PLANETARY ORBITS

(According to “*Hypothesis on* MATTER”)

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Abstract: In any system of bodies, relativistic considerations can provide only those parameters of the constituent bodies, which are related to their relative positions. Use of a reference frame, related to a static central body, causes a planetary orbit to appear as closed geometrical figure around the central body. As the central body, itself is a moving body, this does not reflect physical reality. Although they help to explain apparent phenomena, all properties attributed to elliptical/circular planetary orbital path are unreal. Real physical actions are restricted to real entities and they have to be understood with reference to an absolute reference. Since, elliptical shape of a planetary orbit is an imaginary aspect; it has its limitations to explain real actions in nature. Due to constant motions of free bodies in space, it is practically impossible for a free body to orbit around another. However, they may orbit about each other and follow a common median path in space. Mechanism of orbit-formation and the limitations of orbiting bodies, described in this article, are based on a radically different dynamics from an alternative concept put forward in ‘*Hypothesis on* MATTER’. A planet’s parameters, during initial entry into its datum orbit, determine size and eccentricity of its apparent orbit. Only those bodies, which approach the central body from the rear, on the outer side of its curved path, through a small window in space can form stable orbits. Hence, it is imperative that all bodies of a planetary system orbit in the same sense and are (almost) in the same plane. Perihelion/aphelion of an orbital path could be anywhere in the orbit, but the point at which the orbiting body has its highest/lowest linear speeds are fixed in relation to the central body’s path. All natural planets, whose perihelion are in front of their point of entry; arrive from outside the planetary system.

Keywords: Orbits, Orbital mechanism, Central force, Planetary orbits, Solar system, Celestial mechanism, Cosmology, Hypothesis on MATTER.

Introduction:

‘Hypothesis on MATTER’ describes an alternative concept. In it: Whole matter in the universe is in the form of quanta of matter. Matter content of a macro body and the energy about it are distinctly separate. Matter content is the total sum of three-dimensional matter in a body. Energy is the stress developed in the universal medium due to ‘distortions’ in the natural arrangements of basic matter particles (quanta of matter) in and about the body. Matter content and energy content of a body cause and support each other for their existence and stability. They are not convertible into each other. Entire space is filled with universal medium (‘2D energy fields’), two-dimensional latticework formations by basic 1D quanta of matter. 2D energy fields in various directions and planes, passing through a point, co-exist. Although, 2D energy fields are made of (apparently) rigid quanta of matter, it has all properties of an ideal fluid. Parts of 2D energy fields, within a macro-body's dimensions, contain sufficient distortions to sustain its integrity and stability in its current states. This part of 2D energy fields is the 'matter field' of the body. Distortions in the matter field are the 'work-done' existing in the body and it determines the state of (motion of) the body. Force is the rate of work being stored about a macro body with respect to rate of its displacement. Action of an effort is simple structural reshaping of the matter field and the resulting motion of any matter particles present in the region. State of (motion of) a body depends on the work (energy stored) in it rather than on the effort applied on it. All apparent interactions between matter bodies take place through the medium of 2D energy fields. This avoids the assumption of 'actions at a distance'. There are no 'pull forces' or 'rigid macro bodies' in this concept. All efforts, classified into various types of forces, are different manifestations of 'only one type of force' and it is of 'push nature'. Work is transmitted only in straight lines and separately in each plane. Efforts in different planes do not form a resultant. Efforts in the same plane in different directions interfere to reduce/increase each other's efficiency to produce body's motion. Independent displacements of a body, produced by external efforts in different directions or in different planes may be regarded, together, to be resultant motion of the body in 3D space system. In this article, present conventions of 'pull forces' and their resultants are used for clarity. A free body is that macro body, which is free from all interferences other than the efforts/actions considered. Although a force can exist only when there is a related (body's) acceleration, in this article, the term 'force' is often used in its conventional sense to represent an effort.

Tendency of a 2D energy field to attain serenity does not allow static distortions in it. Transfer of distortions in the matter field of a macro body carries the associated 3D matter particles and thus produces macro body's motion. This inertial action, about a macro body, maintains the body's state (of motion). A change in the inertial actions about a macro body produces its acceleration. If certain work is invested into or removed from a body, the body will attain a stable state only after inertial delay, during which the work within the body stabilizes. This is true even after the action of effort is terminated. Matter is inert; it has no ability to move or act on its own. Associated matter field-distortions of a macro body produce all apparent actions, presently assigned to the matter (bodies).

Presence of 3D matter particles in a 2D energy field breaks its continuity. Discontinuity causes imbalance in the 2D energy field. Pressures applied by the 2D energy field-latticework from the sides, in an attempt to restore its continuity, compress a matter particle within the gap. [Basic 3D matter particles are of uniform radial size and they constitute all other superior matter bodies]. If the extents of 2D energy field on opposite sides of a 3D matter particle are unequal, the matter particle experiences a resultant effort, which tends to move the particle towards the side of lower effort (pressure or force). Extent of 2D energy fields between two matter particles is always less than the extent of 2D energy fields on their outer sides. As a result, two matter particles are pushed towards each other. Motions of constituent particles move a macro body. This action gives rise to (apparent) gravitational attraction between bodies. Apparent gravitational attraction is dynamic nature of gravitation. So far, static effects of gravitation did not attract attention of physicists. Apparent gravitational attraction between two bodies is, relatively, a minor by-product of gravitational actions. It takes place between (spinning and disc shaped) basic 3D matter particles of both the macro bodies, which happens to be in the same plane at the given instant. Apparent gravitational attraction, at any instant, is produced between extremely small numbers of basic 3D matter particles in two macro bodies. An average apparent attraction is derived from sporadic actions between various matter particles, which happen to be in the same plane at any instant. Contrary to present belief, gravitational action (force) is enormously stronger compared to other manifestations of efforts (natural forces). All conclusions, expressed in this article, are taken from the '*Hypothesis on* MATTER' [1]. For details, kindly refer to the same.

Relative motions:

Since no absolute reference is currently available, in physics, we use relative frames of references. By using a relative frame of reference, we assume certain region or a particular body is static (or is in assumed steady state) and use relative motions of other bodies, with respect to the static reference, for all our purposes in mechanics. An alternative concept, advanced by the author, envisages a real universal medium structured by matter particles and which fills the entire space to encompass all three-dimensional matter bodies. As this medium is normally homogeneous and static, it can provide an absolute reference for all actions and movements of all matter bodies.

In nature, no three-dimensional matter body can remain static in space. To survive, it has to have translational motion with respect to universal medium. In fact, it is an inherent property of the universal medium to move all three-dimensional matter particles at the highest possible linear speed. Macro bodies are formed by numorous 3D matter particles, moving at their critical linear speeds in circular paths within the macro body. Each macro body has certain inherent motion and appropriate magnitude of work (kinetic energy) associated with it. By choosing a body as a (static) reference, in that instant, we wipe-out whole of the reference body's kinetic energy, associated with its particular motion. Simultaneously, we modify magnitudes of kinetic energies associated with all referred bodies, considered. Although this is an unreal situation, it is convenient for general understanding of mechanics and mathematical analysis with respect to relative positions of the bodies. When we start assigning reality to the resulting parameters, other than relative positions, it will invariably distort any ensuing theories/physical laws.

Parameters of bodies or paths traced by them in their motion, as considered in the above situation, are unreal with respect to static universal medium. These parameters have no relation to real movements or other parameters of the considered bodies in space, except their relative positions. Theories or mathematical treatments, using these apparent paths (geometrical figures) of moving bodies, represent unreal circumstances. They can, at the most, indicate assumed or imaginary results, which may coincide with our observations. They are always in relation to the steady (immobile) state of the chosen reference, within a system of bodies. These apparent or imaginary parameters cannot provide results for real physical actions.

A spinning body can be assumed as a static reference provided the observer is assigned with imaginary motion in a path around the reference body in opposite direction at equal angular speed. By doing so, magnitude of kinetic energy of the spinning body is reduced to zero and the observer is given appropriate magnitude of kinetic energy to maintain his apparent motion. Any action on the reference body's spin motion by an external effort will appear to produce its results on the observer's apparent motion rather than on the state of (motion of) reference body. In order to maintain the static state of reference body, it is necessary to refrain from any change in its static state (of motion). All real changes in its state of motion are born by the apparent motion of the observer. An external effort, acting on the observer can change his state of motion. This change will be born by the observer, himself.

Calculations, based on observer's apparent (relative) motion can give correct results with respect to their relative positions, for state of bodies within the system in the same region of space. These results will be true only within the system and it will not constitute physical reality. However, we must concede to the fact that when an external effort acts on the reference body, resulting real action is only in the magnitude of its associated work-done (kinetic energy) and corresponding change of state of (motion of) the reference body. Although the external effort appears to have changed the kinetic energy associated with the observer, in reality, the external effort could change only the kinetic energy associated with the reference body. When an external effort acts on the reference body, real action is only in the change of state of (motion of) the reference body. And when the external force acts on the observer, the real action is only in the change of state of (motion of) the observer. However, as the reference body is assumed static, in both cases apparent changes are noticed in the magnitude of kinetic energy and corresponding state of (motion of) the observer.

Real physical action of a small linear effort on the observer, towards the reference body, is to move the observer towards the reference body. However, in the case considered above, apparent motion and speed of motion of observer encompasses both the real physical action and apparent motion of the observer. Observer will apparently move in a resultant direction at a resultant speed. Magnitude of resultant action is greatly influenced by direction of applied effort. This does not correspond to real physical action on the observer.

An apparent action noticed on a body within a system, which is related to a steady reference, may be considered real only within the framework, limited within the system in the same region of space. This is not real physical action in nature, with respect to an absolute reference. Real physical actions can take place only with respect to an absolute reference. Only a static universal medium can provide an absolute reference. If the bodies are in different regions of space with differing properties of universal medium, this type of assumption may not work well.

Relativistic considerations can give right results only in determining relative positions of macro bodies, considered. They are unable to provide real parameters of other states of macro bodies (size, work-done, temperature, pressure, matter content, kinetic energy, etc.) or shapes of their paths.

Figures, in this article, are not to scale. They are depicted to highlight the points presented.

Linear motion of a rotating body:

Linear and rotary motions of a macro body are entirely separate. Each of them is produced by separate set of work-done on the body. However, each point on a linearly moving rotating body has its own path of resultant motion. Its motion and path appear to be resultant of the linear and rotary motions of the body. In figure 1, 'A' shows a rotating body that has no linear motion. Centre point of the body 'O' may be assumed steady in space. Point P on its periphery traces a circular path, as shown by the circle in dashed line. Let the body develop a linear motion, as is shown by 'B' in the figure 1 and its centre of rotation moves from O_1 to O_2 at a constant speed, while the body turns through one revolution. Point P_1 on its periphery traces a loop as shown by the black curved line starting from P_1 and ending at P_2.

'C' in figure 1 shows the rotating body moving at a higher linear speed. Centre of rotation of the body moves linearly through a larger distance from O_1 to O_2, while the body turns through one revolution. Loop traced by a peripheral point becomes narrower as the linear speed increases, for the

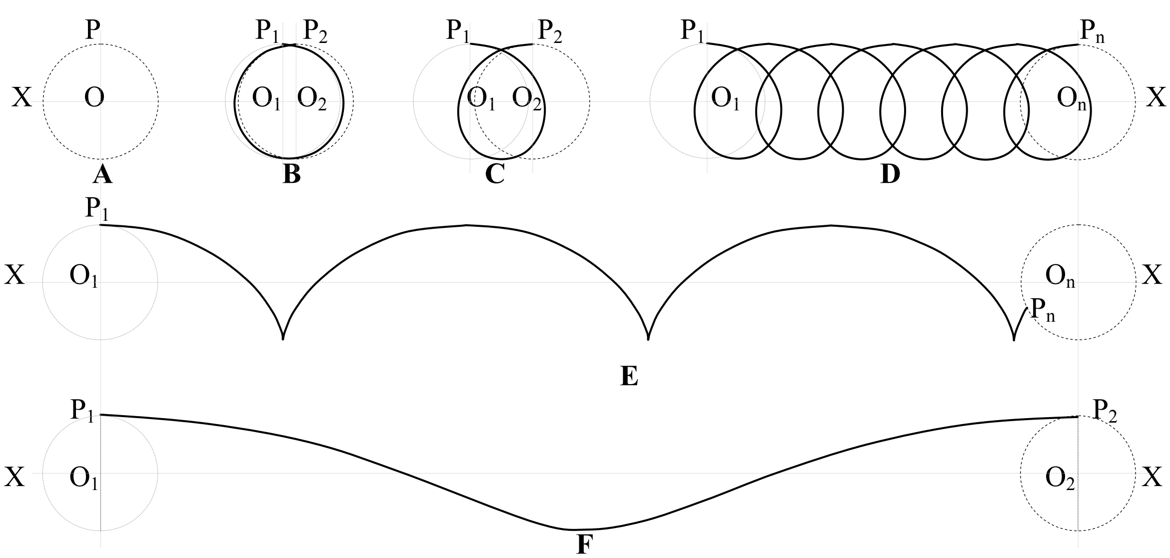

Figure 1

same rotary speed. ‘C’ shows the path of the peripheral point during one rotation of the body. Continuous loops in black from P_1 to P_n in ‘D’ shows a continuous path traced by the peripheral point in space, while the centre of rotation of the rotating body moves linearly from O_1 to O_n along the line XX. As the linear speed of the body increases in relation to its rotary speed, the loops in the path of the peripheral point gradually becomes narrower until the loops altogether disappear at a stage. At this stage, the body’s linear speed equals π times the radius of the rotating body (distance of the peripheral point from the centre of rotation of the body) during every rotation of the body. Black series of semi-circular paths ‘E’ in figure 1 shows the curved path traced by a peripheral point. Resultant path of the peripheral point consists of semi-circular curves with their convex sides in the same direction. The path starts from P_1 to P_n in ‘E’, while the centre of rotation of the rotating body moves linearly from O_1 to O_n along the line XX. As the linear speed of the body exceeds this value, no points in the body have motions in the reverse linear direction. All points in the body have displacements only in the forward direction. Requirements that points in the body on opposite sides of centre of rotation have motion in opposite directions are no more satisfied. No point in the body has circular/elliptical path in space. All points in the body move in forward linear direction only. However, with respect to any point in the body, all other points in its plane of rotation, appears to move in circular path around the point of reference.

As the linear speed of the rotating body is increased, circular path of the peripheral point expands to become a wavy path about the line of motion of the body’s centre of rotation. The black curved line, ‘F’, in figure 1, shows this path. Path of the peripheral point in space traces a wavy curve from P_1 to P_2, while the centre of rotation of the body moves from O_1 to O_2 along the line XX, during one rotation of the body. At lower linear speeds, difference between segments of curved path (on either side of the linear path) is large. As the linear speed of the body increases (for the same rotary speed), lower segment becomes larger and the difference between upper and lower segments of the curve reduces.

Although, depending on body’s linear speed in relation to its rotary speed, the peripheral point traces curves of loops, semi-circular curves or wavy path in space, it still moves in a circle with respect to the centre of rotation of the body. Motion of the peripheral point in a circular path is apparent only to an observer situated at the centre of rotation of the rotating body. Circular path of the peripheral point, noticed by the observer, is an illusion due to the observer not considering his own linear motion in space. In fact, every point in the rotating body, moving in linear path, appears to move around every other point in the same body. This is a false impression, created by choosing a moving point as a reference. Every point has its own independent path in space. Other than when the rotating body has no linear motion, path of the peripheral point does not trace a closed geometrical figure in space.

Rotating body is moving in a linear path. Center of rotation of the body has a linear motion along a straight line, XX as shown in the figure 1. For an observer, situated at one of its peripheral point, the centre of rotation of the body will appear to move around his location. He cannot observe his own true motion in space. He also cannot observe the linear motion of the rotating body (centre of rotation). Observed motion of the centre of rotation in a circular path around the peripheral point is an illusion.

Since both the apparent motion of the peripheral point in circular path around the centre of rotation and the apparent motion of the centre of rotation in circular path around the peripheral point are only illusory motions, no true physical law can be based on them. Such illusory motions cannot be considered as proof of scientific laws. Observers, simultaneously situated at both these points will have apparent motions contrary to each other. None of them can observe the true motion of the points on the rotating body, in space. Real paths of any point on the linearly moving-rotating body can be viewed only from an external point. Origin of the frame of reference has to be outside the body.

A rotating body's integrity keeps relative positions of its peripheral points with respect to its centre of rotation. Its integrity provides certain attachment between these points. All through their displacements, distance between the centre of rotation and a peripheral point remains constant. Each of these points can appear to move in circular paths around the other point. Therefore, in any system of bodies, where distance between two bodies is always kept constant (by some means irrespective of bodies' motions) and where each of the bodies appears to move in circular path around each other, the above given explanations are valid.

Shape of planetary orbital paths:

As recently as few centuries ago, earth was believed to be the centre of universe. All other observable celestial bodies were assumed to revolve around earth. Developments in geometry and mechanics made this belief irrational. Attempts to depict paths of even the nearest celestial bodies were unsuccessful or illogical, until Johannes Kepler formulated his first and second laws on planetary motion (by analyzing observations by earlier astronomers) in year 1609 AD. First law states that '*All planets move about the Sun in elliptical orbits, having the Sun as one of the foci*'. First law gives the shape of the orbital path and the second and third laws, which depend on the first law, give mathematical properties of this path.

Shapes of planetary orbits were categorically stated as elliptical. (Circle is a special ellipse). Neither why such motions should take place nor the mechanism of planetary motions were proposed by these laws. Choice of location of sun, out of two foci of the ellipse, was also not explained. In short, Kepler's laws were formulated on the basis of empirical evidences only. They had no scientific base. Planetary orbital paths were depicted as they would appear to an observer, placed on static sun. These were assumed as true paths of the planets in space.

While formulating his laws on planetary motions, Johannes Kepler used observations only for few of the planets in solar system. Although, the moon is the nearest celestial body to earth and its orbital path was much easier to observe, it was left out. Probably, due to the realization that the moon, a satellite, could not execute an elliptical orbit around the moving earth. His planetary laws are applicable only to the observed orbits of planets around a static sun. Observed orbital paths are what the observer sees, without considering his own state of motion. An observer, placed on a static sun will see all planets in the solar system orbiting around the sun. Similarly an observer in any of the planets will observe all outer planets and the sun orbiting around him. Standing on earth, we see that sun, outer planets and moon orbit around us in complicated geometrical paths. All these orbital motions are mere appearance.

Although a planetary body appears to move in orbital path around a central body, in reality, it has independent motion of its own. (Apparent) gravitational attraction towards the central body causes a planetary body's path to deviate from straight line, to move about and along with the central body in its motions. Since a planet is very small, compared to the central body, deviations in planet's path are more prominent. When these deviations are considered about a static central body, orbital path of a planet appears to be around the central body. This is the apparent orbit of the planet, which we observe in everyday life. Similarly, relative to an assumed static planetary body, apparent direction of motion of the central body is around the planet. Few centuries back, when an earth-centered universe was in prominence, this apparent motion was considered true. Later as the science progressed, idea of a heliocentric universe came into prominence. Earth, orbiting around the sun, is considered true in a heliocentric universe. Although we now know that, the sun is no more a static body at the centre of universe, our view of planetary orbits in a heliocentric solar system has not changed.

Apparent planetary orbits can be assumed around any reference point, within a system. Since we consider instantaneous parameters of planetary bodies, for most of all practical purposes of predictions (of annually) re-occurring phenomena, apparent orbits (relative positions) provide accurate results. Although most astronomers are aware of apparent nature of elliptical orbital paths, they still consider apparent orbit as true orbital path of a planet. Kepler's laws on planetary motion and the elliptical planetary orbits are routinely used in conjunction with many multi-body problems including moon's orbital path, which was not considered for the original planetary laws. Although mathematical treatments of apparent actions may produce results that suit apparent phenomena, they cannot always describe real facts.

We must consider that Kepler's 'laws of planetary motion' were formulated at a time, when the phenomenon of gravitation and the phenomenon of central force were unknown. At that time, even the heliocentric nature of solar system was not an accepted fact. What Kepler has done is to formulate laws to suite the observed locations of planets about the sun, which was considered to be static in space. No interactions or efforts between central body and the planets were considered as cause of their relative motions.

Kepler's laws on planetary motions came into prominence and were widely accepted after they were used to verify and establish Newton's 'laws of motion' and the 'law of universal gravitation'. Newton's theories provided the much needed cause and an imaginary mechanism for planetary orbital motion around a central body. Although, Newton clarified that the planetary orbital paths (under central gravitational force) need not always be elliptical but can also be parabolic or hyperbolic, general shape of a planetary orbit is accepted as an elliptical curve, around the sun. Belief in elliptical planetary orbits around their central bodies played a crucial role in establishing the current theories on motion. It is from these closed geometrical figures of planetary orbits around a central body that proofs of contemporary gravitational laws were derived. Power of these laws to explain and predict various phenomena (with respect to relative positions) were confirmed later. This made Newton's 'laws of gravitation' and 'laws of motion', the foundations of quantitative mechanics; all the while forgetting that the mathematical treatments, used for their validation, are the apparent planetary orbital motions, as observed around an assumed static central body and not the true orbital paths of the planets in space, about their central body.

Even the relativistic mechanics subscribe to planetary orbital paths around central bodies. It suggests curvature of space near a massive body as the cause of planetary orbits rather than an attractive force between planetary and central bodies.

Orbital motion:

A planetary system is formed by a group of large bodies in space. Bodies of this group move together along a median path, while individual bodies have independent relative motions within the group. The planetary system that includes the sun is the solar system. Path of each body in the system is affected by the presence of all other bodies. We may, for the time being, neglect effects on their paths by the presence of other bodies in space, as they are very small. There may also be smaller bodies called satellites in a planetary system. Satellites being very near to the planets, they form (sub) planetary system with their mother planet, within the larger planetary system. Largest body in the group has its path nearest to the median path and its path is least perturbed. This body acts as the leader of the group and it is called the central body of the planetary system. All other bodies in the planetary system move along with the central body, while their paths are perturbed by the presence of all other bodies in the system. For the explanations below, we shall consider a planetary system containing a central body and one planetary body.

A planetary system is essentially a part of a galaxy. All stable galaxies are static in space. Galaxies are rotating systems of macro bodies with no translational motion (author has strong reasons to support this view [1]). Hence, a planetary system in a galaxy traces a circular path around galactic centre. Median path of the planetary system is a very large circle around galactic centre. Largest body in the group has its path nearest to the median path and its path is least perturbed. This body acts as the leader of the group and it is the central body of the planetary system. All other bodies in the planetary system move along with the central body, while their paths are perturbed by the presence of other bodies in the system.

With reference to the planetary body, the central body appears to orbit around the planetary body and with reference to the central body, the planetary body appears to orbit around the central body. Disregarding the eccentricity of an orbit, distance between the central body and the planetary body remains constant. By these characteristics, a planetary system functions as a rotating body moving in linear path. Planet takes the place of a peripheral point and the central body takes the place of centre of rotation, in the explanation given above on the 'linear motion of a rotating body'. Median path of the planetary system is a very large circle. A small part of this very large circle is considered as a straight line for the explanations.

Actions of central force on a planet and its orbital motion are independent of all other bodies, including the central body. Role of the central body or any other body in the vicinity is to limit the extent of 2D energy fields acting on one side of the planet. Rest of all actions on the planet are performed by the 2D energy fields. Although a planetary body appears to move in orbital path around a central body, in reality, it has an independent path of motion of its own. Apparent gravitational attraction towards the central body causes its path to deviate from straight line to move about and along with the central body in its motions. Due to the gravitational actions, orbiting bodies appear to influence the direction of each other's motion and create perturbations in their paths. Since a planet is very small compared to the central body, deviations in its path are more prominent. When these deviations are observed about a central body that is assumed to be static, path of the planet appears to be an orbit around the central body. This is the apparent orbit of the planet, which we observe in everyday life.

Circular/elliptical orbital motion is apparent only with respect to the participating bodies. With respect to absolute reference, a planet does not orbit around the central body. Path of a planet's motion is wave-like, along the central body's path, the planet periodically moving to the front and to the rear of the central body. In figure 2, path of the central body is shown by the arrow in grey dotted line. This curved path, also, is wavy to a smaller extent, curving in the same directions as the path of the planet. Arrow in black wavy-line shows planet's orbital path. Unevenness of curvature of this path

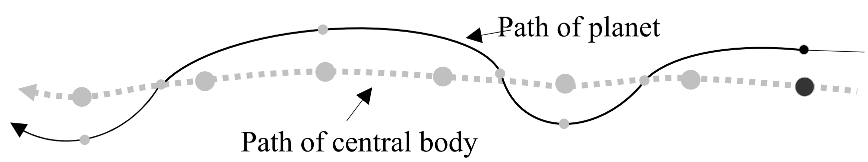

Figure 2

on either side of central body's path (in the figure) is due to different scales used linear and radial displacements. Path of a satellite of the planet is a wavy-line about planet's path. Central body and the planet are shown by black circles and their future positions are shown by grey circles. In this sense, it can be seen that a planet (or a satellite) orbits around the centre of the central body's curved path and the wave pattern in its path is caused by the presence of the central body. Such changes in the path of a free body may be attributed to perturbations caused by presence of nearby bodies. These perturbations look like orbital motion around a central body, only when they are referred to an assumed static central body in a relatively small system of bodies. This argument can be carried further to show that with respect to absolute reference there is no natural orbital motion (around central bodies) at all, except orbital motions of bodies around the (static) galactic centres.

Although it is not generally acknowledged, shape of a planet's orbital path is wavy about the path of the central body. Both, a planet and its central body move in the same direction about the same median path in space. Since the circular/elliptical orbital motion is an apparent phenomenon, either of the bodies can be considered as the central and the other as its planet. Planetary laws are equally valid in either case. Although it is generally stated that the earth orbits around the sun in eastward direction, it is equally valid to state that "the sun orbits around the earth in westward direction". However, when more than two bodies are considered as a single system, it is more convenient to take the common and most prominent body as the central body and to take other bodies as planetary or satellite bodies.

A planetary body moves in the same direction and along with its central body. It is only when we imagine reversing the direction of planet's motion, on one side of central body's path, we can get a geometrically closed figure for planet's apparent orbital path. This is something we unintentionally do. It coincides with our observations and general beliefs. It is a good assumption to have definite reference points on the orbital paths, to predict cyclically varying phenomena. Even with these manipulations, shape of an apparent orbital path is oval with a single focus rather than an ellipse with two foci.

It is an established fact that the sun is a moving body in space. By simple mechanics, it is physically impossible for a free planet to orbit around a moving central body, in any geometrically closed path. Both a circle and an ellipse are closed geometrical figures. Hence, elliptical planetary orbital paths (closed geometrical figures) around the sun are false or apparent. Yet, no text books, atlases or any other type of literature agrees to the fact that planetary orbital paths are not circular or elliptical. Even the suggestion of non circular/elliptical planetary orbital path invites venomous criticism from experts. Circular or elliptical planetary orbits around the sun are apparent structures. They are what an observer on the static sun would notice. They do not exist in reality.

Acceptance of wavy-nature of planetary orbital paths can give simpler and logical explanations to many of the puzzling problems in cosmology, like; formation of planetary system, coplanar locations of bodies in a planetary system, mechanism of planetary spin, higher spin speeds of equatorial region of certain planetary bodies, displacements of tides from local meridian, precession of elliptical apparent orbits, apparent lengthening of solar days, etc. All assumptions, based on the elliptical nature of planetary orbits will become invalid.

Effort on a planetary body:

In this article, all actions of a planet due to its inherent inertial motion are credited to linear motion/work (attained by the planetary body before it entered into its stable orbital path) and all actions due to the central force are credited to radial motion/work in it, towards the central body. A body is defined by the measurements of space, occupied by its matter content and by its mass, representing the quantity of its matter content. A free body tends to move in a straight line due to associated inertia. Apparent gravitational attraction between two bodies is the result of apparent attraction between their constituent 3D matter particles. Inertia of a body does not apply any effort on the body. While inertia maintains a moving planetary body in its straight-line motion, it is the central force by its action on the body, which changes the direction of planet's liner motion and produce its spin motion. Actions on each body are between it and the surrounding 2D energy fields. Concurrent actions on two bodies, considered together, may be interpreted as an apparent interaction between them. Although gravitational action on each body is separate, such actions on the central and planetary bodies, when considered together, provide a central force (apparent attraction) between them. A planet is apparently attracted towards the central body. (Apparent) gravitational attraction between two macro bodies take place only in common planes occupied by them [1]. Actions, similar to the orbital motion of a planet analysed here, takes place on central body also.

A moving macro body contains work-done required for its linear and spin motions. Work is stored in the form of distortions in its matter field. In this article, we shall neglect all work, stored in the macro body, for the sustenance of its stability and integrity. We shall deal with only those additional distortions (work), introduced into body's matter field, by external efforts to change the state of body's motion. A free body, which is associated with such work, will continue its linear motion in a straight line at constant linear speed and maintain its spin motion at constant angular speed. Work contained in a planetary body was invested into its matter field by external efforts (forces), including apparent gravitational attraction towards the central body before the body's entry into stable orbital path. Another external effort is required to change the state of constant motions of the orbiting body. Efforts in different planes do not interact. They act on each of the 3D matter particles independently. Matter particles are moved by each of the efforts in its own direction, to produce resultant direction of a combined-body's motion.

Magnitude of matter field-distortions (work) in a macro body, moving in circular path, does not change. However, to keep changing the direction of motion at a constant rate, distortions in its matter field are modified continuously. Changes in the matter field distortions produce body's accelerating stages. In the case of motion in a circular path, irrespective of changes in the matter field, magnitude of total matter field-distortions in the matter field of the macro body is kept constant. Instantaneous velocity of the macro body depends on the magnitude of distortions in its matter field. Acceleration of the macro body depends on the variation in the work (magnitude or direction of distortions in the matter field) associated with it. A planetary body, simultaneously, maintains a constant acceleration towards the central body, maintains linear motion at constant velocity along the orbital path, maintains linear motion at constant velocity towards the central body and maintains appropriate acceleration of its spin motion.

In the following paragraphs, displacement of the planetary body along its orbital path is called planet's linear motion and planet's displacement towards the central body, by the (apparent) central force, is called radial motion. Disregarding the spin motion, a planet has two simultaneous (linear) motions, a linear motion nearly tangential to its orbital path and a radial motion towards the central body. Linear motion of the planet is deflected, outward from orbital path (away from the median path). Angle between the direction of linear motion and the tangent at the location of the planetary body on its orbital path, the 'drifting rate', produces a perpendicular component of the linear motion. This, a real motion of the planetary body (away from the centre of curvature of the path), replaces the assumed motion produced by the 'imaginary centrifugal force' on it. Major part of (linear) work within a planet's matter field carries the planet along the orbital path. Relative direction of radial motion to the tangential linear motion varies at different points on the real orbital path. Most of the matter field distortions, producing linear motion and radial motion of the body, are in different planes. Hence, they do not produce resultant motions. However, simultaneous and independent displacements of the planetary body, produced by the matter field-distortions in different planes, may be understood together as its resultant motion.

In the following analysis, a planetary body orbiting about a central body (moving in a much larger circular path) is considered. As the planet moves in its orbital path, its relative direction to central body changes through half a circle, alternately in either direction. This is in contrast with present assumption of a planet moving around the central body in full circles (an assumption created by change of reference frame). Changes in relative direction between the bodies cause variations in efforts and their actions. Following explanations are for relative position of the central and planetary bodies, when the tangents to their paths are parallel and both bodies are moving in the same direction.

Action of a central force:

Central force, between a planet and its central body, is provided by apparent gravitational attraction between them. [Real gravitational actions, by the 2D energy fields, pushing these bodies towards each other is considered as apparent attraction between them]. Direction of this apparent attraction, at datum points in the orbit (points on the orbital path where the planet is displaced by π/2 radians from the median path), is perpendicular to planetary body's linear motion. At other points in the orbital path, direction and magnitude of central force vary and depend on the relative position between central and planetary bodies. Action of the central force depends on the magnitude of (radial) distortions; it is able to invest into the planetary body's matter field. Magnitude of (radial) matter field-distortions, a body is able to store is governed by the component of its absolute linear speed (with respect to the space/2D energy fields) across the central body. Action of apparent gravitational attraction is instantaneous and continuous. As long as the participating bodies occupy common planes, apparent gravitational attraction between the bodies, continues to invest additional distortions in their matter fields to produce inertial actions.

Calculations according to the concept in 'Hypothesis on MATTER' (for full calculations, please refer to the book) magnitude of central force on a planetary body,

$$F = \frac{MGmr}{D^2V} \tag{1}$$

Where F is the work-done producing radial velocity, M and m are the matter contents of central and planetary bodies (respectively), G is the gravitational constant in 3D space system, r is the radius of planetary body, D is the distance between central and planetary bodies and V is absolute speed of the planetary body across the central body.

Unequal efforts about the centre of gravity, of a free planet, cause its simultaneous radial and spin motions. Work, in the forward hemisphere and equal part of work in the rear hemisphere, together, produce planet's radial motion towards the central body. They act as single set of work (force) through the centre of gravity of the planetary body. Direction of radial motion, at the datum points, is perpendicular to the orbital path. Remaining one-sided effort produces a couple about centre of gravity and causes spin motion of the planetary body.

Total (radial) work, F_g, acting through the centre of gravity,

$$F_g = \frac{5MGmr}{16D^2V} \times 2 = \frac{5MGmr}{8D^2V} \tag{2}$$

This work, of magnitude $5MGmr \div 8D^2V$, acts to produce planet's (radial) motion towards the central body. No body can stay motionless in space. Hence, the factor V is always of positive value.

Remaining (radial) work, F_s, acting about the centre of gravity of the body and producing spin motion of the planet,

$$F_s = \frac{MGmr}{D^2V} - \frac{5MGmr}{8D^2V} = \frac{3MGmr}{8D^2V} \tag{3}$$

{See the article "Planetary Spin"}

Magnitude of the central force and its components, F_g and F_s, also depend on the position of the planetary body in relation to the central body. In the relative position, considered above (for calculations), direction of central force is perpendicular to planet's orbital path. There are points on the orbital path at which the planetary body experiences the central force in the same or opposite direction to the direction of its linear motion along the orbital path. At these points, magnitude of central force will be much higher and magnitude of its spin component will be zero. At all other points in the orbital path, magnitudes of central force and its components will vary, cyclically, as the planetary body moves along its orbital path.

Magnitude of radial velocity:

Central body of a planetary system is very large, compared to a planet. Therefore, it takes some time for the planet to move across the central body, in any tangential direction. During this time they maintain common planes, parallel to the radial direction considered. As long as the common planes are present, they are under apparent gravitational attraction in that radial direction. Apparent gravitational attraction, in any radial direction, begins as soon as the forward part of planet (plane, perpendicular to the direction of linear motion and parallel to the line joining centres of both bodies) comes in line with similar plane in the central body and continues to be present as the planet advances in its orbital path, moving across the central body. Central force in radial direction ceases when the planet has fully crossed the central body in that tangential direction. At the end of this time, all the work invested into the planet's matter field, for the production of its radial velocity in this direction, has been utilized (to change the direction of linear motion and to spin the planetary body) and the planetary body will end its radial motion in this direction. Actions of the central force on the planetary body overlaps for near-by points on the orbital path. Radial displacement of the planetary body towards the central body, at every consecutive instant, is along different directions and it (in any radial direction) stops as soon as work introduced into the body for motion in that particular direction is lost from the body's matter field. Consequently, despite the continuous displacement towards the central body, a planet never reaches any nearer to the central body (disregarding variations required for eccentricity of the orbital path).

Equation (2) gives (radial) total matter field distortions (or work), held in the planet and producing its constant radial motion, u, towards the central body. Unlike in the normal cases, where an external force introduces matter field distortions in a body during its action, the case of planetary system is different. This is because of the constant change in its direction of motion. In any radial direction, magnitude of total matter field-distortion remains constant. That is, there is no natural accelerating stage for the body. The body moves at a constant radial velocity along the radius in consideration (this consideration lasts only for an instant). Accelerating stage, to develop this constant velocity, took place before the body came in the line of direction considered. Kinetic energy of a body, moving at constant speed, $u = mu^2 / 2$. Mass of the planetary body 'm' is constant and its kinetic energy depends on its velocity.

Comparing these two; $$\frac{mu^2}{2} = \frac{5MGmr}{8D^2V}$$

Radial velocity of the planetary body towards the central body, $$u = \sqrt{\frac{5MGr}{4D^2V}} \text{ m/sec} \qquad (4)$$

Although this (radial) velocity appears to be of constant magnitude (disregarding changes in D and V), it is being renewed at every instant. Work is continuously lost and new work of equal magnitude is invested throughout the planetary body's matter field. Continuous loss of work from the matter field keeps the velocity of the body constant despite continuous investment of work onto the matter field. Investment of work into the matter field produces a body's acceleration. Yet, in this case, final velocity is constant irrespective of body's acceleration. This is because of the limitation on body's (matter field's) ability to store more work (in radial direction) than a constant maximum magnitude, due to planetary body's linear motion. Planetary body starts to accelerate at a rate 'a' in its planes towards the central body, when it starts to cross a common plane with the central body. Acceleration in this direction ceases when the whole body has crossed the common planes with the central body in that radial direction. Thereafter it is unable to store more work of this nature. Long before this time, it would have started similar actions in nearby planes also.

Constancy of radial velocity is mentioned only to emphasis that continuous action of central force in any particular direction does not change its radial velocity in that direction. However, depending on the present position of the planetary body in its orbital path, radial velocity of the planetary body varies continuously and cyclically.

Apparent orbital path:

Larger orbital path of a planet (and all bodies in a galaxy) is around the galactic centre. It is very large and contains many points of similar appearance in relation to the central body of a planetary system. Hence, it is convenient for us to use a much smaller structure, the 'apparent orbit', with unique reference points on it for all practical purposes. Apparent orbit is a small part of the larger orbital path, between two identical appearances of the central body, looking from the planet (e.g.: one solar year). It is an imaginary concept, where shape of the path, speed of the planet and directions of motions are manipulated to suit observations. As such, it has no logical basis. It depicts the appearance of a system, where it is assumed that the central body by some imaginary mechanism (change of reference frame) is held stationary at the centre of the apparent orbit and the planet is moved at a (constant) linear speed by an equally imaginary mechanism.

Only cause of actions within a planetary system is the central force, due to apparent gravitational attraction, which accelerates a planet towards the centre of the apparent orbit – the central body. Parameters of this action are mathematically manipulated to produce the required orbital motion around a central body that matches the observations. [In case of earth, such mathematical treatments are also used to establish proofs of validity for “Laws of motion” and “Laws of universal gravitation”]. While doing this, much greater motions of the planetary body before it became a planet and the motion or path of the central body are ignored. An apparent orbit is convenient to predict cyclic features that take place annually. However, taking an apparent orbit as the real motion of a planet is highly illogical and incorrect.

Mathematical treatments of apparent planetary orbit, around a central body, assume the direction of central force on the planet is always (almost) perpendicular to the direction of its linear motion. This is an essential requirement for all laws derived from apparent orbits. In real orbital motion, it is not so. Radial motion of a planet is perpendicular to the orbital path only at datum points situated farthest and nearest to the galactic centre. At all other points on the orbital path, angle between radial motion and orbital path varies as the sine of relative angular position of the planet with respect to the central body and the median path. In circular (elliptical with negligible eccentricity) orbits, the central force does not affect planet’s linear motion at all. It can produce only centripetal acceleration and displacement of the planet towards the central body. Centrifugal displacement by an imaginary centrifugal force is used by us to nullify centripetal displacement of planet towards the central body.

Unlike in an apparent orbit, in case of real (wavy) orbital motion, direction of action of the central force on a planet changes through a full circle, during planet’s passage through two subsequent segments of (a wave of) the orbital path. This behaviour will not sustain mathematical proofs derived from calculations, using parameters of apparent orbit. Central force not only produces centripetal acceleration of a planet towards the central body but also affects its linear speed. Magnitudes of these effects depend on the relative positions of planet and the central body. Since the direction of centripetal acceleration changes through full circles, depending on the relative positions of the bodies, it has its components assisting and opposing planet’s linear motion.

A non-circular apparent orbit has two reference points on it, periapse and apoapse. They are situated diametrically opposite on the apparent orbit. Apoapse is the point on the apparent orbital path, where the planet is considered to be slowest and farthest from the central body and periapse is the point on the apparent orbital path, where the planet is considered to be fastest and nearest to the central body. In real orbital motion of the planet, periapse is a point on its path, where it is nearest to the central body but the planet need not be fastest at this point. And apoapse is the point on its path, where it is farthest from the central body, but the planet need not be slowest at this point. In case of earth, these points are called perihelion and aphelion, respectively.

Although the perihelion(s) are points on the orbital path at which planetary and central bodies approach nearest, highest linear speed of the planet occur at points on the orbital path, farthest from the galactic centre. Similarly, the aphelion(s) are the points, on the orbital path, at which planetary and central bodies’ approach is farthest, lowest linear speed of the planet occur at points on the orbital path, nearest to the galactic centre. While considering the apparent planetary orbits (around static central body), linear speed of the planet is reduced to a small fraction of its real speed in space (that is equal to its speed relative to central body), with corresponding reduction in planet’s kinetic energy. Any action, due to associated kinetic energy on a planet is likely to show up in miniature form.

Figure 3 compares the real path of an orbiting body and its apparent orbit for the duration of one apparent orbital period. Black central line shows central body’s path. Grey, wavy line is the path of the planet. Larger black circle shows the central body and the circles in dotted line show its future

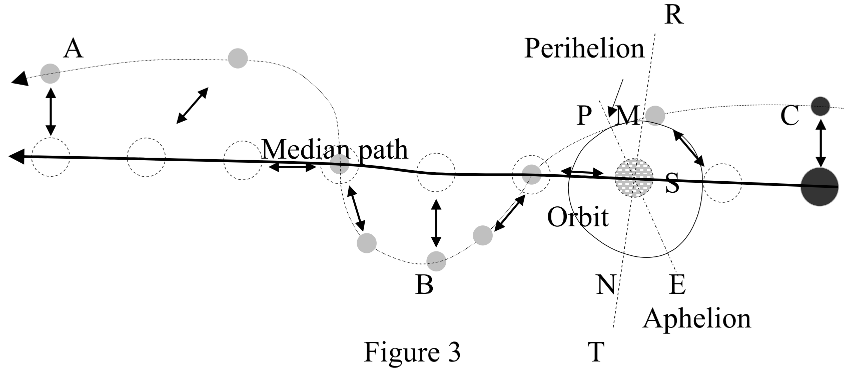

Figure 3

positions. Small black circle shows the orbiting body and the grey circles show its future positions. Double headed arrows show the central force between the bodies at various positions as they move along their paths. As a planet moves, its apparent orbit moves along with the central body.

Apparent orbit of the planetary body, when it is at position P with the central body at S, is shown by the oval in figure 3. Planet's perihelion is at P and aphelion is at E. In real motion, highest and lowest linear speeds of the orbiting body occur, when it is at 90° away from the path of the central body, at M and B, respectively. All parameters of an apparent orbit and the orbiting motion are related to perihelion and aphelion. From its position at C, until B, the orbiting body is in front of the central body and hence it is retarded in its linear motion. From B to A, the orbiting body is behind the central body and hence it is accelerated in its linear motion. Line RST is the radial line connecting the central body to the centre of its curved path (galactic centre). Acceleration and deceleration of the planet change over at points M and B. These points are fixed relative to the path of the central body. Point M, on the outer side of central body's path may be called 'outer datum point' and point B (corresponding to point N on the apparent orbit), on the inner side of central body's path may be called 'inner datum point'. Datum points have only a vague relation to apparent orbit. A circular apparent orbit around a central body represents an ideal orbit about the central body, which may be called 'datum orbit'.

Real orbital path:

In figure 4, P is a planet at a point on its orbital path. XX is the tangent to the orbital path at P. PA is the absolute linear velocity of the planetary body, V, in magnitude and direction. Due to inertia, the planet tends to maintain the direction of its linear motion. Angle between V and the path of the body varies as the body moves in its curved path. Total angular displacement produces body's orbital motion. At any instant, V is deflected away from XX by 'drifting rate', $-\alpha$ (clockwise deflection). Radial motion (velocity) due to the central force is PB = u. Direction of u is towards the central body. Angle between u and the tangent XX, at P is $+\theta$, equal to the angular displacement of the planet in its orbit from a reference point, on the median path X_1 X_1. PP_1 is the resultant motion of the planetary

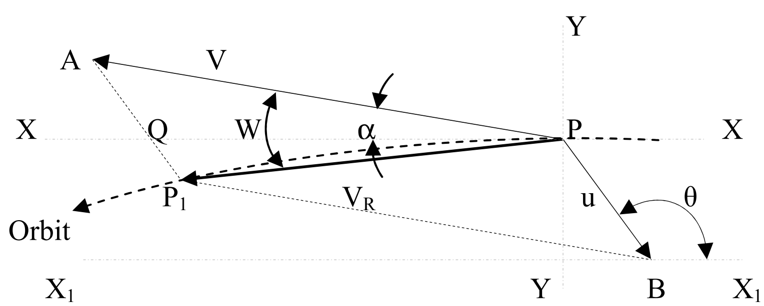

Figure 4

body, V_R, and it makes an angle W with V. Due to the action of the central force (radial motion u), linear motion of the body is deflected from PA to PP_1.

$$\text{Angle between V and } V_R = \angle APP_1 = W,\ \angle QPB = \angle PBX_1 = \theta$$

$$\text{Angle between V and u} = \angle APB = \theta + (-\alpha)$$

$$\tan W = \frac{u\operatorname{Sin}[\theta + (-\alpha)]}{V + u\operatorname{Cos}[\theta + (-\alpha)]} \tag{5}$$

W is the rate of angular deflection between present velocity, V, and resultant velocity, V_R. It may be called the 'deflection rate'. α, the 'drifting rate' is the rate of angular deflection between the present linear velocity, V, and the tangent. In order to make the path curve towards the median path, resultant of W and α should be in the same direction as that of u. Vertical component (to the tangent XX) of present velocity V is a real motion, substituting for the effect of the (presently) imaginary 'centrifugal force'. This part of real motion produces the drifting rate, α.

Figure 5 shows the real orbital paths of inner members of solar system. Planets and the sun, shown in the figure, are not to scale. Eccentricities of orbits are ignored. Relative positions of sun and the planets, shown on the right, are as on 3rd May 2002 [Reference: ESA Website]. Galactic centre is on the lower side and the solar system is depicted as rotating anti-clockwise around the galactic centre. Arrows at the ends of orbital paths show the direction of motion of the sun and the planets. Path of the sun is shown as a straight line and its perturbations, caused by the planets, are not shown in the figure. Curved segments of planetary orbital paths, below the sun's path (on the side towards the galactic centre), appear narrower because of very small scale of distance used in the figure. It can be seen from the figure that the sun and planets move together along a common median path around the galactic centre. Presence of number of bodies in the system causes perturbation to the paths of all members. These perturbations, when observed with respect to any member of the system (which is presumed to be static) gives rise to the apparent orbits of closed geometrical (circular or elliptical) figures around the member, which is assumed to be static. Apparent orbits are shown by the grey lines

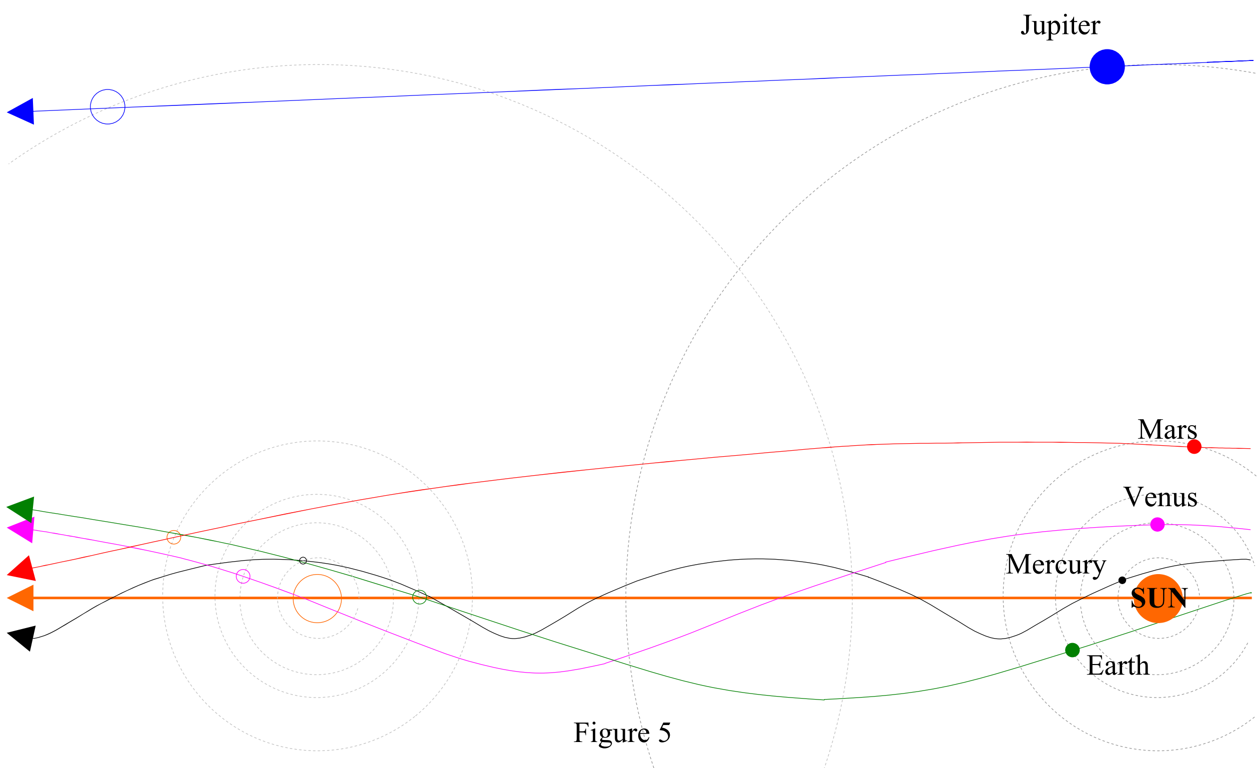

Figure 5

around the sun. Dim set of figures on the left shows the relative positions of the members of the system and their apparent orbits, five months later. Similar apparent orbits and the planetary system can be built about any member of the system. They all are imaginary. Until last days of 16th century A.D., solar system was considered with earth based apparent orbits. Later on; due to popularity of Kepler's planetary laws and Newton's support to the same, the present system of heliocentric apparent orbits for the solar system came into prominence. However, the imaginary nature of these orbital systems continues to be disregarded even after realising the movement of the central body in space.

All bodies in the asteroid belts are planetary bodies with respect to the sun. Their real orbital paths, in the asteroid belt, are similar to planetary orbits about the sun.

Figure 6 shows the real orbital path of moon (a satellite) about the earth. Orange circle shows the sun and the orange arrow shows sun's path as a straight line. Green circle shows the earth and the curved green arrow shows earth's real orbital path for five lunar months. Blue wavy arrow shows the real orbital path of the moon. Black dashed circle around the sun shows the apparent orbit of earth. Black circle in dashed line around the earth shows the apparent orbit of moon around the earth. Lower parts of the real orbital path of the moon about the earth are narrower because of very small scale of distance chosen for the figure. The figure is not according to any particular scale. Relative positions of sun, earth and moon are shown as for full moon days. Dim figures to the left show their relative positions and apparent orbits for subsequent full moon days. Eccentricities of the apparent orbits are not considered. Real orbital paths of all satellites about their corresponding planets are similar.

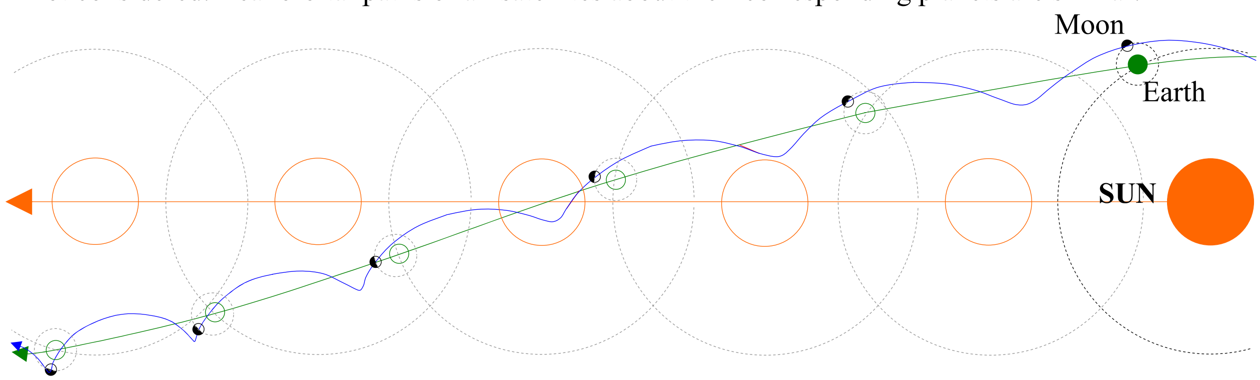

Figure 6

Some planets are found to have many smaller bodies orbiting about them. These, when depicted in their apparent orbits, make picturesque rings about the planets. However, their real orbits are similar to the orbital paths of satellites about the planets. These bodies form a swarm around the planetary body and move along with the planetary body in its motions. Figure 7 shows the real orbital paths of these bodies about the planet. Figures on the right show the relative positions of the bodies and their apparent orbits. Orange circle shows the sun, black circle shows the planet and the coloured circles show three smaller bodies in the ring, situate in the same radial line from the planet. Orange arrow shows the path of the sun in a straight line. Black curved arrow shows the real orbital path of the planet. Coloured curved arrows show the real orbital paths of the smaller particles in the rings. Dim figures on the left show the relative positions of the bodies and their apparent orbits after lapse of certain time.

Planetary bodies have lower rates of angular displacements with respect to their central bodies as their distance from the central body increases. Their orbital paths cross each other at different places in space. Due to their different angular speeds, there is a possibility for any two planets in a planetary system (or for any two satellites of a planet) to come very near to each other. At certain point of time in future, it is possible for any two planets in a planetary system (or for any two satellites of a planet)

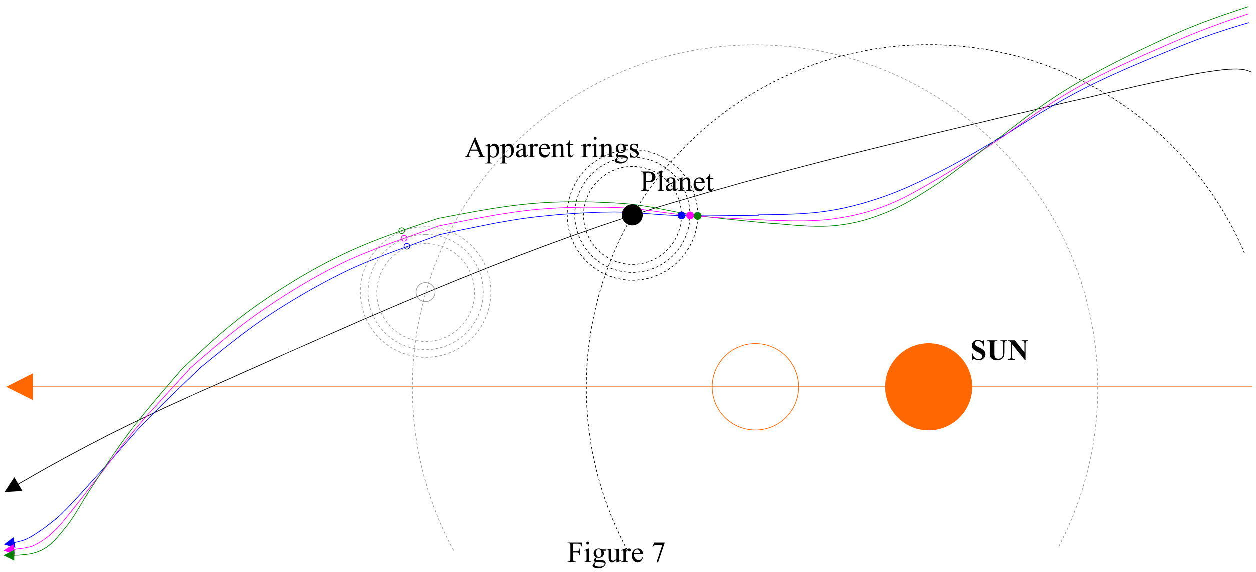

Figure 7

to collide into each other and destroy. In case of smaller bodies, forming rings about a planet, they have identical angular speed with respect to their parent body. This prevents them from colliding into each other during their motion along with their central body.

This swarm of smaller bodies about a planet also obey all rules of planetary motions. Only those smaller bodies in the swarm, which are in (or very nearly in) the orbital plane of the planetary system can survive in the rings, as explained later in this article. All bodies, which do not conform to the planetary laws, will be automatically removed from the system by mutual collisions or rejections. Hence, the apparent rings about a planetary body are very thin and around planet's equator. Although, they are depicted as rotating around the planet, they also move along with the planet in its linear motion as shown by the coloured curved lines in the figure 7. Since their angular speed is the same, linear speeds of these bodies increase as the distance from the planet increases (within the escape velocity corresponding to the planet). Due to centrifugal action, caused by their angular speeds, larger (by matter content) bodies tend to distribute farther from the planetary body and smaller (by matter content) bodies remain near to the planet's surface..

Circular orbit:

For motion in a circular path, $V_R = V$. That is, at any instant, the resultant linear speed of the body in its curved path is equal to its present speed. In a circular orbit, W is constant. There is no angular acceleration. Hence, the drifting rate remains constant and equal to $-\alpha$ all around the path. If a negative drifting rate $(-\alpha)$ can be maintained constant by external means or by natural process, the resultant linear motion of the body along its curved path deflects at a constant rate and its magnitude remains a constant equal to its present (instantaneous) linear speed.

In figure 8; V is the present (absolute linear) speed, deflected from the tangent XX at P on the circular path by an angle $(-\alpha)$, u is the radial motion perpendicular to the tangent. $PP_1 = V_R$, is the resultant motion of the body, deflected from V by an angle W.

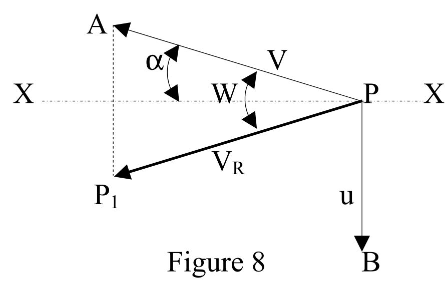

Figure 8

$$\angle APB = \tfrac{\pi}{2} + (-\alpha)$$

$$V_R^{\,2} = V^2 + u^2 + 2VuCos\left[\tfrac{\pi}{2} + (-\alpha)\right],$$

$$V_R^{\,2} = V^2 + u^2 - 2VuSin(-\alpha)$$

For motion in a circular path; $V_R = V$, Putting V in place of V_R,

$$V^2 = V^2 + u^2 - 2VuSin(-\alpha),\ u^2 = 2VuSin(-\alpha),$$

$$u = 2VSin(-\alpha) \tag{6}$$

$$Sin(-\alpha) = \frac{u}{2V} \text{ or } (-\alpha) = Sin^{-1}\frac{u}{2V} \text{ radians} \tag{7}$$

In case of circular orbits, direction of radial displacement is perpendicular to the tangent at the point on the orbital path. Hence angle Θ in equation (5) is equal to π/2.

Putting the value of 'u' from equation (6) and Θ is equal to π/2 in equation (5),

$$tanW = \frac{2VSin(-\alpha)Cos(-\alpha)}{V - 2VSin(-\alpha)Sin(-\alpha)} = \frac{-2VSin\alpha \times Cos\alpha}{V - 2VSin^2\alpha} = \frac{-Sin2\alpha}{1 - 2Sin^2\alpha} = \frac{-Sin2\alpha}{Cos2\alpha}$$

$$\text{Deflection rate, } W = tan^{-1}\frac{-Sin2\alpha}{Cos2\alpha} = tan^{-1}(-tan2\alpha) = -2\alpha \tag{8}$$

$$\text{Putting value of } \alpha \text{ from equation (7), } W = -2\alpha = 2Sin^{-1}\frac{u}{2V},\ Sin\tfrac{W}{2} = u \div 2V \tag{9}$$

For a circular orbit, where direction of W is positive:

$$\text{Drifting rate, } \alpha = W \div 2 \quad \text{in negative direction.} \tag{10}$$

This is the condition, required for a circular orbital path around a central body or circular parts of other orbital paths. Resultant linear speed of a planet along the curved path (at points exhibiting circular nature) remains a constant, equal to its present (instantaneous) linear speed. Angular speed of the planet (deflection rate) is equal to twice the drifting rate (in opposite angular direction) and it is a constant. Drifting rate of a planet, required to achieve a circular orbit (in this case) is less than the angle of contingence at the point of initial entry on the datum orbit (clockwise from the tangent at P) and it is precisely equal to half the rate of deflection rate produced by the central force at that distance. Hence, the body is required to initially approach the entry point P from within the datum orbit. These conditions can be met only in cases, where the orbit is formed around a static central body. All bodies in nature, except stable galaxies, are under continuous motion. Hence, formation of a real circular orbit around a (moving) central body is impossible.

All natural planetary bodies are much smaller than their central bodies and they approach their orbits from outside their datum orbits. In real orbital motion, a planet traces segments of curved paths on either sides of its median path. A circular orbital path requires semi-circular paths on either sides of median path. Due to constantly changing relative direction of central force, it is also impossible to maintain constant angular speed by a planet about a moving central body. Consequently, natural planetary bodies cannot have circular orbits around their central bodies.

Exceptions to the above are probable cases of binary systems with linear motion perpendicular to their plane or other planetary systems formed by explosion of a static parent body, where the planets are thrown away from a static central body to enter their orbits from within. Circular orbit is a critical condition. Parameters of a body (maintained in a circular orbit by external means) are very precise. Once in the orbit, the drifting rate can be easily changed by external factors. Changes in the masses of the planetary and central bodies or their speeds due to external influence are bound to affect the stability of a circular orbit due to changes in the drifting rate. Collision with debris in space or even uneven distribution of mass of the bodies can influence the state of a circular orbit. It should also be noted that no bodies, smaller than a galaxy, can remain static in space.

To form a circular apparent orbit, parameters of a planet should satisfy the equation (9),

$W = 2\sin^{-1}(u \div 2V)$ at every point on its orbital path. All factors in the equation remain constants. Apparent circular orbit is the smallest apparent orbit of a planetary body. It is the 'datum orbit' of the body for its present parameters. This equation is also applicable to circular parts of non-circular orbits. Every stable orbital path has two points on it, for every completed cycle, which corresponds to (above mentioned) requirements for circular orbital paths.

Elliptical Orbit:

Variations in parameters of an orbiting body change its datum orbit. Consequently, even if a body was in an apparent circular orbit, its datum orbit will change on variation of any parameter. Such a change or a difference in the drifting rate changes the shape of the orbital path. Non-circular apparent orbits are based on the datum orbit of the body. A deformed datum orbit becomes non-circular apparent orbit of the body. Deformation of the datum orbit is with respect to two points (mid-points), which are on diametrically opposite sides on the apparent orbit. Either forward or rearward part of non-circular apparent orbit is placed within and the other part is placed outside the datum orbit.

Since a planet moves in a non-circular path, tangent to a point on the orbit is not perpendicular to the radius of the orbital path (along which the central force is acting). But, there are two points that lie on the orbital path (for every completed cycle), at which the conditions required for circular orbits are satisfied. At these points, direction of radial motion of the planetary body is perpendicular to the tangent at the orbital path and direction of change in the length of apparent orbit's radius reverses. If the radius was increasing before, after crossing this point, it will gradually decrease till the body reaches a similar point on the diametrically opposite side of the apparent orbit. At this point, direction of change in the distance between the bodies reverses and the radius gradually increases till the body reaches the original point on the apparent orbit. Periodic changes in the length of radius of the apparent orbit about a mean value sustain the stable orbital path. Points, where these reversals occur are the perihelion and aphelion at which the bodies are nearest or farthest from each other. Other reference points are outer and inner datum points, where the planetary body attains highest and lowest linear speeds, respectively.

In case of real motion, an orbital path is not around the central body but it oscillates about a common median path, shared by the central body. Angular speed of an orbiting body does not correspond to circular or elliptical paths. Deflection rate of orbital path from the median path is limited, alternating on both sides; where as, a total deflection of 2π radians in the same direction is required for every apparent orbit. Linear motion of the planet is accelerated up to the outer datum point, when the planet moves to the front of the central body or it is decelerated up to the inner datum point, where the planetary body falls behind the central body. Highest and lowest speeds of the planet occur at these datum points. They need not coincide with either perihelion or aphelion of the apparent orbit, assumed above. Datum points of orbital path are situated on radial lines of the galactic radius (line perpendicular to the median path) and passing through both the central and planetary bodies, at datum points. Points of perihelion or aphelion indicate the points, on the path of the planet, which are nearest and farthest from the central body. They have no other relations to the motions of the orbiting body. Perihelion and aphelion of an orbit may be displaced along the orbital path without affecting other parameters (except planetary spin speed) of orbital motion. But the points, at which the acceleration / deceleration change-over takes place, are fixed with respect to the median path of the central body and depend on the relative position of the planetary body to the central body.

Part A, in figure 9, shows the planetary motion at the perihelion of an orbit and part B, in figure 9, shows the planetary motion in the same orbit at its aphelion. V is the present speed, 'u' is the radial speed and V_R is the resultant speed of the body. Drifting rates are equal to $-\alpha$. W is the deflection rate of the resultant motion. Changes due to the angular acceleration/deceleration add to the drifting and deflection rates. Motions of the planetary body at perihelion and aphelion (of its non-circular orbital path) exhibit properties of circular orbit. Angles between ‘u’ and tangents at perihelion and aphelion are 90° each.

Putting drifting rate, $-\alpha = W/2$ and $\theta = \pi/2$ in equation (5);

$$\tan W = \frac{u\mathrm{Cos}\frac{W}{2}}{V - u\mathrm{Sin}\frac{W}{2}} \tag{11}$$

$$V\,\mathrm{Sin}W - u\,\mathrm{Sin}W\,\mathrm{Sin}\tfrac{W}{2} - u\,\mathrm{Cos}W\,\mathrm{Cos}\tfrac{W}{2} = 0,$$

$$V\,\mathrm{Sin}W - u\,\mathrm{Cos}\left(W - \tfrac{W}{2}\right) = 0,\; 2V\,\mathrm{Sin}\tfrac{W}{2}\mathrm{Cos}\tfrac{W}{2} - u\,\mathrm{Cos}\tfrac{W}{2} = 0,$$

$$2V\,\mathrm{Sin}\tfrac{W}{2} - u = 0,\; \mathrm{Sin}\tfrac{W}{2} = u \div 2V,\; W = 2\mathrm{Sin}^{-1}\frac{u}{2V} \tag{12}$$

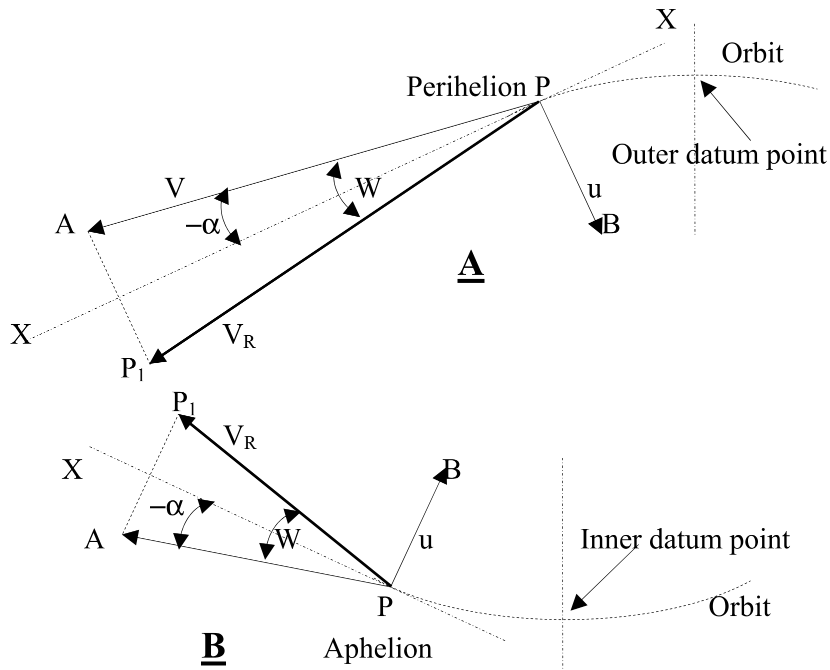

Figure 9

This is same as equation (9) obtained for a circular orbit. Since the curvature of the path varies continuously, this circular behaviour lasts only for an instant. As soon as the points of perihelion or aphelion are passed, planetary body will revert to pursue its non-circular path. Drifting rate at perihelion, α_{peri}, is half of deflection rate, W_{peri}, and at aphelion; drifting rate, α_{aphe}, is half of deflection rate, W_{aphe}, in magnitudes. As shown in figure 9 A & B, directions of drifting rates with respect to radial motion are always the same. Included angle between u and direction of approach are of the same sense. In a non-circular orbit; equation (5) gives the deflection rate. Equation (9) for circular orbit is applicable to a non-circular orbit at its perihelion and aphelion, where circular orbital-conditions exist.

Putting value of u from equation (4) in equation (12);

$$\text{At perihelion or aphelion, deflection rate, } W = 2\mathrm{Sin}^{-1}\frac{\sqrt{\frac{5MGr}{4D^2V}}}{2V} = 2\mathrm{Sin}^{-1}\sqrt{\frac{5MGr}{16D^2V^3}} \tag{13}$$

Deflection rate, ‘W’ for perihelion and ‘W’ for aphelion are in opposite directions. If the planetary body has entered its datum orbit from within (with negative drifting rate), it will move towards its aphelion, where conditions of circular orbit takes place. Similar conditions (as required for circular orbit) should also repeat at a point in the orbital path 180° (in apparent orbit) away from the perihelion/aphelion, as the case may be. A stable orbit can be formed only if these conditions are met. At perihelion, direction of change in the distance between the planetary and central bodies reverses. The planetary body moves towards its aphelion, where condition for circular orbit is fulfilled once again. At mid-points between perihelion and aphelion, W becomes equal to $-\alpha$. Resultant angular speed of the body becomes zero. For an instant, planetary body moves in a straight line. Direction of linear motion of the planetary body is tangential to the orbital path at these points but direction of radial motion is not perpendicular to the tangent. Therefore, conditions for circular orbit are not fulfilled. Tangents at these points are not parallel to the major axis of the apparent orbit. In an elliptical path, tangents at the ends its minor axis are parallel to major axis. In this case, they are not so. Hence, apparent orbital path of a planet is oval (with its narrower end towards the aphelion) rather than an ellipse. However, due to very small eccentricity of the apparent orbits, we come across in nature; they are usually considered as elliptical or circular. Present planetary laws are formed for (the imaginary) elliptical apparent orbits.

After the mid-point, angular difference between the radial and linear motions diminishes. When the planetary body has moved from this point by an angular displacement equal to the deflection of perihelion/aphelion from the datum points, linear and radial motions of the planetary body become co-linear. At this point, there are no deflection rates of the body due to central force. However, the body continues to move in its curved orbital path under the influence of drifting rate, which continues to decrease in magnitude. Once this point is passed, direction of angular difference between linear and radial motion reverses. Deflection rate, W, and drifting rate, α, both are in the same direction for a short while until α changes its sense of direction. The planetary body will angularly accelerate till it reaches another point, where conditions for circular-orbital motion are fulfilled, where W and α are in opposite directions and magnitude of W is twice that of α. This is the aphelion of the orbit. Thereafter, similar processes continue to sustain stable orbital motion of the planetary body.

$$\text{Resultant orbital angular speed at perihelion} = = W_{peri} - \alpha_{peri} = \omega_{peri}$$

$$\text{Resultant orbital angular speed at mid-point} = = W_{mid} - \alpha_{mid} = 0$$

$$\text{Resultant orbital angular speed at aphelion} = = W_{aphe} - \alpha_{aphe} = \omega_{aphe}$$

$$\text{Time to move from perihelion to aphelion} = T \div 2\,, \qquad \text{Where, T is orbital time period.}$$

Resultant orbital angular speed decreases from ω_{peri} at the perihelion to zero at mid-point, increases from zero at mid-point to ω_{aphe} at aphelion, decreases from ω_{aphe} at the aphelion to zero at mid-point and increases from zero at mid-point to ω_{peri} at perihelion.

Taking variation in the angular speed to be uniform;

$$\text{Total difference between angular speeds at perihelion and at aphelion} \quad = \omega_{peri} + \omega_{aphe}$$

$$\text{Orbital angular acceleration / deceleration} \; = \left(\omega_{peri} + \omega_{aphe}\right) \div \tfrac{T}{2} \qquad (14)$$

Location of ‘perihelion’ or ‘aphelion’ on an orbital path depends on the location of point of entry of the planetary body on the datum orbit and its drifting rate at the time of entry. For the appropriate drifting rate, the point of entry can be the perihelion or aphelion of the orbital path. Location of perihelion/aphelion can shift along the orbital path later due to external influences; whereas, datum points of the orbital path remain at their relative positions with respect to central body.

Limits of angular speeds at the point of entry:

Orbital path of a planetary body is a path in space, whose parameters are related to the central body. It is improbable for planets to be born in their orbits. They have to come to their orbits from space, away from orbital path. For a smooth transition from their motion outside the orbit into the orbital path, all their parameters of motion at the point of entry should be same, as if they were moving in the orbital path at that point. Central force is active on planetary bodies even when they are very far from orbital path. Hence, parameters of planetary bodies' motions are modified continuously, even before they enter their orbital paths. A planetary body enters its orbit in near-tangential direction subject to the following limits. Bodies, approaching the point of entry into datum orbit, outside certain limits of their angular speeds, are unable to form stable orbits. As the magnitude of drifting rate, α, approaches a limit in negative (clockwise) direction, deflection rate, W, becomes insufficient to overcome the drifting rate and the direction of the resultant motion, V_R, becomes parallel to the tangent. Such a body is not able to form an orbit.

When V_R is along the tangent; $\frac{u}{V} = -\text{Sin}\alpha$, $-\alpha = \text{Sin}^{-1}\frac{u}{V}$

This is the lower limit of drifting rate at the point of entry (from within the datum orbit) for bodies, which may form successful orbits about a central body. Bodies, approaching the datum orbit from within, with higher (negative) drifting rate than this value will fly away from the central body.

Equation (7), $-\alpha = \text{Sin}^{-1}\frac{u}{V}$ gives the condition required for an orbiting body to have perihelion and aphelion in its orbit. This equation should be satisfied two times in every completed apparent orbit. If the body is entering its datum orbit from outside, by the time it reaches its perihelion, drifting rate of the body attains a value of $\alpha = \text{Sin}^{-1}\frac{u}{2V}$. As long as this value is not reached, the body will continue to move towards the perihelion. That is, distance between the central and orbiting bodies continues to reduce. If the drifting rate exceeds $\alpha = \text{Sin}^{-1}\frac{u}{2V}$, the orbiting body will move towards the central body at a higher rate and spiral down into it, without ever attaining the condition required for perihelion. Even if the orbiting body is to enter the datum orbit at the point of perihelion, its drifting rate should not exceed this limit. Thus, $\alpha = \text{Sin}^{-1}\frac{u}{2V}$ is the outer limit of drifting rate during entry (for a body entering the datum orbit from outside) for a successful orbit.

Considering the above limits together, to form a stable orbital motion about a central body, a planet has to enter its datum orbit with drifting rate between $\text{Sin}^{-1}(u \div 2V)$ and $-\text{Sin}^{-1}(u \div 2V)$ at the point of entry. Limit between $-\text{Sin}^{-1}(u \div 2V)$ and zero is for those bodies approaching from inside the datum orbit. Bodies with drifting rate between $-\text{Sin}^{-1}(u \div V)$ and $-\text{Sin}^{-1}(u \div 2V)$ will have their aphelion in front of the entry point. When the drifting rate is equal to the critical value of $-\text{Sin}^{-1}(u \div 2V)$, the planetary body will trace semi-circular orbits or either sides of the median path. Bodies with drifting rates between $-\text{Sin}^{-1}(u \div 2V)$ and $\text{Sin}^{-1}(u \div 2V)$ have their perihelion in front of their point of entry. Limits between zero and $\text{Sin}^{-1}(u \div 2V)$ are for those bodies approaching from outside the datum orbit. From the point of entry they can move only towards their perihelion. These stringent restrictions, in conjunction with restrictions on the magnitude of angle of entry (direction of approach as explained in the next sub-section on 'Orbits about a moving central body'), considerably lowers the number of bodies, those are able to form stable orbits and prevents profusion of planetary bodies about a central body.

Curvature of orbital path and the tangential speed of a planetary body depend on its location on the orbital path. Centre of curvature at any point on the orbit is the focus of the orbital path. In real-motion, centre of curvatures for orbital motion on either side of median path, lie on the opposite sides of the median path. Curvature is zero at mid-points and increases as the body moves towards the aphelion or perihelion. However, while considering the apparent orbit, the curved path is assumed to close-in on itself to provide circular/elliptical nature, by assuming the central body in a static state and arbitrarily reversing the direction of one half of wavy orbital motion. This is accomplished by the change of reference to a convenient frame from the real (absolute) reference frame. By doing so, each planetary orbit is made to appear as a closed geometrical figure around the central body.

Apparent angular motion of a planet:

While a planet is performing its orbital motion about the central body, it is also orbiting around the centre of central body's orbital centre (galactic centre). Consider a planetary system as a single unit (of revolving bodies about a central body) that is orbiting the galactic centre. Galaxies are spinning bodies but they have no orbital motion about any other body. They are static in space other than for small movements during their stabilization. By the time the central body completes an orbit around the galactic centre, every planet in the unit apparently loses one apparent orbit each, about the central body. This provides an apparent loss of orbital motion to the planet. A planet apparently loses part of its orbital motion at a constant rate.

Orbits about a moving central body:

It is unlikely that bodies of considerable sizes move away from a central body to enter into orbital path about it. All larger bodies, planets, have to come from outside the planetary system. Planets may enter into their orbits in any direction around a static central body. However, if the central body is moving (as is the case with all free bodies in universe), directions of approach of the planets are restricted. Following description is about planetary bodies approaching the central body from outside of their datum orbits. To make the explanation simpler, an apparent orbit is used to describe the actions.

All large bodies move at very high speed. (It is estimated that the sun moves in a circular path around the galactic centre at a relative speed of about 250000 m/sec, much greater than the relative speed of earth with respect to the sun, which is about 30000 m/sec, in its orbit). Relative speed between the central body and a planet trying to enter into an orbit depends on the relative directions of their motions.

Planetary bodies, approaching in opposite direction to the motion of the central body will find the interaction due to central force enhancing their present speed. Relative speed of the bodies will become too large for them to form a planetary system. Consequently, no planet that is approaching the central body in a direction opposite to the direction to its own motion can enter into a successful orbit. Similarly, bodies approaching from the sides (all around) will be left far behind the central body. Such bodies have very little or no motion in the direction of motion of the central body. Hence, their relative speed is too large. They cannot have stable orbits. In order to enter into a successful orbit, a body has to approach the central body from the rear and nearly in its orbital plane. During such an approach, relative speeds of the planetary bodies with respect to the central body's absolute speed will be only a small fraction. Relative speed of the approaching body is with respect to the absolute speed of the central body.

A central body usually has a curved path as shown by line NOM in figure 10, where the direction of approach is shown with respect to an apparent orbit. A planetary body, approaching its datum orbit from the inner side of this curved path, will find that it has an additional relative motion away from the galactic centre. This is produced by the curvature of central body's path. Planetary body's drifting rate is enhanced by the curvature of central body's path. Additional relative motion will also enhance the radial motion produced by the central force. These factors prevent a body, approaching from the concave side of the central body's path to enter into an orbit (about the central body that itself is moving in a curved path).

Above factors leave only a small window, shown by APEC in figure 10 (width of the window shown in the figure is highly exaggerated), through which a planet may enter into successful orbit about a central body. This window is on the outer (convex) side of curved path and to the rear of the central body. It is somewhat conical in shape, with its apex towards the outer datum point. Girth of the cone restricts entry to the bodies, whose orbital plane can be gradually stabilized into central body's orbital plane. All planets, entering into successful orbit, enter through this window, which is further restricted by the limits of drifting rate. Therefore, there are no planets orbiting in opposite direction to central body's own orbital direction or having its orbital plane too far from central body's orbital plane. Direction of apparent orbital motion of a planet is the same as the direction of central body's orbital motion about the galactic centre. Thus, all orbiting bodies in a planetary (or galactic) system move in the same angular direction and in planes not much different from central body's orbital plane.

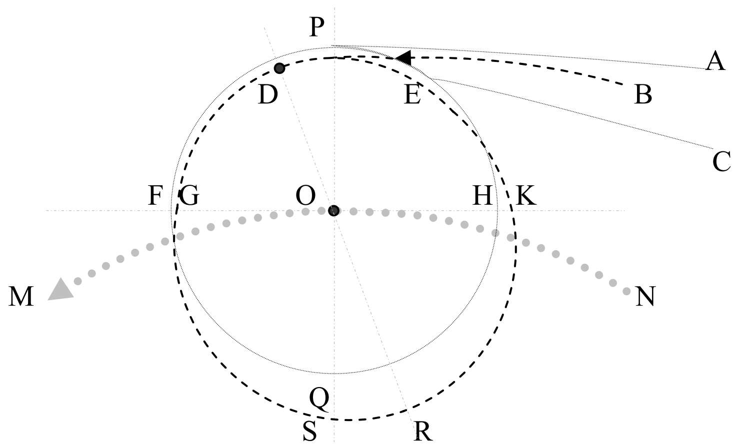

Figure 10

As shown in figure 10, O is the centre of apparent orbit. Black circle at O is the central body and the black circle at D is the planet at its perihelion. PFQH is the datum orbit corresponding to body's parameters. P and S are the datum points, where highest and least linear speeds of the orbiting body occur. Orbiting body may enter into the datum orbit anywhere through the conical window shown by the region between A and C. Position of perihelion of the orbit, D, depends on the point of initial entry, E, and the drifting rate. Greater the drifting rate, farther from the point of entry is the perihelion.

Only those planetary bodies, whose drifting rate at the time of their entry into orbital path, are within the limits $\mathrm{Sin}^{-1}(u \div 2V) < \alpha < -\mathrm{Sin}^{-1}(u \div 2V)$ and whose direction of entry is through the permitted window can enter into a stable orbit about a central body that is itself moving in a curved path. Changes in the mass or speed of an orbiting body may change the size of its orbit, not its eccentricity and angular position. In order to change the eccentricity or angular position of an orbit, an external force has to be applied on the orbiting body to deflect it from its present course and change the deflection rate of V by an effective change to the drifting rate, while in the orbit.

Figure 11 shows the entry zone for planets on their real orbital path. KDRK is the orbital path and APC shows the entry zone. This may be compared with figure 10. Entry window is from the rear and on the outer side of the median path. This arrangement ensures that all planets of a planetary system move in the same direction along with the central body, giving rise to similar angular direction of rotation to all apparent orbits of a planetary system.

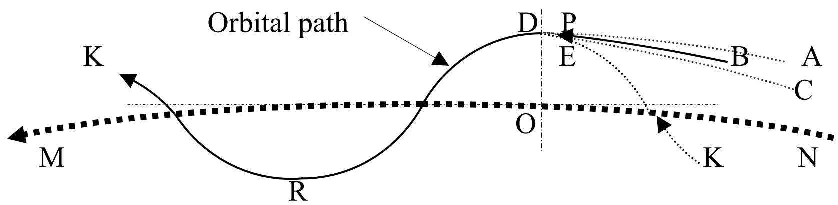

Figure 11

Unlike planets, comets have very large and highly eccentric apparent orbits. Their periapse occur within central body's path and highest absolute orbital speed occurs nearer to their apoapse. Hence, it may be deduced that they enter their orbit from within their datum orbit.

Anomalies:

Since an eliptical apparent orbit is an imaginary entity, it can neither execute an action nor an external effort can act on it. It is a small part of planet's large orbital path around galactic centre. It is not a completed geometrical figure. Hence it cannot rotate or precess.

The phenomenon, by which perihelion of elliptical apparent orbital path of a planet appears to rotate around a central body, is known as its precession. Since precession of mercury's orbital path is much greater, compared to that of other planets, it has attracted much attention. This perturbation is attributed to various reasons. Classical physics lists precession of the equinoxes, gravitational pulls from other planets, presence of dust/particles in space between sun and mercury and unevenness of the Sun's spherical body as reasons. But results of calculations by classical physics gave the magnitude of precession shorter by about 43 seconds of arc per century from the observed magnitude. Neither Kepler's laws nor Newton's laws could satisfactorily explain this discrepancy. Later, 'general theory of relativity' was able to account for this discrepancy, by attributing it to the curvature of space around the sun. This fact is usually taken as a veritable proof of relativity theory's accuracy. It helped the relativity theory's adoption as a superior theory.

In all explanations of the phenomenon of precession of perihelion of an orbital path, it is taken that the shape of mercury's orbital path is elliptical around the sun. Without planet's elliptical orbital path, the above phenomenon would not exist. What we observe is the appearance of planet's location in its orbital path in relation to us. With respect to us, on earth, all other celestial bodies (including the sun) orbit around the earth. Observed planetary orbital paths are then manipulated to give us a planetary system about the most prominent body in the system – the sun. Sun, being the most prominent body in the solar system, we are magnanimous enough to assign it the status of a reference body. Since the sun is taken as a reference body, it is assumed to be static in space and all planetary bodies are assumed to orbit around the static sun in circular/elliptical planetary orbital paths. Thus, we came to regard the sun as the central body and all planets as orbiting around the sun. For this to be true, the sun has to remain static, in space.

It is a true fact that there is no circular/elliptical planetary orbital path in space (except the large orbital path around the galactic centre). Assumed circular/elliptical planetary orbital path are mere appearances and hence they are imaginary figures. They exist only in observer's mind and in mathematical treatments. Physical actions can take place only on real entities, not on apparent or imaginary non-entities. Elliptical planetary orbital paths, being imaginary non-entities, they cannot take part in any physical action like rotation or precession. Hence, precession of mercury's (or any other planet's) perihelion is only a myth. No amount of calculations or varieties of theories can make it a real fact. Theories, mentioned above, and calculations based on them are explaining a non-existent phenomenon. They are vain exercises to satisfy our curiosity about imaginary situations. Such calculations, even if it is using advanced mathematics cannot make a theory true or superior.

However, we do observe certain discrepancy during the observations of planetary orbital paths. These have to be analyzed and explained with respect to planet's real motions and its wavy path in space; not on imaginary motions or elliptical paths. What happens to cause the observed precession of planetary orbit is that the point of closest approach (between sun and the planet) on the planet's wavy path shifts along the orbital path for subsequent-alternate segments. This is mainly caused by the curvature of central body's path and eccentricity of orbital segments. There is no shift or rotation of orbital path. Orbital path remains steady in space. It is only the point on the orbital path, at which the distance between the planet and the sun is a minimum, is shifted along the orbital path.

Precession due to eccentricity:

If there is a large difference in the masses of the central body and a planetary body, orbiting in highly eccentric orbit, difference between the linear speeds of the orbiting body during its acceleration stage (when the planet is behind the central body) and decelerating stage (when the planet is in front of the central body) is considerable (action of an external effort on a macro body depends on the linear speed of the body [1]). This speed difference influence central force's actions. Such actions can apparently rotate (precess) an apparent orbit without changing its shape or size. Rotation of apparent orbit means forward or rearward shifting of real orbital path in relation to central body.

In real motions, both the central and the planetary bodies move about a median path. Perturbations of planet's path are more apparent and it appears to be its orbital motion. While the planet moves along with the central body, it is in front of the central body for half the orbital period (during its motion from outer datum point to inner datum point) and it is behind the central body for the next half the orbital period (during its motion from inner datum point to outer datum point). When the planet is in front, the central force acts to decelerate the planetary body and when it is behind, the central force tends to accelerate the planetary body. (Actions on the central body are of opposite nature). Inertial actions are slower and hence less effective in the direction of motion of a body. Hence, it takes longer for the planetary body to traverse the path from inner datum point to outer datum point compared to the other half. Longer time period causes larger radial displacement of the planetary body, taking it nearer to the median path. Planetary body's perpendicular distance from median path during this period becomes shorter than its distance in opposite direction during the next half of the orbit. This difference provides a resultant displacement of the orbital path towards the centre of central body's path. The planetary body, in its path is brought nearer to the centre of central body's path (galactic centre).

In an apparent oval orbit, there is only one point that is nearest to the focus. This point is the perihelion. If the apparent orbital path is displaced, such that another point in the apparent orbit comes nearest to the focus, it is as if the perihelion of the apparent orbit has shifted to the new point. As different points on the apparent orbit come nearest to the central body on successive orbits, perihelion of the orbit shifts along the apparent orbit and the apparent orbit of the body appears to rotate about the central body, in space. This precession is an illusion provided by displacement of 'point of nearest approach' of the bodies. In reality, no changes take place in the relative motions of the orbiting bodies, except that the point in space at which these bodies come nearest shifts along the perturbed paths. Magnitudes of the perturbations or their time periods are not affected.

If the orbital motion is considered with respect to the planet (central body, orbiting the planet), orbit of the central body will appear to precess in opposite direction. Apparent orbits of all planetary bodies with highly eccentric orbits have appreciable precession about their central bodies. In case of a central body, having two or more such planetary bodies in the apparent orbits around it, the central body has different rates of precessions simultaneously, a different rate of precession with respect to each of the planet. If the precession is linked to real motion of the body this is an impossible situation. Direction of this precession is the same as the direction of motion of planet in its orbit.

Precession due to curvature of central body's path:

Orbital paths are formed in space. Central body moves in a curved path. Consequently, as the central body moves in its curved path, the median path of the planet is required follow this curved path. Due to their relative motion (caused by the curvature of central body's path) and the inertia of the planetary body, median path of the planet tends to move outward from the centre of central body's path and with respect to the median path of the central body. (For the time being, we may neglect the effect of remaining bodies of the galaxy on the planetary body). Median path of the planet tries to be straight, while central body's path curves. A shift in the median path of the planet introduces corresponding shift in the central body's path also. Consequently, the planet is on the concave side of the median path for shorter time compared to its existence on the convex side of the median path. Additional radial displacement in perpendicular direction, provided by the central force, brings the median path back to its original state. By doing so, the median path of the planet is shifted towards the centre of the central body's path (galactic centre). Shifting of the median path also shifts the 'point of their closest approach' in opposite direction, away from the galactic centre. This relative motion creates another type of apparent precession of the orbit. Direction of this precession is in a direction opposite to the orbital motion of the planet. This precession is an illusion provided by relative inward displacement of median path of the planet with respect to the central body's path (caused by the curvature of its path).

Two types of precessions, mentioned above, are in opposite directions. In cases of apparent orbits with low eccentricity, they, more or less neutralize each other. No resultant precession may be noticed over extended periods. In cases of apparent orbits with higher eccentricity, precession caused by the orbital eccentricity may be large enough to produce observable resultant precession of the apparent orbit in forward direction. If the eccentricity of the apparent orbit approaches zero, precession caused by the curvature of central body's curved path may become apparent over extended period as a rotation of the apparent orbit in rearward direction.

Perturbations caused by collisions:

Wandering free bodies in open space may fall into the planetary bodies or into the central body during their attempt to form orbits around either of the bodies. A foreign body, falling on these bodies, brings-in additional matter content and work associated with it. Such additions are likely to modify orbital parameters of the bodies. Over extended period, in space, such modifications of orbital properties are very probable. Orbital motions of planetary bodies are also influenced by nearby bodies. These changes may be either temporary or permanent. An accurate picture of orbital motion can be developed only when all other bodies in space and their effects on the orbiting body are considered.

Electronic orbits:

From the largest of stars to the smallest of fundamental particles, if a body has to orbit about another, it has to do so under the same principle and such orbital motions should obey the same physical laws. Any free matter body with sufficiently large linear speed may orbit about a moving central body of (comparatively) appreciable matter content (mass). At first glance, it may appear that the topic of electronic orbital motion is inappropriate in this article. Reader may be rest assured that it is not so. Details on the mechanism of orbital motions of electrons in the atoms, about their nuclei, may be found in the reference book [1].

Electrons are matter bodies with definite physical structures. In their stable orbital motion, central force (provided by apparent gravitational attraction) is the only effort between them and the nuclei to which they are attached. Electrons, in the atoms, keep their attachments with the nuclei under the central force, provided by apparent gravitational attraction. Orbits of atomic-electrons are located in a region, where the electromagnetic or nuclear efforts have no effects. {Various natural forces are different manifestations of only one type of effort in nature. It is the nature of action of an effort that makes its class. [1]. Hence, we may say that the gravitational nature of effort is prominent and nuclear and electromagnetic nature of effort is absent about an electron in stable orbital path about its nucleus}. During unstable periods, electromagnetic efforts develop between nucleus and electrons to stabilize electrons' orbital motion. These stabilizing efforts determine the size, angular and linear speeds of electrons, eccentricity and location of electronic orbital paths. It is the orbital motion, (in addition to the repulsive electric field efforts during unstable periods), which prevents an electron from spiralling down into atom's nucleus or flying away from it.

Since the electrons are too small and curved paths of their central bodies are within the electronic orbits, electronic orbits in stationery atoms appear to be real orbital motion around a central body. An electronic orbit is the nearest, a real orbit can resemble apparent orbital path. Electronic orbits remain on the same side (outside) of the central body's path and deflection and drifting rates do not change directions. Electrons in the atoms also have apparent orbital motion about their nuclei. In these cases, the central bodies (corresponding deuteron, paired to each of the electrons) are anchored to the nucleus and hence they are unable to have independent orbital motion of their own, other than that provided by linear or spin motions of the nucleus. All planetary laws are applicable to orbiting electrons, with modification as required due to controlled motion of the central body and the orbits being placed outside the central body's path.

Conclusion:

Elliptical/circular planetary orbits around a central body are apparent geometrical structures, developed from relativistic considerations and appearance of planetary motions to an observer (assumingly) based on the static central body. They are created to explain relative positions and observed movements of planets about a static central body. We are able to predict certain cyclic phenomena from apparent orbits. However, they do not provide logical and physically correct explanations to many phenomena. In reality, a planet moves along with the central body in a wavy path about the median path of the planetary system around galactic centre, alternatively moving to the front and rear of the central body.. A real orbital path does not form a closed geometrical figure. A planet enters into its orbit straight away as it approaches the central body; there is no gradual development of orbital motion. All planets and satellites in a planetary system orbit in the same direction, which is same as central body's orbital path about the galactic centre. Direction of entry of planetary bodies is limited within extremely small region. In order to enter a successful orbit, a planetary body has to approach the central body in (almost) parallel direction to its path at the right distance away and from the rear of the central body. Right distance is determined by speed and matter content of the planetary body.

References:

References are self-published by the author. Since, this concept is unprecedented; they are not reviewed or edited.

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