of Jupiter is $1.89813*10^{27}$ kg. Old mass $9.702*10^{28}$ kg Jupiter also was around 51.115 times heavier than present showing a pattern that most of these planets past show a significant turmoil and lost mass either to their respective moons or by simple attrition. Interestingly, the Europa's (Appendix B) calculated old mass was $6.756*10^{29}$ kg, much more than old Jupiter's mass. Also gives insight into the present strange orbital interaction of Europa with Jupiter.
12. Planets old mass for Pluto, Mars, Mercury and Venus were close to Sun's mass suggests some strange phenomenon occurred in the past and explain the way they now orbit or behave. They apparently lost lot of weight at present suggesting heavy bombardment [(ref. 19)]. The "tidal lock" behavior [(Ref. 14)] may explain this massiveness of these planets in the past. Especially Jupiter's moon, Europa's mass was much larger than (old and present) Jupiter's mass. This suggests some tidal locking might have occurred and eventually Europa lost its mass. The strange behavior still

continues because loosing mass in time does not change the orbital characteristics because orbit velocity only depend on average orbital distance (Appendix C). Foci are more characterized by mass in the beginning of the planet formation. Once the average orbital distance is determined, the mass change does not have a bearing on the orbital characteristics nor the foci.

13. The LHB theory seems to be more likely happened in light of my findings in Appendix B: Quote from (Ref. 14) (Ref. 15) (Ref. 16) "The **Late Heavy Bombardment** (commonly referred to as the **lunar cataclysm**, or the **LHB**) is a hypothetical event thought to have occurred approximately 4.1 to 3.8 billion years ago (Ga).[1] During this interval, a disproportionately large number of asteroids apparently collided with the early terrestrial planets in the inner solar system, including Mercury, Venus, Earth and Mars.[2] The LHB happened "late" in the Solar System's accretion period when the Earth and other rocky planets formed and accreted most of their mass; it is a period still early in the history of the solar system as a whole". (Ref. 13)
14. Theories like tidal lock between Pluto and Charon also seem to be more appropriate to have occured with my new theory: Quote from reference 13 "Pluto and Charon are an extreme example of a tidal lock. Charon is a relatively large moon in comparison to its primary and also has a very close orbit. This has made Pluto also tidally locked to Charon. In effect, these two celestial bodies revolve around each other (their barycenter lies outside of Pluto) as if joined with a rod connecting two opposite points on their surfaces" (Ref. 16)
15. Quote from reference 14 "If the difference in mass between the two bodies and their physical separation is small, each may be tidally locked to the other, as is the case between Pluto and Charon" (Ref. 14).

iii. Constants:

Analysis of the equilibrium equations:

1. Let us look at the forces (Equation A5 and A6 in Image 3) acting between Sun and earth:
2. Fc and Fg are equal. This Fc keeps the equilibrium of all the planets in the solar system from flying away. Fc is the force that tugs in equilibrium with gravity. This is keeping the planets attached to large mass like our Sun without flying away.
3. The key feature of this theory is by combining these equations:
4. $\therefore Fg = G \times m_{pe} \times \frac{Ms}{d^2} = m_{pe} \times \frac{velorbit^2_{earthsun}}{d_{earthsun}}$ Equation 14
5. $\therefore G \times m_{pe} \times \frac{Ms}{d^2_{earthsun}} = m_{pe} \times \frac{velorbit^2_{earthsun}}{d_{earthsun}}$ Equation 15 ref 22
6. $\therefore G \times \frac{M_s}{d_{earthsun}} = m_{pe} \times velorbit^2{}_{earthsun}$ Equation 16 ref. 26
7. $\therefore G \times Ms = velorbit^2{}_{earthsun} \times d_{earthsun}$ Equation 17
8. $\therefore G \times Ms = C\ (constant)$ Equation 18 ref. 27
9. $\therefore C/d_{earthsun} = velorbit^2{}_{earthsun}$ Equation 19
10. This component $G*M_s$ is constant (C) for all the planets in our solar system.

Let us start with equilibrium equations for Sun and earth.

EQUILIBRIUMEQUATIONS

$$Fg := G \cdot m_{pe} \cdot \frac{M_s}{d_{earthsun}^{\ 2}} = \left(3.547 \cdot 10^{22}\right) N$$ Gravitational attraction of Sun to Earth EQUATION A1

$$Fc_{earthsun} := m_{pe} \cdot \frac{velorbit_{earthsun}^{\ 2}}{d_{earthsun}} = \left(3.546 \cdot 10^{22}\right) N$$ C-FORCE is at earth's orbital distance EQUATION A2

The key feature of these section is combining both A1 and A2

Since these equations A1 and A2 are equal.

$\therefore$ $Fg := Fc_{earthsun}$ EQUATION C1

$$\therefore \quad G \cdot m_{pe} \cdot \frac{M_s}{d_{earthsun}^{\ 2}} = m_{pe} \cdot \frac{velorbit_{earthsun}^{\ 2}}{d_{earthsun}}$$ EQUATION C2

IMAGE 9 (CONSTANT EQUATIONS (Earth & Sun System)

$$\therefore \quad G \cdot \frac{M_s}{d_{earthsun}} = velorbit_{earthsun}^{\ 2}$$ EQUATION C3

$$G \cdot \frac{M_s}{d_{earthsun}} = \left(8.874 \cdot 10^{8}\right) \frac{m^2}{s^2}$$ EQUATION C4

$$velorbit_{earthsun}^{\ 2} = \left(8.871 \cdot 10^{8}\right) \frac{m^2}{s^2}$$ EQUATION C5

Since G is constant and Mass of Sun are constants

$C_{sun} := G \cdot M_s$ This is standard grvitational constant. I will call this "Sun constant" because I need a name for all other planet constants. EQUATION C6

$\therefore$ $C_{sun} := velorbit_{earthsun}^{\ 2} \ d_{earthsun}$ EQUATION C7

EQUATION C8

$$GM_s := velorbit_{earthsun}^{\ 2} \cdot d_{earthsun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C9

$$Sunconstant := G \cdot M_s = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EARTH RELATED: IMPORTANT: These Equation C8 equations have same value. This s true with all planets.

$$velorbit_{earthsun}^{\ 2} \cdot d_{earthsun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$ EQUATION C10

IMAGE 10 (CONSTANT EQUATIONS (Earth & Sun System) cont'd

11. Analyzing Equation 8 (section C3) and equation C7(Image 10) in the screen shot above, the following important observations can be made:

In the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci according to the principle of Center of Mass (CM). Orbiting planet's mass is useful in initial foci formation and in resisting gravitational force.

Interestingly enough once the foci and orbital distance of the planet are established, the orbital distance alone determines the orbital velocity according to the equation $G*Ms = V^2*d_{planet}$ ($G*M_s$ being constant).
Once the foci and the equilibrium of the both the masses are established, initial value of the foci remains the same irrespective of the changing mass of the orbiting planet. Since mass component is in both equilibrium equations (C-Force and G-Force) it won't affect the equilibrium of the system. This is true as long as the C-Force of the changing mass of the secondary planet exceeds or equals gravitational force of the primary mass. I will give more explanation in Planet Constants section and Appendix C.

This explanation in the above paragraph is a very important because in appendix A (elliptical orbit – foci calculations) I will explain that all the planets went through large mass changes in their history. I want to emphasize here that once planet orbit is established, mass change won't affect the orbit or the foci.

12. Now I will establish some laws pertaining to the orbits of the planets.

13. Emani's orbital laws:

In Appendix B, I showed that foci calculations of all the planets in our present solar system are all over the place and do not follow the CM principle. Because of this, in my calculations I predicted in all the planets in our solar system lost mass and this fits well with the present foci values. Foci determine the orbital distance. By combining equilibrium equations in Appendix C, we also infer that orbital distance alone determines the velocity (Section 3 C and Appendix C). Thus I concluded that after the foci were formed, orbital distance alone determine the velocity of orbit. Planets stayed in the same orbit from then on or locked in. Because of this lock-in, although all the planets in our solar system lost mass later the foci remained the same. Since mass component is in both equilibrium equations (C-Force and G-Force) it didn't affect or disturb the equilibrium of the system. Equilibrium stays intact as long as the C-Force of the changing mass of the secondary planet can equal or exceed gravitational force of the primary mass. This is the reason for the discrepancies in the present foci calculation in the present solar system. I will give more explanation in Planet Constants section and Appendix C.

This explanation in the above paragraph is a very important because in appendix A (elliptical orbit - foci calculations) I will explain that all the planets went through large mass changes in their history. I want to emphasize here that once planet orbit is established, mass change won't affect the orbit or the foci.

I will establish some laws that follow the orbital mechanics. I call these "Emani's Orbital laws":

All these orbiting bodies of the universe follow simple and specific laws in forming their orbits from the beginning to their demise. This paper formulated five Universal laws ("Emani's Orbital Laws") using the insights into the equilibrium equations during the foci calculations orbiting planets follow around their primary mass from the beginning of their formation till the end.

1st law: In the beginning of the formation of the orbit, both primary and secondary masses determine the orbital distance according to the principle of Center of Mass (CM). Then the orbital distance is locked-in.
2nd law: The orbital distance determines the planet's orbital velocity. This locks-in all the orbital characteristics I.e. orbital distance or orbital velocity.
3rd law: Once the orbits are established, mass changes of the orbiting planet do not affect the orbital characteristics.
4th law: Equilibrium of the planet is still maintained irrespective of any mass changes occurring in the orbiting body by its Centripetal-force (C-force) in defending gravitational and or other disturbing forces as long as the planet's C-force equals or exceeds total force acting on it.
5th law: The above laws are true for all the orbiting bodies of the universe.

14. Appendix C shows all the Constant value calculations and analysis of all the other planets in our solar system: (Ref. 18)

APPENDIX C palnets constants @ equatior

Analysis:

The equilibrium equations using C-Force and G-force were discussed at length in this paper gives a new look into the way our solar system balances C-Force with the gravitational force. Although gravity is still a mystery, we now know how much C-Force is needed by the particular planet to balance the G-force. The dynamics of the Sun-Planet system is achieved and balance to the system is in place for smooth running of the whole system. From the C-Force calculations, one can also infer how much extra C-Force is still in reserve for other disturbances if needed.

In Appendix B (Elliptical orbits), I showed that foci calculations of all the planets in our present solar system are all over the place and do not follow the CM principle. We also now know how the foci of the planetary system came into play using CM calculations and this paper was able to predict the history of the planets using this mathematical logic. Using foci calculations, I deduced that all the planets in the solar system were more massive than present. We now know from this elliptical orbits section that in the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci according to the principle of Center of Mass (CM). In my calculations, I deduced that all the planets in our solar system lost mass and calculated the old mass required that fits well with the present foci values. By combining equilibrium equations in Appendix C, I concluded that after the foci were formed, orbital distance alone determine the velocity of orbit (Section 3 C and Appendix C). Once the orbital velocity was determined, planets stayed in the same orbit from then on or locked in. Because of this lock-in, although all the planets in our solar system lost mass later the foci remained the same and orbital characteristics did not change. Since mass component is in both equilibrium equations (C-Force and G-Force) it didn't affect or disturb the equilibrium of the system. This equilibrium stays intact as long as the C-Force of the changing mass of the orbiting planet is equal or greater than the gravitational force of the primary mass.

I also explained how irrespective of all these planets lost their mass in history without major orbital chaos. This information regarding the planets were more massive in the past explain the strange orbital behavior of some of the planets in our solar system. This information makes it easy for future theories or predictions on this topic. By analyzing closely the equilibrium equations (as discussed in the Constants section) that distance alone is the reason for the orbital velocity of the planet. I also derived the planet constants and how the orbits of all the moons or satellites of all the planets can be derived using these constants.

In order to explain this orbital dynamics, I formulated 5 laws (Emani's Laws) that orbiting planets follow when forming their orbits around the primary mass and the way the planets behave afterwards. In general, this paper gave and predicted history of our planet system in more logical manner using pure mathematical formulas. This information can be extended to all the planets and stars in the whole universe. This solves many mysteries and unanswered questions that mankind is riddled with regarding clear definition of the equilibrium and orbital dynamics of the solar system and how it is achieved. It also gives a deep look into how the planets formed their orbits in clear and concise mathematical equations and why the orbits still follow a pattern irrespective of loosing mass in history. Using this information, the odd behavior of these planetary orbits can be more clearly explained.
Above information is confirmed in Planet Constants section and Appendix C for all the planets of our solar system including our moon and Europa (one of Jupiter's moons).

Sun Constant $G*M_s$ was established for ease of calculating all the planet orbital characteristics in our solar system. Appendix C has all the details. Similarly, I proposed other planet constants like earth, Jupiter and all other planets in our solar system that can be used to calculate all the moons or all the satellite orbits of the particular planet in our solar system. These constants are very important and orbital characteristics can be easily calculated using these constants. The above information can be extended to all the orbiting bodies of the universe.

5.Conclusions:

The balancing of C-Force and G-force in this paper shows us how our solar system neutralizes its forces in running smoothly. Although gravity is still a mystery, we now know how much C-Force is needed by the particular planet to work the smooth running of the whole system and we can infer how much extra force is still in reserve for other disturbances if needed. We also now know how the foci of the planetary system came into play and this paper predicted the history of the planets using this mathematical logic. All the reasons why the planets lost their mass in history can be predicted and accounted for without major orbital chaos. This information is also useful in explaining the strange orbital behavior of some of the planets in our solar system and makes it easy for future theories or predictions on this topic. I also discussed in the Constants section that distance alone is the reason for the Orbital velocity of the planet. I also gave the planet constants and how the orbits of all the moons or satellites of all the planets can be derived using these constants. I also set some laws or rules (Emani's Laws) explaining how these planets are formed and behave. In general, this paper gives and predicts history of our planet system in more logical manner using pure mathematical formulas. This information can be extended to all the planets and stars in the whole universe. This solves many mysteries and unanswered questions that mankind is riddled with regarding clear definition of the equilibrium and orbital dynamics of the solar system and how it is achieved. It also gives a deep look into how the planets formed their orbits in clear and concise mathematical equations and why the orbits still follow a pattern irrespective of loosing mass in history. Using this information, the odd behavior of these planetary orbits can be more clearly explained.

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[18]. All the planet parameter information in Appendices A, B and C are taken from the WIKI WEBSITE: http://en.wikipedia.org/wiki/Solar_System

[19]. THE LATE HEAVY BOMBARDMENT: POSSIBLE INFLUENCE ON MARS. D. M. Burt1, L. P. Knauth2, and K. H. Wohletz3 1School of Earth and Space Exploration, Arizona State University, Box 871404, Tempe, AZ 85287-1404, dmburt@asu.edu, 2same, knauth@asu.edu, 3Los Alamos National Laboratory, Los Alamos, NM 87545, wohletz@lanl.gov.

[20]. Because the Moon is 1:1 tidally locked, only one side is visible from Earth. The Moon's rotation and orbital periods are tidally locked with each other, so no matter when the Moon is observed from Earth the same hemisphere of the Moon is always seen. The far side of the Moon was not seen in its entirety until 1959, when photographs were transmitted from the Soviet spacecraft Luna 3. Despite the Moon's rotational and orbital periods being exactly locked, about 59% of the Moon's total surface may be seen with repeated observations from Earth due to the phenomena of libration and parallax. Librations are primarily caused by the Moon's varying orbital speed due to the eccentricity of its orbit: this allows up to about 6° more along its perimeter to be seen from Earth. Parallax is a geometric effect: at the surface of Earth we are offset from the line through the centers of Earth and Moon, and because of this we can observe a bit (about 1°) more around the side of the Moon when it is on our local horizon.

[21]. http://en.wikipedia.org/wiki/Binary_star

APPENDIX A

EQUILIBRIUM EQUATIONS FOR ALL THE PLANETS AND MOON AND EUROPA (ONE OF JUPITER'S MOON)

EARTH

$m_{pe} := 5.9726 \cdot 10^{24}\ kg$ Mass of present Earth

$velorbit_{earthsun} := 2.9785 \cdot 10^{4}\ \frac{m}{s}$ Earth's orbital velocity around Sun

$d_{earthsun} := 1.496 \cdot 10^{11}\ m$ Orbital distance of Earth to Sun

$radearth := 6.371 \cdot 10^{6}\ m$ Mean Radius of earth

SUN

$G := 6.67384 \cdot 10^{-11}\ \frac{m^3}{kg \cdot s^2}$ Universal Gravitational Constant

$M_s := 1.9891 \cdot 10^{30}\ kg$ Sun's mass

Centripetal Force of earth F=mass of present earth* vel^2 /radearth

$$a := \frac{velorbit_{earthsun}^{\;\;2}}{radearth}$$

$$F_{corbit} := m_{pe} \cdot a$$

Fcorbit is the Centripetal force due to of earth's orbit

$$Fcorbit := m_{pe} \cdot velorbit_{earthsun} \cdot \frac{velorbit_{earthsun}}{radearth} = \left(8.317 \cdot 10^{26}\right) N$$

EQUATION A1
@ the earth's surface

Notice that this force IS CALCULATED AT THE SURFACE OF THE EARTH. This is the NOT THE equilibrium force.

EQUILIBRIUMEQUATIONS

EARTH

$$Fg_{earthsun} := G \cdot m_{pe} \cdot \frac{M_s}{d_{earthsun}^{\;\;2}} = \left(3.543 \cdot 10^{22}\right) N$$

EQUATION A5

This is the Gravitational attraction between Sun and Earth

$$Fcatdistd_{earthsun} := m_{pe} \cdot \frac{velorbit_{earthsun} \cdot velorbit_{earthsun}}{d_{earthsun}} = \left(3.542 \cdot 10^{22}\right) N$$

EQUATION A6
Important

This is the force that tugs with gravity of the sun. Notice that this C-Force IS CALCULATED AT ORBITAL DISTANCE. NOT ON THE SURFACE OF EARTH. THE EARTH EXTENDS THIS FORCE TO THE CENTER OF THE SUN AND THIS IS THE VALUE OF THE C-FORCE THAT keeps the planets attached to large mass objects and not flyaway. THIS IS THE EQUILIBRIUM FORCE.

MOON

$$m_{pmoon} := 7.3477 \cdot 10^{22}\ kg$$

Mass of present Moon

$$radmoon := 1.7371 \cdot 10^{6}\ m$$

Mean Radius OF MOON

$$velorbit_{moonearth} := 1.022 \cdot 10^{3}\ \frac{m}{s}$$

Moon's orbital velocity around earth

$$d_{moonearth} := 3.844 \cdot 10^{8}\ m$$

Orbital distance of earth to Moon

EQUILIBRIUMEQUATIONS

$$Fgmoon := G \cdot m_{pe} \cdot \frac{m_{pmoon}}{d_{moonearth}^{\;\;2}} = \left(1.982 \cdot 10^{20}\right) N$$

EQUATION A3

This is the Gravitational attraction between the Earth and moon

$$Fcatdistmoon := m_{pmoon} \cdot \frac{velorbit_{moonearth}^{2}}{d_{moonearth}} = \left(1.997 \cdot 10^{20}\right) N$$

EQUATION A4

This equilibrium force between earth and moon is the reason for moon rotating around earth without flying away.

Small variations in the equation may be the result of physical measurement inaccuracies in mass calculations or small pertubances or variations in velocity and distance dmoonearthOnce the Fc and Fg relationship is established, changes in mass becomes irrelevent and the orbit remains the same.

JUPITER

$m_{pjup} := 1.89813 \cdot 10^{27}\ kg$ Mass of present Jupiter

$velorbit_{jupsun} := 1.307 \cdot 10^{4}\ \frac{m}{s}$ Jupiter's orbital velocity around Sun

$Vjupiter := 13.07 \cdot 10_3$ **m — s** Mean Radius OF Jupiter

$d_{jupsun} := 7.78547 \cdot 10^{11}\ m$ Orbital distance of Jupiter to Sun

EQUILIBRIUNEQUATIONS

$$Fgjupiter := G \cdot M_s \cdot \frac{m_{pjup}}{d_{jupsun}^{2}} = \left(4.157 \cdot 10^{23}\right) N$$

EQUATION A5

This is the Gravitational attraction between Sun and Jupiter

$$Fcatdistjupiter := m_{pjup} \cdot \frac{Vjupiter^{2}}{d_{jupsun}} = \left(4.165 \cdot 10^{23}\right) N$$

EQUATION A6

This is the Centripetal - equilibrium force

EUROPA One of Jupiter's Moons

$m_{peuropa} := 4.7998 \cdot 10^{22}\ kg$ Mass of present Europa

$velorbit_{europajup} := 1.374 \cdot 10^{4}\ \frac{m}{s}$ Europa's orbital velocity around Sun

$d_{europajup} := 6.709 \cdot 10^{8}\ m$ Orbital distance of Europa and Jupiter

EQUILIBRIUNEQUATIONS

$$Fgjupitereuropa := G \cdot m_{pjup} \cdot \frac{m_{peuropa}}{d_{europajup}^{2}} = \left(1.351 \cdot 10^{22}\right) N$$

EQUATION A7

$$Fcatdisteuropa := m_{peuropa} \cdot \frac{velorbit_{europajup}^{2}}{d_{europajup}} = \left(1.351 \cdot 10^{22}\right) N$$

EQUATION A8

NEPTUNE

$m_{pnep} := 1.0247 \cdot 10^{26}\ kg$ Mass of present Neptune

$velorbit_{nepsun} := 5.43 \cdot 10^{3}\ \frac{m}{s}$ Neptune's's orbital velocity around Sun

$d_{nepsun} := 4.503443661 \cdot 10^{12}\ m$ Orbital distance of Neptune and Sun

EQUILIBRIUNEQUATIONS

$$Fgneptune := G \cdot M_{s} \cdot \frac{m_{pnep}}{d_{nepsun}^{2}} = \left(6.707 \cdot 10^{20}\right) N$$

EQUATION A9

$$Fcatdistneptune := m_{pnep} \cdot \frac{velorbit_{nepsun}^{2}}{d_{nepsun}} = \left(6.709 \cdot 10^{20}\right) N$$

EQUATION A10

SATURN

$m_{psat} := 5.69 \cdot 10^{26}\ kg$ Mass of present Saturn

$velorbit_{satsun} := 9.69 \cdot 10^{3}\ \frac{m}{s}$ Saturn's orbital velocity around Sun

$d_{satsun} := 1.4246 \cdot 10^{12}\ m$ Orbital distance of Saturn to Sun

EQUILIBRIUNEQUATIONS

$$Fgsaturn := G \cdot M_{s} \cdot \frac{m_{psat}}{d_{satsun}^{2}} = \left(3.722 \cdot 10^{22}\right) N$$

EQUATION A11

$$Fcatdistsaturn := m_{psat} \cdot \frac{velorbit_{satsun}^{2}}{d_{satsun}} = \left(3.75 \cdot 10^{22}\right) N$$

EQUATION A12

URANUS

$m_{puran} := 8.6810 \cdot 10^{25}\ kg$ Mass of present Uranus

$velorbit_{uransun} := 6.81 \cdot 10^{3} \ \frac{m}{s}$ Uranus's orbital velocity around Sun

$d_{uransun} := 2.873550 \cdot 10^{12} \ m$ Orbital distance of Uranus to Sun

EQUILIBRIUNEQUATIONS

$$Fguranus := G \cdot M_s \cdot \frac{m_{puran}}{d_{uransun}^{2}} = \left(1.396 \cdot 10^{21}\right) N$$ EQUATION A13

$$Fcatdisturanus := m_{puran} \cdot \frac{velorbit_{uransun}^{2}}{d_{uransun}} = \left(1.401 \cdot 10^{21}\right) N$$ EQUATION A14

MERCURY

$m_{pmer} := 3.3022 \cdot 10^{23} \ kg$ Mass of present Mercury

$velorbit_{mersun} := 4.787 \cdot 10^{4} \ \frac{m}{s}$ Mercury's orbital velocity around Sun

$d_{mersun} := 5.79091 \cdot 10^{10} \ m$ Orbital distance of Mercury to Sun

EQUILIBRIUNEQUATIONS

$$Fgmercury := G \cdot M_s \cdot \frac{m_{pmer}}{d_{mersun}^{2}} = \left(1.307 \cdot 10^{22}\right) N$$ EQUATION A15

$$Fcatdistmercury := m_{pmer} \cdot \frac{velorbit_{mersun}^{2}}{d_{mersun}} = \left(1.307 \cdot 10^{22}\right) N$$ EQUATION A16

MARS

$m_{pmars} := 6.84185 \cdot 10^{23} \ kg$ Mass of present Mars

$velorbit_{marssun} := 2.4077 \cdot 10^{4} \ \frac{m}{s}$ Mars's orbital velocity around Sun

$d_{marssun} := 2.279391 \cdot 10^{11} \ m$ Orbital distance of Mars to Sun

EQUILIBRIUNEQUATIONS

$$Fgmars := G \cdot M_s \cdot \frac{m_{pmars}}{d_{marssun}^{\ 2}} = \left(1.748 \cdot 10^{21}\right)\ N$$

EQUATION A17

$$Fcatdistmars := m_{pmars} \cdot \frac{velorbit_{marssun}^{\ 2}}{d_{marssun}} = \left(1.74 \cdot 10^{21}\right)\ N$$

EQUATION A18

VENUS

$$m_{pvenus} := 4.8676 \cdot 10^{24}\ kg$$

Venus of present Mars

$$velorbit_{venussun} := 3.502 \cdot 10^{4}\ \frac{m}{s}$$

Venus's orbital velocity around Sun

$$d_{venussun} := 1.08208 \cdot 10^{11}\ m$$

Orbital distance of Venus to Sun

EQUILIBRIUNEQUATIONS

$$Fgvenus := G \cdot M_s \cdot \frac{m_{pvenus}}{d_{venussun}^{\ 2}} = \left(5.519 \cdot 10^{22}\right)\ N$$

EQUATION A19

$$Fcatdistvenus := m_{pvenus} \cdot \frac{velorbit_{venussun}^{\ 2}}{d_{venussun}} = \left(5.517 \cdot 10^{22}\right)\ N$$

EQUATION A20

PLUTO

$$m_{ppluto} := 1.305 \cdot 10^{22}\ kg$$

Mass of present Pluto

$$velorbit_{plutosun} := 4.7 \cdot 10^{3}\ \frac{m}{s}$$

Pluto's orbital velocity around Sun

$$d_{plutosun} := 5.874 \cdot 10^{12}\ m$$

Orbital distance of Pluto to Sun

EQUILIBRIUNEQUATIONS

$$Fgpluto := G \cdot M_s \cdot \frac{m_{ppluto}}{d_{plutosun}^{\ 2}} = \left(5.021 \cdot 10^{16}\right)\ N$$

EQUATION A21

$$Fcatdistpluto := m_{ppluto} \cdot \frac{velorbit_{plutosun}^{\ 2}}{d_{plutosun}} = \left(4.908 \cdot 10^{16}\right)\ N$$

EQUATION A22

APPENDIX B

FOCII EQUATIONS FOR ALL THE PLANETS AND MOON AND EUROPA (ONE OF JUPITER'S MOON)

EARTH

$m_{pe} := 5.98 \cdot 10^{24}\ kg$ Mass of present Earth

$velorbit_{earthsun} := 2.9785 \cdot 10^{4}\ \frac{m}{s}$ Earth's orbital velocity around Sun

$d_{earthsun} := 1.496 \cdot 10^{11}\ m$ Orbital distance of Earth to Sun

$radearth := 6.371 \cdot 10^{6}\ m$ Mean Radius of earth

$a_{earth} := 1.52098232 \cdot 10^{11}\ m$ Earth's orbital periapsis distance from the Sun

$b_{earth} := 1.47098290 \cdot 10^{11}\ m$ Earth's orbital apoapsis distance from the Sun

SUN

$G := 6.67384 \cdot 10^{-11}\ \frac{m^{3}}{kg \cdot s^{2}}$ Universal Gravitational Constant

$M_{s} := 1.9891 \cdot 10^{30}\ kg$ Sun`s Mass

$DSun := 1.391 \cdot 10^{9}\ m$ Diameter of the Sun

CENTER MASS CALCULATION

$a_{earth} := 1.52098232 \cdot 10^{11}\ m$ Earth's orbital periapsis distance from the Sun

$b_{earth} := 1.47098290 \cdot 10^{11}\ m$ Earth's orbital apoapsis distance from the Sun

The formula for Center of Mass (CM) Calculations is as follows:

Ms*Sundistance to CM=mpe*earth's orbital distance to CM *Equation1*

I will calculate the required CM for a balanced mass system:

$$EarthsunCMshouldbe := \frac{(m_{pe} \cdot d_{earthsun})}{M_{s}} = (4.498 \cdot 10^{5})\ m$$ EQUATION B1

$$focii_{earth} := a_{earth} - b_{earth} = \left(5 \cdot 10^{9}\right)\ m$$

EQUATION B2

$$presentearthsunCMis := \frac{focii_{earth}}{2} = \left(2.5 \cdot 10^{9}\right)\ m$$

EQUATION B3

This is the Present CM of earth Sun mass system. This is too far away from what it should be.
The reason for this is when orbit of the earth was forming, earth had a LARGER MASS.

$$ratioearth := \frac{presentearthsunCMis}{EarthsunCMshouldbe} = 5.559 \cdot 10^{3}$$

EQUATION B4

This above ratio gives how many times mass of the earth was bigger in the past.

$$oldearthmass := m_{pe} \cdot ratioearth = \left(3.324 \cdot 10^{28}\right)\ kg$$

EQUATION B5

If we recalculate the focii using this old earth mass in equation B1:

$$oldCM := oldearthmass \cdot \frac{d_{earthsun}}{M_s} = \left(2.5 \cdot 10^{9}\right)\ m$$

EQUATION B6

This is also the present CM of earth-Sun.
This means the earth's foci and orbit was formed when the earth was more massier.
To validate Equation 1:

$$M_s \cdot presentearthsunCMis = \left(4.973 \cdot 10^{39}\right)\ kg \cdot m$$

OK EQUATION B7

$$oldearthmass \cdot d_{earthsun} = \left(4.973 \cdot 10^{39}\right)\ kg \cdot m$$

OK EQUATION B8

The above equations show mass distribution Sun and earth in space is balanced using old earth mass. The center of mass equation is satisfied. Using present earth mass equation below shows an imbalance.

$$m_{pe} \cdot d_{earthsun} = \left(8.946 \cdot 10^{35}\right)\ kg \cdot m$$

NOTOK EQUATION B9

A SPECIAL NOTE: In the beginning of the formation of the orbit, both primary and secondary masses play important role in determining the value and location of the foci according to the principle of Center of Mass (CM). Orbiting planet's mass is useful in initial foci formation and in resisting gravitational force. Once the foci and the equilibrium of the both the masses are established, initial value of the foci remains the same irrespective of the changing mass of the orbiting planet. This is true because mass component is in both equilibrium (C-Force and G-Force) equations, it won’t affect the equilibrium of the system. This istrue as long as the C-Force of the changing mass of the secondary planet Equals or exceeds total force acting on it.

MOON

$$m_{pmoon} := 7.3477 \cdot 10^{22}\ kg$$

Mass of present Moon

$$radmoon := 1.7371 \cdot 10^{6}\ m$$

Mean Radius OF MOON

$$velorbit_{moonearth} := 1.022 \cdot 10^{3}\ \frac{m}{s}$$

Moon's orbital velocity around earth

$d_{moonearth} := 3.844 \cdot 10^{8}\ m$

Moon's orbital velocity around earth

$fociimoon := amoon - bmoon = (4.221 \cdot 10^{7})\ m$

EQUATION B10

$avgmoon := \frac{fociimoon}{2} = (2.11 \cdot 10^{7})\ m$

moon ellipse midpoint Midpoint

EQUATION B11

$presentfociimoon := (405503\ km - 363295\ km) = (4.221 \cdot 10^{7})\ m$

EQUATION B12

$presentmoon'sCMis := \frac{presentfociimoon}{2} = (2.11 \cdot 10^{7})\ m$

EQUATION B13

This is the Present CM of earth moon mass system. This is far away.

$earthmoonCMshouldbe := \frac{d_{moonearth}}{m_{pe}}\ m_{pmoon} = (4.723 \cdot 10^{6})\ m$

EQUATION B14

$ratio := \frac{earthmoonCMshouldbe}{presentmoon'sCMis} = 0.224$

EQUATION B15

This ratio gives how many times the moon was bigger in the past.

$oldmoonmass := \frac{m_{pmoon}}{ratio} = (3.283 \cdot 10^{23})\ kg$

EQUATION B16

Recalculating the focil with this old moon mass:

$m_{pe} \cdot presentmoon'sCMis = (1.262 \cdot 10^{32})\ kg \cdot m$ OK EQUATION B17

$oldmoonmass \cdot d_{moonearth} = (1.262 \cdot 10^{32})\ kg \cdot m$ OK EQUATION B18

$m_{pmoon} \cdot d_{moonearth} = (2.824 \cdot 10^{31})\ kg \cdot m$ NOTOK EQUATION B19

A SPECIAL NOTE: I will show in my last constants section of the main paper that earth's orbit or orbit charactersticks is not effected by the changes in the mass. Fg and Fc values are still satisfied irrespective of the changes in the planet mass because mass component is in both the Fc and Fg equations. After the foci is formed and orbit distance is determined, velocity of the orbiting planet is determined by the orbital distance.

JUPITER

$m_{pjup} := 1.89813 \cdot 10^{27}\ kg$

Mass of present Jupiter

$radjup := 3.035 \cdot 10^{8}\ m$

Mean Radius OF Jupiter

$velorbit_{jupsun} := 1.307 \cdot 10^{4}\ \frac{m}{s}$

Jupiter's orbital velocity around earth

$d_{jupsun} := 7.785472 \cdot 10^{11}\ m$ Orbital distance of earth to Moon

$ajup := 8.165208 \cdot 10^{11}\ m$ Jupiter's orbital periapsis distance from the earth

$bjup := 7.405706 \cdot 10^{11}\ m$ Jupiter's orbital apoapsis distance from the Sun

$$presentfociijup := ajup - bjup = (7.595 \cdot 10^{10})\ m$$ EQUATION B20

$$presentjup'sCMis := \frac{presentfociijup}{2} = (3.798 \cdot 10^{10})\ m$$ EQUATION B21

This is the Present CM of Jupiter Sun mass system. This is far away.

$$jupsunCMshouldbe := \frac{d_{jupsun}}{M_s}\ m_{pjup} = (7.429 \cdot 10^{8})\ m$$ EQUATION B22

$$ratio := \frac{jupsunCMshouldbe}{presentjup'sCMis} = 0.02$$ EQUATION B23

This ratio gives how many times the Jupiter was bigger in the past.

$$oldjupmass := \frac{m_{pjup}}{ratio} = (9.702 \cdot 10^{28})\ kg$$ EQUATION B24

Old jupiter was 51.115 times more massive. May have lost mass to its moons

$$oldjupitermassCM := \frac{d_{jupsun}}{M_s}\ oldjupmass = (3.798 \cdot 10^{10})\ m$$ EQUATION B25

This is the same present sun/jupiter CM. Old jupiter mass was also higher.

$$oldjupmass \cdot d_{jupsun} = (7.554 \cdot 10^{40})\ kg \cdot m$$ OK EQUATION B26

$$M_s \cdot presentjup'sCMis = (7.554 \cdot 10^{40})\ kg \cdot m$$ OK EQUATION B27

EUROPA One of Jupiter's Moons

$m_{peuropa} := 4.7998 \cdot 10^{22}\ kg$ Mass of present Europa

$velorbit_{europajup} := 1.374 \cdot 10^{4}\ \frac{m}{s}$ Europa's orbital velocity around Sun

$d_{europajup} := 6.709 \cdot 10^{8}\ m$ Orbital distance of Europa and Jupiter

$aeuropa := 6.76938 \cdot 10^{8}\ m$ Europa's orbital periapsis distance from Jupiter

$beuropa := 6.64862 \cdot 10^{8}\ m$ Europa's orbital apoapsis distance from Jupiter

$presentfociieuropa := aeuropa - beuropa = \left(\left(1.208 \cdot 10^{7}\right)\right)\ m$ EQUATION B28

$$presenteuropajup'sCMis := \frac{presentfociieuropa}{2} = \left(6.038 \cdot 10^{6}\right)\ m$$ EQUATION B29

This is the Present CM of Europa-Jupiter mass system. This is far away. This is the midpoint of Europa's orbital ellipse.

$$presenteuropajupCMshouldbe := \frac{d_{europajup}}{m_{pjup}}\ m_{peuropa} = \left(1.697 \cdot 10^{4}\right)\ m$$ EQUATION B30

$$ratio := \frac{presenteuropajupCMshouldbe}{presenteuropajup'sCMis} = 0.003$$ EQUATION B31

This ratio gives how many times the Jupiter was bigger in the past.

$$oldeuropamass := \frac{m_{pjup}}{ratio} = \left(6.756 \cdot 10^{29}\right)\ kg$$ EQUATION B32

$$\frac{1}{ratio} = 355.908$$ EQUATION B33

Old Europa was 355.908 times more massive than present. May have lost mass to its moons.

$$oldjupitermassCM := \frac{d_{jupsun}}{M_s}\ oldjupmass = \left(3.798 \cdot 10^{10}\right)\ m$$ EQUATIONB34

This is the same present sun/jupiter CM. Old jupiter mass was also higher.

$oldjupmass \cdot d_{jupsun} = \left(7.554 \cdot 10^{40}\right)\ kg \cdot m$ OK EQUATION B35

$M_s \cdot presentjup'sCMis = \left(7.554 \cdot 10^{40}\right)\ kg \cdot m$ OK EQUATION B36

It is iteresting to note that Europa's old mass was bigger than old jupiter. This suggests that tidal locking may have occured. This tidal locking occurs when difference in mass between the two bodies and their physical separation is small, each may be tidally locked.Reference: http://en.wikipedia.org/wiki/Tidal_locking

NEPTUNE

$m_{pnep} := 1.0247 \cdot 10^{26}\ kg$ Mass of present Neptune

$radnep := 2.4764 \cdot 10^{4}\ m$ Mean Radius OF Neptune

$velorbit_{nepsun} := 5.43 \cdot 10^{3} \ \frac{m}{s}$ Neptune's orbital velocity around Sun

$d_{nepsun} := 4.503443661 \cdot 10^{12} \ m$ Orbital distance of Sun to Neptune

$anep := 4.55394649 \cdot 10^{12} \ m$ Neptune's orbital periapsis distance from the earth

$bnep := 4.452940833 \cdot 10^{12} \ m$ Neptune's orbital apoapsis distance from the Sun

$$presentfocineptune := (anep - bnep) = \left(1.01 \cdot 10^{11}\right) \ m$$ EQUATION B37

$$neptuneCMis := \frac{presentfocineptune}{2} = \left(5.05 \cdot 10^{10}\right) \ m$$ EQUATION B38

$$neptunesunCMshouldbe := \frac{d_{nepsun}}{M_s} \ m_{pnep} = \left(2.32 \cdot 10^{8}\right) \ m$$ EQUATION B39

$$ratio := \frac{neptunesunCMshouldbe}{neptuneCMis} = 0.005$$ EQUATION B40

$$oldmassneptune := \frac{m_{pnep}}{ratio} = \left(2.231 \cdot 10^{28}\right) \ kg$$ EQUATION B41

$$\frac{oldmassneptune}{m_{pnep}} = 217.686$$ Neptune mass was 217.686 times heavier EQUATION B42

$$oldmassneptune \cdot d_{nepsun} = \left(1.005 \cdot 10^{41}\right) \ kg \cdot m$$ OK EQUATION B43

$$M_s \cdot neptuneCMis = \left(1.005 \cdot 10^{41}\right) \ kg \cdot m$$ OK EQUATION B44

SATURN

$m_{psat} := 5.69 \cdot 10^{26} \ kg$ Mass of present Saturn

$radsat := 2.4764 \cdot 10^{4} \ m$ Mean Radius OF Saturn

$velorbit_{satsun} := 9.69 \cdot 10^{3} \ \frac{m}{s}$ Saturn's orbital velocity around Sun

$d_{satsun} := 1.4246 \cdot 10^{12} \ m$ Orbital distance of Sun to Saturn

$asat := 1.523325783 \cdot 10^{12} \ m$ Saturn's orbital periapsis distance from the earth

$bsat := 1.353572956 \cdot 10^{12}\ m$ Saturn's orbital apoapsis distance from the Sun

$fociisat := asat - bsat = (1.698 \cdot 10^{11})\ m$ EQUATION B45

$presentCMis := \frac{fociisat}{2} = (8.488 \cdot 10^{10})\ m$ EQUATION B46

$satsunCMshouldbe := \frac{d_{satsun}}{M_s}\ m_{psat} = (4.075 \cdot 10^{8})\ m$ EQUATION B47

$ratiosat := \frac{presentCMis}{satsunCMshouldbe} = 208.276$ EQUATION B48

$oldsatmass := m_{psat} \cdot ratiosat = (1.185 \cdot 10^{29})\ kg$ EQUATION B49

$M_s \cdot presentCMis = (1.688 \cdot 10^{41})\ kg \cdot m$ OK EQUATION B50

$oldsatmass \cdot d_{satsun} = (1.688 \cdot 10^{41})\ kg \cdot m$ OK EQUATION B51

$m_{psat} \cdot d_{satsun} = (8.106 \cdot 10^{38})\ kg \cdot m$ NOTOK EQUATION B52

URANUS

$m_{puran} := 8.6810 \cdot 10^{25}\ kg$ Mass of present Uranus

$velorbit_{uransun} := 6.81 \cdot 10^{3}\ \frac{m}{s}$ Uranus's orbital velocity around Sun

$d_{uransun} := 2.873550 \cdot 10^{12}\ m$ Orbital distance of Uranus to Sun

$aur := 3.004419704 \cdot 10^{12}\ m$ Uranus's orbital periapsis distance from Sun

$bur := 2.748938461 \cdot 10^{12}\ m$ Uranus's orbital apoapsis distance from Sun

$fociiur := aur - bur = (2.555 \cdot 10^{11})\ m$ EQUATION B53

$CMur := \frac{fociiur}{2} = (1.277 \cdot 10^{11})\ m$ EQUATION B54

$$ursunCMshouldbe := \frac{d_{uransun}}{M_s} m_{puran} = \left(1.254 \cdot 10^{8}\right)\ m$$

EQUATION B55

$$ratiour := \frac{CMur}{ursunCMshouldbe} = 1.019 \cdot 10^{3}$$

EQUATION B56

$$oldurmass := m_{puran} \cdot ratiour = \left(8.842 \cdot 10^{28}\right)\ kg$$

EQUATION B57

$$M_s \cdot CMur = \left(2.541 \cdot 10^{41}\right)\ kg \cdot m$$

OK EQUATION B58

$$oldurmass \cdot d_{uransun} = \left(2.541 \cdot 10^{41}\right)\ kg \cdot m$$

OK EQUATION B59

$$m_{puran} \cdot d_{uransun} = \left(2.495 \cdot 10^{38}\right)\ kg \cdot m$$

NOTOK EQUATION B60

MERCURY

$$m_{pmer} := 3.3022 \cdot 10^{23}\ kg$$

Mass of present Mercury

$$velorbit_{mersun} := 4.787 \cdot 10^{4}\ \frac{m}{s}$$

Mercury's orbital velocity around Sun

$$d_{mersun} := 5.79091 \cdot 10^{10}\ m$$

Orbital distance of Mercury to Sun

$$amer := 6.9816900 \cdot 10^{10}\ m$$

Mercury's orbital periapsis distance from Sun

$$bmer := 4.6001200 \cdot 10^{10}\ m$$

Mercury's orbital apoapsis distance from Sun

$$fociimer := amer - bmer = \left(2.382 \cdot 10^{10}\right)\ m$$

EQUATION B61

$$presentCMmer := \frac{fociimer}{2} = \left(1.191 \cdot 10^{10}\right)\ m$$

EQUATION B62

$$mersunCMshouldbe := \frac{d_{mersun}}{M_s} m_{pmer} = \left(9.614 \cdot 10^{3}\right)\ m$$

EQUATION B63

$$ratiomer := \frac{presentCMmer}{mersunCMshouldbe} = 1.239 \cdot 10^{6}$$

EQUATION B64

$$oldmermass := m_{pmer} \cdot ratiomer = \left(4.09 \cdot 10^{29}\right)\ kg$$

EQUATION B65

$M_s \cdot presentCMmer = (2.369 \cdot 10^{40})\ kg \cdot m$ OK EQUATION B66

$oldmermass \cdot d_{mersun} = (2.369 \cdot 10^{40})\ kg \cdot m$ OK EQUATION B67

$m_{pmer} \cdot d_{mersun} = (1.912 \cdot 10^{34})\ kg \cdot m$ NOTOK EQUATION B68

MARS

$m_{pmars} := 6.4185 \cdot 10^{23}\ kg$ Mass of present Mars

$velorbit_{marssun} := 2.4077 \cdot 10^{4}\ \frac{m}{s}$ Mars's orbital velocity around Sun

$d_{marssun} := 2.279391 \cdot 10^{11}\ m$ Orbital distance of Mars to Sun

$amar := 2.49209300 \cdot 10^{11}\ m$

$bmar := 2.06669000 \cdot 10^{10}\ m$

$fociimar := amar - bmar = (2.285 \cdot 10^{11})\ m$ EQUATION B69

$presentCMmar := \frac{fociimar}{2} = (1.143 \cdot 10^{11})\ m$ EQUATION B70

$marsunCMshouldbe := \frac{d_{marssun}}{M_s}\ m_{pmars} = (7.355 \cdot 10^{4})\ m$ EQUATION B71

$ratiomar := \frac{presentCMmar}{marsunCMshouldbe} = 1.554 \cdot 10^{6}$ EQUATION B72

$oldmarmass := m_{pmars} \cdot ratiomar = (9.972 \cdot 10^{29})\ kg$ EQUATION B73

$M_s \cdot presentCMmar = (2.273 \cdot 10^{41})\ kg \cdot m$ OK EQUATION B74

$oldmarmass \cdot d_{marssun} = (2.273 \cdot 10^{41})\ kg \cdot m$ OK EQUATION B75

$m_{pmars} \cdot d_{marssun} = (1.463 \cdot 10^{35})\ kg \cdot m$ NOTOK EQUATION B76

VENUS

$m_{pvenus} := 4.8676 \cdot 10^{24}\ kg$ Venus of present Mars

$velorbit_{venussun} := 3.502 \cdot 10^{4}\ \frac{m}{s}$ Venus's orbital velocity around Sun

$d_{venussun} := 1.08208 \cdot 10^{11}\ m$ Orbital distance of Venus to Sun

$avenus := 1.0893900 \cdot 10^{11}\ m$ Mass of present Venus

$bvenus := 1.07477000 \cdot 10^{11}\ m$ Venus's orbital velocity around Sun

$fociivenus := avenus - bvenus = (1.462 \cdot 10^{9})\ m$ EQUATION B77

$presentCMvenus := \frac{fociivenus}{2} = (7.31 \cdot 10^{8})\ m$ EQUATION B78

$venussunCMshouldbe := \frac{d_{venussun}}{M_s}\ m_{pvenus} = (2.648 \cdot 10^{5})\ m$ EQUATION B79

$ratiovenus := \frac{presentCMvenus}{venussunCMshouldbe} = 2.761 \cdot 10^{3}$ EQUATION B80

$oldvenusmass := m_{pvenus} \cdot ratiovenus = (1.344 \cdot 10^{28})\ kg$ EQUATION B81

$M_s \cdot presentCMvenus = (1.454 \cdot 10^{39})\ kg \cdot m$ OK EQUATION B82

$m_{pvenus} \cdot d_{venussun} = (5.267 \cdot 10^{35})\ kg \cdot m$ NOTOK EQUATION B83

$oldvenusmass \cdot d_{venussun} = (1.454 \cdot 10^{39})\ kg \cdot m$ OK EQUATION B84

PLUTO

$m_{ppluto} := 1.305 \cdot 10^{22}\ kg$ Mass of present Pluto

$velorbit_{plutosun} := 4.7 \cdot 10^{3}\ \frac{m}{s}$ Pluto's orbital velocity around Sun

$d_{plutosun} := 5.874 \cdot 10^{12}\ m$ Orbital distance of Pluto to Sun

$apluto := 7.311 \cdot 10^{12}\ m$ Mass of present Pluto

$bpluto := 4.437 \cdot 10^{12}\ m$ Pluto's orbital velocity around Sun

$presentfociipluto := apluto - bpluto = (2.874 \cdot 10^{12})\ m$ EQUATION B85

$presentCMpluto := \frac{presentfociipluto}{2} = (1.437 \cdot 10^{12})\ m$ EQUATION B86

$plutosunCMshouldbe := \frac{d_{plutosun}}{M_s} m_{ppluto} = (3.854 \cdot 10^{4})\ m$ EQUATION B87

$ratiopluto := \frac{presentCMpluto}{plutosunCMshouldbe} = 3.729 \cdot 10^{7}$ EQUATION B88

$oldplutomass := m_{ppluto} \cdot ratiopluto = (4.866 \cdot 10^{29})\ kg$ EQUATION B89

$M_s \cdot presentCMpluto = (2.858 \cdot 10^{42})\ kg \cdot m$ OK EQUATION B90

$oldplutomass \cdot d_{plutosun} = (2.858 \cdot 10^{42})\ kg \cdot m$ OK EQUATION B91

$m_{ppluto} \cdot d_{plutosun} = (7.666 \cdot 10^{34})\ kg \cdot m$ NOTOK EQUATION B92

APPENDIX C

CONSTANTS EQUATIONS FOR ALL THE PLANETS AND MOON AND EUROPA (ONE OF JUPITER'S MOON) I named this Appendix C as Constants because from the equilibrium equations we can extrapolate certain constants related to each planet in the solar system and beyond for use in orbital calculations of their moons.

EARTH

$m_{pe} := 5.98 \cdot 10^{24}\ kg$ Mass of present Earth

$velorbit_{earthsun} := 2.9785 \cdot 10^{4}\ \frac{m}{s}$ Earth's orbital velocity around Sun

$d_{earthsun} := 1.496 \cdot 10^{11}\ m$ Orbital distance of Earth to Sun

$radearth := 6.371 \cdot 10^{6}\ m$ Mean Radius of earth

SUN

$G := 6.67384 \cdot 10^{-11}\ \frac{m^3}{kg \cdot s^2}$ Universal Gravitational Constant

$$M_s := 1.9891 \cdot 10^{30}\ kg$$

Sun's mass

Let us start with equilibrium equations for Sun and earth.

EQUILIBRIUMEQUATIONS

$$Fg := G \cdot m_{pe} \cdot \frac{M_s}{{d_{earthsun}}^2} = \left(3.547 \cdot 10^{22}\right)\ N$$

Gravitational attraction of Sun to Earth
EQUATION A1

$$Fc_{earthsun} := m_{pe} \cdot \frac{{velorbit_{earthsun}}^2}{d_{earthsun}} = \left(3.546 \cdot 10^{22}\right)\ N$$

C-FORCE is at earth's orbital distance
EQUATION A2

The key feature of these section is combining both A1 and A2Since these equations A1 and A2 are equal.

$$\therefore\ Fg := Fc_{earthsun}$$

EQUATION C1

$$\therefore\ G \cdot m_{pe} \cdot \frac{M_s}{{d_{earthsun}}^2} = m_{pe} \cdot \frac{{velorbit_{earthsun}}^2}{d_{earthsun}}$$

EQUATION C2

$$\therefore\ G \cdot \frac{M_s}{d_{earthsun}} = {velorbit_{earthsun}}^2$$

EQUATION C3

$$G \cdot \frac{M_s}{d_{earthsun}} = \left(8.874 \cdot 10^{8}\right) \frac{m^2}{s^2}$$

EQUATION C4

$${velorbit_{earthsun}}^2 = \left(8.871 \cdot 10^{8}\right) \frac{m^2}{s^2}$$

EQUATION C5

Since G is constant and Mass of Sun are constants
This is standard grvitational constant. I will call this "Sun constant" because I need a name for all other planet constants.

$$C_{sun} := G \cdot M_s$$

EQUATION C6

$$\therefore\ C_{sun} := {velorbit_{earthsun}}^2\ d_{earthsun}$$

EQUATION C7

$$GM_s := {velorbit_{earthsun}}^2 \cdot d_{earthsun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C8

$$Sunconstant := G \cdot M_s = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C9

$$velorbit_{earthsun}{}^2 \cdot d_{earthsun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EARTH RELATED: IMPORTANT:

These Equation C8 equations have same value. This s true with all planets.

EQUATION C10

From the above equations we can infer that orbits are controlled only by the velocity of the orbiting planet and planet's orbital distance because G x Mass of the Sun is constant. Orbital mechanics does not depend on the mass of the orbiting body after the foci formation. IMPORTANT: G*Ms is constant for all planets in the solar system. All planets follow G*M = *velorbit* 2 *orbital distance above is specific to EARTH. All planets follow this equation.

In Appendix B, I showed that foci calculations of all the planets in our present solar system are all over the place and do not follow the CM principle. Because of this, in my calculations, I predicted in Appendix B all the planets in our solar system lost mass and this fits well with the present foci values. Foci determine the orbital distance. From the combined equilibrium equations, we also infer that orbital distance alone determines the velocity (Equation C8). Thus after the foci were formed, orbital distance alone determine the velocity of orbit. Planets stayed in the same orbit from then on or locked in. Because of this lock-in, although all the planets in our solar system lost mass later the foci remained the same. Since mass component is in both equilibrium equations (C-Force and G-Force) it didn't affect or disturb the equilibrium of the system. Equilibrium stays intact as long as the C-Force of the changing mass of the secondary planet can equal or exceed gravitational force of the primary mass. This is the reason for the discrepancies in the present foci calculation in the present solar system.This explanation in the above paragraph is a very important because in appendix B (elliptical orbit-foci calculations) I explained that all the planets went through large mass changes in their history in this section. I want to emphasize here that once planet orbit is established, mass change won't affect the orbit or the foci. **I will establish some laws that follow the orbital mechanics. I call these Emani's Orbital laws:** All these orbiting bodies of the universe follow simple and specific laws in forming their orbits from the beginning to their demise. This paper formulated five Universal laws ("Emani's Orbital Laws") using the insights into the equilibrium equations during the foci calculations orbiting planets follow around their primary mass from the beginning oftheir formation till theend. **1stlaw:** In the beginning of the formation of the orbit, both primary and secondary masses determine the orbital distance according to the principle of Center of Mass (CM). Then the orbital distance is locked-in. **2ndlaw:** The orbital distance determines the planet's orbital velocity. This locks-in all the orbital characteristics I.e. orbital distance or orbital velocity. 3rdlaw: Once the orbits are established, mass changes of the orbiting planet do not affect the orbital characteristics.4thlaw: Equilibrium of the planet is still maintained irrespective of any mass changes occurring in the orbiting body by its Centripetal-force (C-force) in defending gravitational and or other disturbing forces as long as theplanet's C-force equals or exceeds total force acting on it. **5thlaw:** The above laws are true for all the orbiting bodies of the universe. Now I will calculate different planet constants of the Solar system **Now like we arrived at the Sun Constant, earth constant also can be calculated in order to calculate orbits of any of its moons:**

MOON

$$m_{pmoon} := 7.3477 \cdot 10^{22}\ kg$$

Mass of present Moon

$$radmoon := 1.7371 \cdot 10^{6}\ m$$

Mean Radius OF MOON

$$velorbit_{moonearth} := 1.022 \cdot 10^{3}\ \frac{m}{s}$$

Moon's orbital velocity around earth

$$d_{moonearth} := 3.844 \cdot 10^{8}\ m$$

Orbital distance of earth to Moon

EQUILIBRIUMEQUATIONS

$$Fgmoon := G \cdot m_{pe} \cdot \frac{m_{pmoon}}{d_{moonearth}^{2}} = \left(1.985 \cdot 10^{20}\right) N$$

EQUATION A3

$$Fcatdistmoon := m_{pmoon} \cdot \frac{velorbit_{moonearth}^{2}}{d_{moonearth}} = \left(1.997 \cdot 10^{20}\right) N$$

EQUATION A4

This equilibrium force between earth and moon is the reason for moon rotating around earth without flying away.
Small variations in the equation may be the result of physical measurement inaccuracies in mass calculations or small pertubances or variations in velocity and orbital distance.

ORBITALEQUATIONS

$$velorbit_{moonearth}^{2} = \left(1.044 \cdot 10^{6}\right) \frac{m^2}{s^2}$$

EQUATION C11

$$m_{pe} \cdot \frac{G}{d_{moonearth}} = \left(1.038 \cdot 10^{6}\right) \frac{m^2}{s^2}$$

EQUATION C12

EARTh and MOON RELATED: IMPORTANT: These 2 equations have same value

$$earthconstantC_{earth} := G \cdot m_{pe} = \left(3.991 \cdot 10^{14}\right) \frac{m^3}{s^2}$$

EARTHCONSTANT
EQUATION C13

$$velorbit_{moonearth}^{2} \cdot d_{moonearth} = \left(4.015 \cdot 10^{14}\right) \frac{m^3}{s^2}$$

EQUATION C14

$$\therefore\ earthconstantC_{earth} := velorbit_{moonearth}^{2}\ d_{moonearth}$$

EQUATION C15

EARTH and moon RELATED: IMPORTANT: This is a constant for all the earth moons or any mass orbiting the earth.

JUPITERCONSTANT

$$m_{pjup} := 1.89813 \cdot 10^{27}\ kg$$

Mass of present Jupiter

$$velorbit_{jupsun} := 1.307 \cdot 10^{4}\ \frac{m}{s}$$

Jupiter's orbital velocity around Sun

$$Vjupiter := 13.07 \cdot 10^{3}\ \frac{m}{s}$$

Mean Radius OF Jupiter

$$d_{jupsun} := 7.78547 \cdot 10^{11}\ m$$

Orbital distance of Jupiter to Sun

EQUILIBRIUNEQUATIONS

$$Fgjupiter := G \cdot M_s \cdot \frac{m_{pjup}}{d_{jupsun}^{\ 2}} = \left(4.157 \cdot 10^{23}\right)\ N$$

EQUATION A5

This is the Gravitational attraction between Sun and Jupiter

$$Fcatdistjupiter := m_{pjup} \cdot \frac{Vjupiter^2}{d_{jupsun}} = \left(4.165 \cdot 10^{23}\right)\ N$$

EQUATION A6

This is THE C-FORCE OR the equilibrium force

ORBITTALEQUATIONS

$$velorbit_{jupsun}^{\ 2} = \left(1.708 \cdot 10^{8}\right)\ \frac{m^2}{s^2}$$

EQUATION C16

$$M_s \cdot G \div d_{jupsun} = \left(1.705 \cdot 10^{8}\right)\ \frac{m^2}{s^2}$$

EQUATION C17

$$GM_s := velorbit_{jupsun}^{\ 2} \cdot d_{jupsun} = \left(1.33 \cdot 10^{20}\right)\ \frac{m^3}{s^2}$$

EQUATION C18

$$velorbit_{jupsun}^{\ 2}\ d_{jupsun} = \left(1.33 \cdot 10^{20}\right)\ \frac{m^3}{s^2}$$

EQUATION C19

EUROPA One of Jupiter's Moons

$$m_{peuropa} := 4.7998 \cdot 10^{22}\ kg$$

Mass of present Europa

$$velorbit_{europajup} := 1.374 \cdot 10^{4}\ \frac{m}{s}$$

Europa's orbital velocity around Sun

$$d_{europajup} := 6.709 \cdot 10^{8}\ m$$

Orbital distance of Europa and Jupiter

EQUILIBRIUNEQUATIONS

$$Fgjupitereuropa := G \cdot m_{pjup} \cdot \frac{m_{peuropa}}{d_{europajup}^{\ 2}} = \left(1.351 \cdot 10^{22}\right)\ N$$

EQUATION A7

$$Fcatdisteuropa := m_{peuropa} \cdot \frac{velorbit_{europajup}^{\ 2}}{d_{europajup}} = \left(1.351 \cdot 10^{22}\right)\ N$$

EQUATION A8

ORBITTALEQUATIONS

$$velorbit_{europajup}{}^{2} = \left(1.888 \cdot 10^{8}\right) \frac{m^{2}}{s^{2}}$$ EQUATION C20

$$m_{pjup} \cdot \frac{G}{d_{europajup}} = \left(1.888 \cdot 10^{8}\right) \frac{m^{2}}{s^{2}}$$ EQUATION C21

$$velorbit_{europajup}{}^{2} \; d_{europajup} = \left(1.267 \cdot 10^{17}\right) \frac{m^{3}}{s^{2}}$$ EQUATION C22

$$JupConstCjup := m_{pjup} \cdot G = \left(1.267 \cdot 10^{17}\right) \frac{m^{3}}{s^{2}}$$ EQUATION C23

Jupiter RELATED: IMPORTANT: This is a constant for all the moons of Jupiter

NEPTUNE

$$m_{pnep} := 1.0247 \cdot 10^{26} \; kg$$ Mass of present Neptune

$$velorbit_{nepsun} := 5.43 \cdot 10^{3} \; \frac{m}{s}$$ Neptune's's orbital velocity around Sun

$$d_{nepsun} := 4.503443661 \cdot 10^{12} \; m$$ Orbital distance of Neptune and Sun

EQUILIBRIUNEQUATIONS

$$Fgneptune := G \cdot M_{s} \cdot \frac{m_{pnep}}{d_{nepsun}{}^{2}} = \left(6.707 \cdot 10^{20}\right) N$$ EQUATION A9

$$Fcatdistneptune := m_{pnep} \cdot \frac{velorbit_{nepsun}{}^{2}}{d_{nepsun}} = \left(6.709 \cdot 10^{20}\right) N$$ EQUATION A10

ORBITTALEQUATIONS

$$velorbit_{nepsun}{}^{2} = \left(2.948 \cdot 10^{7}\right) \frac{m^{2}}{s^{2}}$$ EQUATION C24

$$M_{s} \cdot \frac{G}{d_{nepsun}} = \left(2.948 \cdot 10^{7}\right) \frac{m^{2}}{s^{2}}$$ EQUATION C25

$$GM1 := velorbit_{nepsun}^{2} \cdot d_{nepsun} = \left(1.328 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C26

We can also derive orbits of all the moons of the Neptune by using Neptune Conctant similar to the derivation of the Europa with Jupiter constant:

$$NeptuneConstCnep := m_{pnep} \cdot G = \left(6.839 \cdot 10^{15}\right) \frac{m^3}{s^2}$$

EQUATION C27

neptune IMPORTANT: This is a constant
for all planets - same value

NEPTUNECONSTANT

———————

Neptune&MOONS

SATURN

$$m_{psat} := 5.69 \cdot 10^{26}\ kg$$

Mass of present Saturn

$$velorbit_{satsun} := 9.69 \cdot 10^{3}\ \frac{m}{s}$$

Saturn's orbital velocity around Sun

$$d_{satsun} := 1.4246 \cdot 10^{12}\ m$$

Orbital distance of Saturn to Sun

EQUILIBRIUNEQUATIONS

$$Fgsaturn := G \cdot M_s \cdot \frac{m_{psat}}{d_{satsun}^{2}} = \left(3.722 \cdot 10^{22}\right) N$$

EQUATION A11

$$Fcatdistsaturn := m_{psat} \cdot \frac{velorbit_{satsun}^{2}}{d_{satsun}} = \left(3.75 \cdot 10^{22}\right) N$$

EQUATION A12

ORBITTALEQUATIONS

$$velorbit_{satsun}^{2} = \left(9.39 \cdot 10^{7}\right) \frac{m^2}{s^2}$$

EQUATION C28

$$M_s \cdot \frac{G}{d_{satsun}} = \left(9.318 \cdot 10^{7}\right) \frac{m^2}{s^2}$$

EQUATION C29

$$GM_s := velorbit_{satsun}^{2} \cdot d_{satsun} = \left(1.338 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C30

$$SaturnConst := m_{psat} \cdot G = \left(3.797 \cdot 10^{16}\right) \frac{m^3}{s^2}$$

EQUATION C31

SATURNCONSTANT
————————
SATURN&MOONS

URANUS

$$m_{puran} := 8.6810 \cdot 10^{25}\ kg$$

Mass of present Uranus

$$velorbit_{uransun} := 6.81 \cdot 10^{3}\ \frac{m}{s}$$

Uranus's orbital velocity around Sun

$$d_{uransun} := 2.873550 \cdot 10^{12}\ m$$

Orbital distance of Uranus to Sun

EQUILIBRIUNEQUATIONS

$$Fguranus := G \cdot M_s \cdot \frac{m_{puran}}{d_{uransun}^{\ 2}} = \left(1.396 \cdot 10^{21}\right) N$$

EQUATION A13

$$Fcatdisturanus := m_{puran} \cdot \frac{velorbit_{uransun}^{\ 2}}{d_{uransun}} = \left(1.401 \cdot 10^{21}\right) N$$

EQUATION A14

ORBITTALEQUATIONS

$$velorbit_{uransun}^{\ 2} = \left(4.638 \cdot 10^{7}\right) \frac{m^2}{s^2}$$

EQUATION C32

$$M_s \cdot \frac{G}{d_{uransun}} = \left(4.62 \cdot 10^{7}\right) \frac{m^2}{s^2}$$

EQUATION C33

$$velorbit_{uransun}^{\ 2} \cdot d_{uransun} = \left(1.333 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C34

$$G \cdot M_s = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C4

$$Uranusconstant := m_{puran} \cdot G = \left(5.794 \cdot 10^{15}\right) \frac{m^3}{s^2}$$

EQUATION C36 Uranus

RELATED: IMPORTANT: This is a constant for all of its orbiting moons calculations

MERCURY

$$m_{pmer} := 3.3022 \cdot 10^{23}\ kg$$

Mass of present Mercury

$$velorbit_{mersun} := 4.787 \cdot 10^4\ \frac{m}{s}$$

Mercury's orbital velocity around Sun

$$d_{mersun} := 5.79091 \cdot 10^{10}\ m$$

Orbital distance of Mercury to Sun

EQUILIBRIUNEQUATIONS

$$Fgmercury := G \cdot M_s \cdot \frac{m_{pmer}}{d_{mersun}^2} = \left(1.307 \cdot 10^{22}\right) N$$

EQUATION A15

$$Fcatdistmercury := m_{pmer} \cdot \frac{velorbit_{mersun}^2}{d_{mersun}} = \left(1.307 \cdot 10^{22}\right) N$$

EQUATION A16

ORBITTALEQUATIONS

$$velorbit_{mersun}^2 = \left(2.292 \cdot 10^9\right) \frac{m^2}{s^2}$$

EQUATION C37

$$M_s \cdot \frac{G}{d_{mersun}} = \left(2.292 \cdot 10^9\right) \frac{m^2}{s^2}$$

EQUATION C38

$$velorbit_{mersun}^2 \cdot d_{mersun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C39

$$GM_s := velorbit_{mersun}^2 \cdot d_{mersun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C40

$$M_s \cdot G = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$

EQUATION C4

$$Umercuryconstant := m_{pmer} \cdot G = \left(2.204 \cdot 10^{13}\right) \frac{m^3}{s^2}$$

EQUATION C41

Mercury RELATED: IMPORTANT: This is a constant for all its moon calculations.

$$MercuryCONSTANT \over Mercur\&MOONS$$

MARS

$$m_{pmars} := 6.84185 \cdot 10^{23}\ kg$$

Mass of present Mars

$$velorbit_{marssun} := 2.4077 \cdot 10^{4}\ \frac{m}{s}$$

Mars's orbital velocity around Sun

$$d_{marssun} := 2.279391 \cdot 10^{11}\ m$$

Orbital distance of Mars to Sun

$$Fgmars := G \cdot M_s \cdot \frac{m_{pmars}}{d_{marssun}^{2}} = \left(1.748 \cdot 10^{21}\right)\ N$$

EQUATION A17

$$Fcatdistmars := m_{pmars} \cdot \frac{velorbit_{marssun}^{2}}{d_{marssun}} = \left(1.74 \cdot 10^{21}\right)\ N$$

EQUATION A18

ORBITTALEQUATIONS

$$velorbit_{marssun}^{2} = \left(5.797 \cdot 10^{8}\right)\ \frac{m^2}{s^2}$$

EQUATION C42

$$M_s \cdot \frac{G}{d_{marssun}} = \left(5.824 \cdot 10^{8}\right)\ \frac{m^2}{s^2}$$

EQUATION C43

$$velorbit_{marssun}^{2} \cdot d_{marssun} = \left(1.321 \cdot 10^{20}\right)\ \frac{m^3}{s^2}$$

EQUATION C44

$$GM1 := velorbit_{marssun}^{2} \cdot d_{marssun} = \left(1.321 \cdot 10^{20}\right)\ \frac{m^3}{s^2}$$

EQUATION C45

$$M_s \cdot G = \left(1.327 \cdot 10^{20}\right)\ \frac{m^3}{s^2}$$

EQUATION C4

$$Umarsconstant := m_{pmars} \cdot G = \left(4.566 \cdot 10^{13}\right)\ \frac{m^3}{s^2}$$

EQUATION C46

Mars RELATED: IMPORTANT: This is a constant for all MOONS - same value

VENUS

$m_{pvenus} := 4.8676 \cdot 10^{24}\ kg$ Venus of present Mars

$velorbit_{venussun} := 3.502 \cdot 10^{4}\ \frac{m}{s}$ Venus's orbital velocity around Sun

$d_{venussun} := 1.08208 \cdot 10^{11}\ m$ Orbital distance of Venus to Sun

EQUILIBRIUNEQUATIONS

$$Fgvenus := G \cdot M_s \cdot \frac{m_{pvenus}}{d_{venussun}^2} = \left(5.519 \cdot 10^{22}\right) N$$ EQUATION A19

$$Fcatdistvenus := m_{pvenus} \cdot \frac{velorbit_{venussun}^2}{d_{venussun}} = \left(5.517 \cdot 10^{22}\right) N$$ EQUATION A20

ORBITTALEQUATIONS

$$velorbit_{venussun}^2 = \left(1.226 \cdot 10^{9}\right) \frac{m^2}{s^2}$$ EQUATION C47

$$M_s \cdot \frac{G}{d_{venussun}} = \left(1.227 \cdot 10^{9}\right) \frac{m^2}{s^2}$$ EQUATION C48

$$velorbit_{venussun}^2 \cdot d_{venussun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$ EQUATION C49

$$GM1 := velorbit_{venussun}^2 \cdot d_{venussun} = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$ EQUATION C50

$$M_s \cdot G = \left(1.327 \cdot 10^{20}\right) \frac{m^3}{s^2}$$ EQUATION C4

$$Uvenusconstant := m_{pvenus} \cdot G = \left(3.249 \cdot 10^{14}\right) \frac{m^3}{s^2}$$ EQUATION C51 *VenusCONSTANT*

———————— *Venus&MOONS*

PLUTO

$m_{ppluto} := 1.305 \cdot 10^{22}\ kg$ Mass of present Pluto

$$velorbit_{plutosun} := 4.7 \cdot 10^{3}\ \frac{m}{s}$$

Pluto's orbital velocity around Sun

$$d_{plutosun} := 5.874 \cdot 10^{12}\ m$$

Orbital distance of Pluto to Sun

$$Fgpluto := G \cdot M_s \cdot \frac{m_{ppluto}}{d_{plutosun}^{2}} = \left(5.021 \cdot 10^{16}\right)\ N$$

EQUATION A21

$$Fcatdistpluto := m_{ppluto} \cdot \frac{velorbit_{plutosun}^{2}}{d_{plutosun}} = \left(4.908 \cdot 10^{16}\right)\ N$$

EQUATION A22

Pluto RELATED: IMPORTANT: This is a constant for all planets - same value

ORBITTALEQUATIONS

$$velorbit_{plutosun}^{2} = \left(2.209 \cdot 10^{7}\right)\ \frac{m^{2}}{s^{2}}$$

EQUATION C52

$$M_s \cdot \frac{G}{d_{plutosun}} = \left(2.26 \cdot 10^{7}\right)\ \frac{m^{2}}{s^{2}}$$

EQUATION C53

$$velorbit_{plutosun}^{2} \cdot d_{plutosun} = \left(1.298 \cdot 10^{20}\right)\ \frac{m^{3}}{s^{2}}$$

EQUATION C54

$$GM_s := velorbit_{plutosun}^{2} \cdot d_{plutosun} = \left(1.298 \cdot 10^{20}\right)\ \frac{m^{3}}{s^{2}}$$

EQUATION C55

$$M_s \cdot G = \left(1.327 \cdot 10^{20}\right)\ \frac{m^{3}}{s^{2}}$$

EQUATION C4

$$Uplutoconstant := m_{ppluto} \cdot G = \left(8.709 \cdot 10^{11}\right)\ \frac{m^{3}}{s^{2}}$$

EQUATION C56

$$\frac{PlutoCONSTANT}{Plut\&MOONS}$$

Pluto RELATED: IMPORTANT: This is a constant for all its moons