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PLANETARY SPIN

(According to "*Hypothesis on* MATTER")

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Abstract: A part of central force between planetary and central bodies cause their spin motions. All bodies in planetary systems develop mean accelerating spin motion. Depending on their orbital parameters, planets and central bodies may spin in forward direction, rearward direction or, in rare cases, may have no spin motion at all. All bodies in a planetary system tend to spin in their common orbital plane. Angular accelerations of orbiting bodies continue indefinitely until their high spin speeds cause disintegration of planets and planetary system. In a planetary system, consistency of body-matter and radial size of a body determine relative spin speeds at different parts of its body. Equatorial region of all very large bodies spin faster than their polar region or regions towards their spin-axes. Lengthening of (terrestrial) solar days, presently misinterpreted as slowing down of earth's spin motion, is the result of insufficient compensation to earth's apparent spin motion about the sun.

Keywords: Terrestrial spin, planetary spin, planetary orbit, solar system, terrestrial-solar day, celestial mechanism, Hypothesis on MATTER.

Introduction:

'Hypothesis on MATTER' describes an alternative concept. According to which 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 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 spatial dimensions, contain sufficient distortions to sustain macro body's integrity and stability in its current states. This part of 2D energy fields is the 'matter field' of the macro body. Distortions in a matter field are 'work-done', existing about the body and it determines state of (motion of) the body. Force is the rate of work being stored about (or removed from) a macro body's matter field with respect to rate of (rate of) macro body's displacement. Action of an effort is simple structural reshaping of matter field and the resulting motion of any matter particles present in the region. State of (motion of) a body depends on magnitude of work (energy stored) in its matter field rather than on magnitude or duration of effort applied on it.

2D energy fields maintain direct physical contact with all basic 3D matter particles in nature and interact with them. All apparent interactions between macro bodies take place through the medium of 2D energy fields. This avoids assumption of 'actions at a distance through empty space'. There are no 'pull forces' or 'rigid macro bodies' in this concept. All efforts, classified into various types of natural 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 combine to form a resultant. Efforts in same plane in different directions interfere to reduce/increase each other's efficiency to produce a 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 spatial 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 related (body's) acceleration, in this article, the term 'force' is 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. Delay required for distribution and stabilisation of stored work and stability of stored work, in a matter field, cause the property of inertia. Matter is inert. It has no ability to move or act. Associated matter field-distortions about a macro body produce all actions, presently assigned to matter (bodies). Transfer of distortions in the matter field of a macro body carries constituent 3D matter particles of the body and thus produces macro body's motion. This inertial action, about a macro body, maintains the body's state (of motion). A change in inertial actions about a macro body produces body's acceleration. If certain work is invested into or removed from matter field of a body, the body will attain stable state only after inertial delay, during which work about the body stabilizes. This is true even after the action of effort is terminated. Imbalance in distribution of matter field-distortions in a macro body moves the centre of action of work in the body, away from the body's centre of mass. Inertial action on a free macro body, away from its centre of mass, produces linear as well as spin motion of the body.

Presence of 3D matter particles in universal medium breaks continuity of 2D energy fields and causes imbalance in them. Pressures applied by 2D energy field-latticework from sides of discontinuity, in an attempt to restore 2D energy fields' continuity, compress 3D matter particle within the gap. [Basic 3D matter particles are of uniform radial size and they constitute all other superior matter bodies]. If extents of 2D energy fields 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). Displacements of constituent 3D matter particles move a macro body.

Extent of 2D energy fields between two 3D matter particles is always less than the extents of 2D energy fields on their outer sides. As a result, two 3D matter particles are pushed towards each other, giving rise to the phenomenon of (apparent) gravitational attraction. Apparent gravitational attraction is the dynamic nature of gravitation. So far, static nature of gravitation did not attract attention of physicists. Static nature of gravitation is more basic and important. Apparent gravitational attraction between two 3D 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 a 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 3D matter particles, which happen to be in the same plane at any instant. Contrary to present belief, gravitational effort (force) is enormously stronger compared to other manifestations of effort (natural forces). All 'natural forces' have their origin in gravitational actions.

Most celestial bodies have certain rotary motions along with their linear and precessional motions. In case of (artificial) satellites, their spin motion is often attributed an imaginary 'frame dragging' by the earth. As the earth rotates, due to 'frame dragging', it is assumed to gently drag functional entities 'space' and 'time' along with it. This is assumed to be the cause of satellite's rotation in the same direction as the earth's rotation. Celestial bodies, including satellites, are real physical entities. Real bodies cannot be physically affected by imaginary efforts. Real efforts are required to spin real bodies. It may be noticed that in all planetary systems, its members spin in a systematic order. All members of a planetary system spins only (almost) in their orbital plane. Spin speed is related to orbital parameters and size of a body. These common behaviours are neither a coincidence nor produced by haphazard actions of external efforts or other macro bodies in vicinity. Imaginary causes or unreal entities cannot produce mechanical motions of real matter bodies. There is a definite mechanism that causes spin motions of planetary bodies and it is related to their orbital motion. This article attempts to give a brief but logical explanation to the phenomenon of planetary spin. Same explanation is valid for spin motions of all central and satellite bodies also.

All conclusions, expressed in this article, are taken from the book, "*Hypothesis on* MATTER" [1]. For details, kindly refer to the same. Figures, in this article, are not to scale. They are depicted to highlight the points presented.

Relative motions:

Since no absolute reference is currently available, in mechanics, 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) in space and use relative motions of other bodies, with respect to the static reference, for all our purposes in mechanics. An alternative concept, advanced by author of this article, 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 other three-dimensional matter bodies.

In nature, it is impossible for a three-dimensional matter particle to 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 universal medium to move all basic three-dimensional matter particles at the highest possible linear speed. Macro bodies are formed by numerous 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. This inherent motion is gained by mutual (apparent) gravitational attraction between different macro bodies in space. By choosing a body as a (static) reference, in that instant, we eliminate whole of 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 macro bodies. When we start assigning reality to the resulting parameters, other than relative positions, it will invariably distort any ensuing theories or physical laws.

Parameters of macro 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 macro bodies in space, except those which are related to their relative positions. Shape of paths traced by macro bodies or magnitudes of their speeds, obtained by using relative frame of reference, are of apparent nature. Theories or mathematical treatments, using these apparent paths (geometrical figures) of moving macro bodies, represent unreal circumstances. They can, at the most, indicate assumed or imaginary results, which may coincide with our observations, without considering observer's motion in space. 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, involving referred bodies.

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 around the reference body. Any action on 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 static state of reference body, it is necessary to refrain from any change in its state (of rest). 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 or theories, based on observer's apparent (relative) motion can give correct results with respect to relative positions or state of motion bodies within a system of bodies in the same region of space. These results will be true only as they are observed within the system and they will not constitute physical reality in space. 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 work-done (kinetic energy) associated and corresponding to 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 effort 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, changes are assigned to magnitude of kinetic energy and corresponding state of (motion of) the observer.

Real physical action of a small linear effort on the observer (considered in the above example), towards the reference body, is to move the observer towards the reference body. However, in the case considered above, direction (path) and speed of motion of observer encompasses both 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.

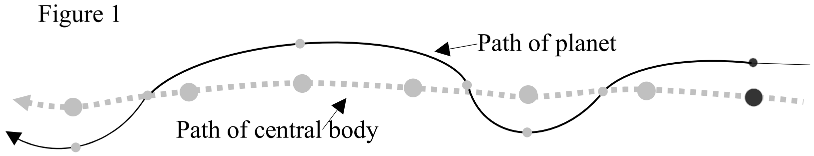
An apparent action noticed on a body within a system, which is related to a steady reference, may be considered real only within the framework, limited within the system in the same region of space. This is not real physical action in nature, with respect to an absolute reference. Real physical actions 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.

Planetary orbital motion:

Although planets appear to move in orbital paths around a central body, in reality, they move along with the central body in its motions [4]. With respect to an absolute reference, a planetary body does not orbit around its central body. Motion of the planetary body is wave-like, along central body's path. Planetary body periodically moves to the front and to the rear of the central body. All our present 'planetary laws' are derived for their apparent motion and assumed paths as observed by moving observers, without considering their own motion or paths.

In figure 1, a small part of curved path of a central body is shown by the grey dotted line. Black wavy-line shows the path of a planetary body about the central body. Central body and planetary body are shown by the black circles and their future positions are shown by grey circles. In this sense, it can be seen that a planetary body orbits around the center of the central body's curved path (the galactic centre). Wave pattern in its path is caused by the presence of the central body. Two consecutive (circular) segments of these perturbations appear like an orbital motion around the central body only when they are referred to a relatively small system of bodies. All real motions can be considered only with absolute reference. Hence, it is incorrect to insist that a planetary orbital path is of circular (elliptical) shape around a central body.

Figure 1



Observed (apparent) orbital path of a planet, considered in relativistic frame of reference, is of oval shape with its narrower end towards aphelion, rather than an ellipse. It is a closed geometrical figure around the central body. During development of planetary laws, parameters of this apparent orbit is mathematically manipulated (including change of reference frame and arbitrary changes of directions of motions) to obtain results to suit observed (apparent) parameters.

Both, central body and planet, move about a common median path. Unlike in apparent orbital motion, where a planet is assumed to move around a static central body, in the real orbital motion, direction of planet's motion oscillates about the path of central body's motion {See Article, 'Planetary Orbits' [4]}. Planetary orbital path, around galactic centre, consists of numerous apparent orbits (number of completed cycles of wavy motion), each with its own perihelion and aphelion. Each perihelion is a point on orbital path, when distance between planet and central body is least and each aphelion is a point, when this distance is most. Datum points on orbital paths are situated on straight line connecting centers of both bodies to the galactic centre. Outer datum point is on outer side (farther from galactic centre) of median path and inner datum point is in inner side (nearer to galactic centre) of median path. A planet has its highest linear speed at outer datum point and least linear speed at inner datum point, both in the same direction. Perihelion and aphelion of apparent orbit need not coincide with datum points.

A planetary body has two simultaneous linear motions and a spin motion; linear motion, nearly tangential to its orbital path, is referred here as 'linear motion' and linear motion towards the central body is referred as the 'radial motion'. Linear motion of the planet is the result of inertial actions about the planet, gained before the planet entered stable orbital path. Radial motion of the planet is the result of gravitational attraction (central force) between central and planetary bodies. Linear motion of planetary body, in the direction of central body's motion, is modified by radial motion to produce angular deflection of linear path, required for wavy nature of orbital path. Radial motion due to central force has three functions. A component in the direction of linear motion constantly modifies magnitude of planet's linear motion. Lateral component modifies direction of planet's linear motion and moves the planetary body radially towards the central body. Part of central force causes planetary body's spin motion about an axis perpendicular to its orbital plane and passing through the centre of mass of the planetary body.

Action of central force:

In this article, all actions of a planetary body, 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 central force are credited to radial motion / work in it, towards the central body. A body is defined by 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. Gravitational attraction between two macro bodies is the result of gravitational attractions between their constituent (basic) 3D matter particles. Inertia (associated with a body) does not apply effort on the body. While inertia maintains a moving planetary body in its straight-line motion, it is the gravitational attraction between the planetary and central body (by its action on each of the bodies, separately) that changes direction of planet's linear motion and produces its spin motion. This effort, apparently between two free macro bodies (moving about each other) along the line joining them, is the 'central force'. 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 central and planetary bodies, when considered together, provide a central force (apparent attraction) between them. A planetary body is apparently attracted towards its central body and vice versa. (Apparent) gravitational actions between two bodies take place only in common planes occupied by them. Actions, similar to orbital motion of a planetary body analysed here, takes place on central body also. For details on the action of a 'central fore', kindly refer to article 'Central force' [3].

Although there are differences in magnitudes of additional work, introduced by central force into different planes in the matter field of a planetary body, resultant action of central force will continue towards the central body. As the magnitude of additional (radial) work, in the planetary body's matter field increases, it will continuously accelerate to increase its radial velocity towards the central body, until its matter field is saturated with additional (radial) work in the direction considered. Magnitude of additional (radial) work in the direction considered at saturation corresponds to absolute linear speed of planetary body. Higher the absolute linear speed of the body, lower is the saturation limit. In saturated state, magnitudes of additional (radial) work introduced into planetary body's matter field and the additional work lost from it, due to forward displacement of the planetary body, will balance each other. Changes in the magnitude of additional (radial) work due reduction in distance between the bodies are ignored. Difference in the magnitudes of additional (radial) work in the forward and rearward hemispheres of the planetary body shifts planetary body's centre of gravity to the rear. Shift of centre of gravity from centre of mass of a free body causes part of central force to act as a couple and spin the planetary body in the plane of its linear motion. Axis of spin will be perpendicular to orbital plane of the planetary body. Since all bodies in a planetary system have a common orbital plane [4], this phenomenon ensures that all bodies in a planetary system spin in their common orbital plane.

Efforts in different planes do not interfere; they act on 3D matter particles independently. Constituent 3D matter particles of a macro body are moved by each of the efforts in its own direction and plane, to produce resultant magnitude and direction of combined-body's motion. Matter field of a moving macro body contains additional work required for its original linear and spin motions. Work is stored in macro body's matter field in the form of matter field-distortions. In this article, we shall neglect all work, stored in a macro body's matter field, for sustenance of its stability and integrity as a single (combined) body. 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 and direction. Original work, associated with a planetary body was invested into its matter field by external efforts (forces), including apparent gravitational attraction towards the central body, before its entry into stable orbital path about its central body. Additional external effort is required to change the state of constant motions of orbiting planetary body after it has entered its stable orbital path. It is these changes, which convert inherent linear motion of the planetary body (in straight line) to its linear motion along curved orbital path. We shall deal with only those additional distortions (work), introduced into planetary body's matter field, by external efforts to change its state of motion, after it has entered its stable orbital path, in order to transform its linear motion in a straight line into motion along curved paths as required for orbital motion. Further, we shall limit our investigation to the magnitude of spin acceleration of a planetary body, when it is at either of its orbital datum points. At datum points, a planetary body experiences highest magnitude of spin accelerations. Magnitudes of spin accelerations at other points on orbital path depend of relative positions of planetary and central bodies and they will be less than the magnitude of spin accelerations at datum points.

As per calculations on 'Central force' (as given in article [3]), magnitude of additional (radial) work invested into matter field of a planetary body at datum points in its orbital path;

Magnitude of total (radial) matter field distortions in forward hemisphere of a dynamic planetary body

$$= \frac{3MGm}{4r^3D^2V} \times \frac{5r^4}{12} = \frac{5MGmr}{16D^2V} \tag{1}$$

Magnitude of total (radial) matter field distortions in rear hemisphere of a dynamic planetary body

$$= \frac{3MGm}{4r^3D^2V} \times \frac{11r^4}{12} = \frac{11MGmr}{16D^2V} \tag{2}$$

where 'M' and 'm' are matter contents (represented by 'masses') of central and planetary bodies, respectively, 'G' is gravitational constant in 3D spatial system, 'r' is radius of planetary body, ‘D’ is distance between central and planetary bodies and ‘V’ is absolute linear speed of planetary body in direction parallel to tangent at central body’s surface point, facing the planetary body. Dimensional units are not used in the equations.

Equal additional (radial) works, $5MGmr/16D^2V$ each, on either side of centre line (that produces equal momenta about centre of mass) cause planetary body’s radial motion towards central body. Work and energy are numerically equal. Kinetic energy of a body of mass ‘m’, moving at constant velocity, u, is equal to $mu^2 \div 2$. Comparing this with the total additional work in matter field of the planetary body and producing its radial motion:

Total (radial) work acting through the centre of mass and producing body’s radial motion,

$$\frac{mu^2}{2} = \frac{5MGmr}{16D^2V} \times 2 = \frac{5MGmr}{8D^2V} \text{ , where u is the radial velocity.}$$

$$u^2 = \frac{5MGmr}{8D^2V} \div \frac{m}{2} = \frac{5MGr}{4D^2V}$$

Radial speed of planetary body towards central body at datum point, $u = \sqrt{\frac{5MGr}{4D^2V}}$ (3)

A planetary body obtains its constant radial speed in any direction by the time whole of its body crosses rear point on the central body in tangential direction. Planetary body loses its constant radial speed in this radial direction by the time it crosses foremost point on the central body in tangential direction. In the mean time, work introduced to create radial motion is utilized to curve planetary body’s linear path and change its direction of motion. Radial motion of a planetary body is towards the central body. Real orbital path of a planetary body alternates on either side of its median path. Hence, direction of its radial motion towards the central body is perpendicular to direction of its linear motion only at inner and outer datum points on orbital path. At all other points on orbital path, direction of its radial motion depends on its relative position with respect to central body. There are points on orbital path, where direction of radial motion is in same or in opposite direction to planetary body’s linear motion.

Left-over (radial) work in the matter field about rear hemisphere of the planetary body

= Total additional (radial) work – additional (radial) work from rear hemisphere, used for radial motion

$$= \frac{11MGmr}{16D^2V} - \frac{5MGmr}{16D^2V} = \frac{3MGmr}{8D^2V} \quad (4)$$

Radial work $5MGmr \div 8D^2V$ acts to produce radial motion of the planetary body towards the central body and the remaining work $3MGmr \div 8D^2V$ acts to spin the planetary body. Direction of radial motion, in relation to body’s linear motion, varies throughout the orbital path. Hence, the magnitude and direction of the torque produced by additional (radial) work will also depend on the relative position of a planetary body in its orbital path (with respect to central body). However, with respect to spin axis of the planet (perpendicular to orbital plane), direction of torque changes every half-apparent-orbit. For whole period of each half-apparent-orbit (one curved segment of orbital path on any side of planetary body’s median path), on either side of median path, direction of torque remains steady and accelerates planetary body’s spin motion.

Figure 2 shows representation of part of orbital path of a planetary body about its central body. Central line X_1 X_2 shows a small part of their curved median path. Wavy (dashed) line,

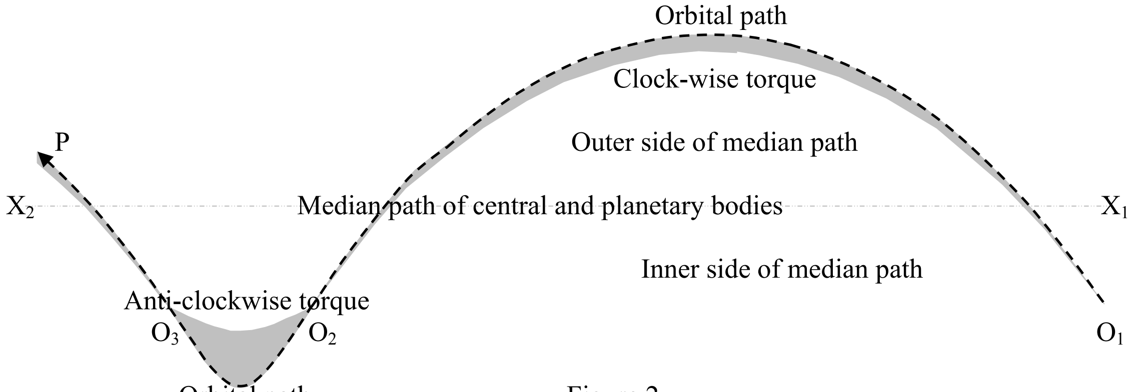


Figure 2

O_1O_2 O_3 P, shows part of orbital path of a planetary body, with arrow in the direction of its linear motion. Uneven sizes of segments of orbital paths on either side of median path are due to difference in scales used for horizontal and vertical coordinates in the drawing. In practical case, parts of segments of orbital paths on both sides of median path will appear almost similar. (Vertical) thickness of the shaded part shows relative magnitude of torque applied on the planetary body at any point on its orbital path. For directions of motion of central and planetary bodies as shown in the figure, when the planetary body is on the outer side of the median path (moving from O_1 to O_2), it experiences a clockwise torque and when the planetary body is on the inner side of the median path (moving from O_2 to O_3), it experiences an anti-clockwise torque, as shown in figure 3.

Points O_1, O_2, O_3, etc. are situated very near to median path. At points O_1, O_2 and O_3, central force and hence planetary body's radial motion is co-linear with linear motion of the planetary body. At point O_2, central force acts in opposite direction to planetary body's linear motion. Action of central force is purely to decelerate the planetary body in its linear motion. At points, O_1 and O_3, central force acts in the same direction as the linear motion of the planetary body. Action of central force is purely to accelerate the planetary body in its linear motion. At these points in the orbital path, centre of mass and the centre of action of central force (centre of gravity) of the planetary body are situated on the line connecting the planetary body to the central body. Whole of the central force acts through the centre of mass of the body. At these points, planetary body will experience no torque but have only radial acceleration/deceleration due to central force. Central force does not have a component that causes torque on the planetary body at points similar to these on the orbital path. At all other points on the orbital path, central force has a component that causes planetary body's acceleration/deceleration towards/away from central body and another component that causes clockwise or anti-clockwise torque on the planetary body. Relative magnitudes of these components vary and depend on the relative positions of central and planetary bodies.

Since a planet is made of composite materials and it is a large body, it cannot attain constant spin speed appropriate to torque on it [produced by additional (radial) work invested in its matter field], instantaneously. Instead, spin-component of additional (radial) work is held within the planetary body's matter field as compressive energy, which is gradually converted to rotational kinetic energy. Since direction of central force on the planetary body is towards the central body, direction of additional work producing the spin motion is towards the central body and it is applied on the rear hemisphere of the planetary body. As planetary body develops spin motion, this additional work is distributed throughout the planetary body's matter field in various directions. Magnitude of additional (spin) work is continuously replenished by central force.

Thus, irrespective of development of spin motion by planetary body, additional work (producing the spin acceleration) is augmented at a rate related only to the central force and its relative direction to body's linear motion.

Spin motions of a planetary body:

Once a planetary body has settled into an apparent orbit around the central body, during its motion, both bodies develop spin motions about parallel diameters, which are perpendicular to their (common) orbital plane. If the planetary body was already spinning before it entered into its orbit, attempts are made to gradually modify its spin speed and direction of spin as required, by inertial efforts to suit present conditions. 'Absolute spin motion' of a body is with respect to 2D energy fields in space. It is the result of additional (spin) work invested into its matter field. It requires effort and is usually produced by the action of central force. Additional work, invested by external efforts into body's matter field, produces its spin motion and changes its state (of motion). 'Apparent spin motion' of planetary or central body is with respect to any (moving) reference, the observer assigns. This requires no effort or central force. It is only apparent to an observer, who does not realise his own state of motion in space. Its direction and magnitude may change with a change of reference. While considering planetary spin motions, currently, we use both these types of spin motions as real. Assigning reality to apparent spin motion and combining it with real spin motion of a planetary body, often results in false notions.

Spin due to central force:

Part of additional (radial) work, introduced into the matter field of a planetary or central body by the central force, creates absolute spin motion of the body. Magnitudes and directions of absolute spin acceleration depend on magnitude and directions of absolute torque on the planetary body. They are with respect to static 2D energy fields (absolute reference) in space.

We shall consider planetary spin actions near 'datum points' on a planetary orbital path. Datum points on an orbital path of a planetary body is situated at the inter-sections of planetary orbital path and straight lines passing through galactic centre, centre of central body and centre of planetary body. Outer datum point (point A, as shown in figure 3) is situated on the outer side of median path, farther from galactic centre. Inner datum point (point B, as shown in figure 3) is situated on the inner side of median path, nearer to galactic centre. When a planetary body is in the vicinity of median path (points O_1, O_2, O_3, etc. in figure 2), magnitudes of torque on the body are very small. Magnitudes of torque are highest, when planetary body is at datum points on its orbital path. In order to simplify the explanations, we may for the time being, consider that magnitudes of torque varies as sine function of relative angle the planetary body makes with

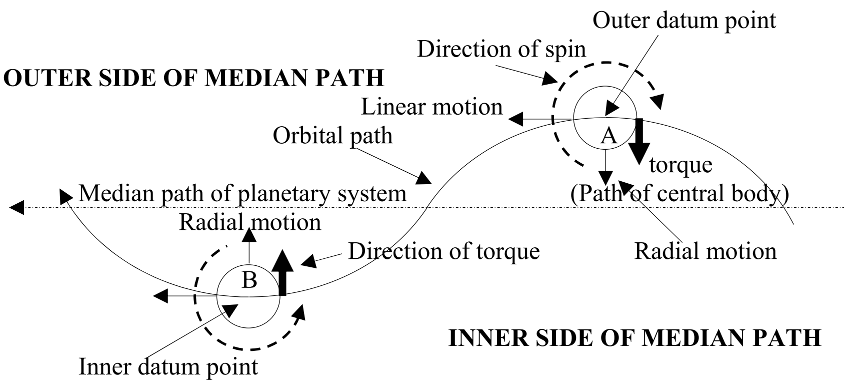


Figure 3

central body. That is, throughout outer segment of orbital path, the planetary body experience torque in one direction and throughout inner segment of orbital path, the planetary body experience torque in opposite direction, as shown in figure 3.

Due to changes in relative direction between direction of central force and direction of linear motion of the planetary body, at all points on orbital path, spin parameters of planetary body differ. Considering actions in any semi-circular segment of orbital path (half-apparent-orbit); introduction of additional (radial) work into planetary body's matter field is continuous in same direction. This additional (radial) work acts to accelerate spin motion of the planetary body. Since a planetary body is too large for immediate stabilisation of its spin characteristics, spin-component of additional (radial) work is stored about its matter field in the form of compression energy [1]. Stored spin-component of additional (radial) work is gradually converted into kinetic energy of spin of the planetary body. Rate of conversion of spin-component of additional (radial) work is planetary body's spin acceleration. Planetary body's spin speed at any instant depends on the compressibility and consistency of its body-matter. Although spin-component of additional (radial) work is utilized by its distribution throughout planetary body's matter field to produce spin motion, continuous action by central force prevents depletion (other than by change in the relative direction) of spin-component of additional (radial) work, required to maintain planetary body's spin acceleration, in magnitude and direction.

As a planetary body moves about its central body, for every completed apparent orbit, central force's action on it is towards the median path; in the direction towards galactic center for half-duration of apparent orbit (shown in figure 3, position A). Direction of torque on the body during this period is clockwise (as shown in the figure by thick short arrow), in angular direction opposite to planet's orbital motion about the central body (around galactic centre). Planetary body develops clockwise (in negative angular direction) spin acceleration during this half of its apparent orbit, when it is moving from median path through outer datum point to median path.

Similarly, for other half of apparent orbit, planetary body is moving towards median path. Direction of central force's action is in direction away from the galactic center for half-duration of apparent orbit (shown in figure 3, position B). Direction of torque on planetary body during this period is anti-clockwise (as shown in the figure by thick short arrow), same angular direction as planet's orbital motion about the central body (around galactic centre). Planetary body develops anti-clockwise (in positive angular direction) spin acceleration during this half of its apparent orbit, when it is moving from median path through the inner datum point to median path. Spin accelerations/motions developed on the outer side and on the inner side of median path are in opposite directions. Ultimately, the planetary body will develop an overall resultant spin motion in the direction of higher spin motion produced, if any. As an example, we may calculate spin accelerations of a planetary body, when it is at inner/outer datum points on its orbital path as follows;

Magnitude of left-over additional (radial) work from the rear hemisphere of planetary body, in unit time due to central force; by equation (4) = $\frac{3MGmr}{8D^2V}$

Depending on the direction of torque; rate of increase in spin-work = $\pm\frac{3MGmr}{8D^2V}$

We shall use '+' sign for anti-clockwise direction and '–' sign for clockwise direction of spin accelerations and motions. As magnitude of spin-work in planetary body's matter field increases in magnitude, it is equal to a torque on the body, whose magnitude is proportional to the rate of change of spin-work. Let the spin acceleration of planetary body at datum point is 'γ' rad/sec^2.

Spin speed of the planetary body increases by γ radians in unit time. Angular displacement of the planetary body in unit time due to spin-work (introduced in unit time) = γ / 2 radian. [Angular displacement = (angular acceleration × time^2) / 2].

Total magnitude of spin-work introduced in unit time = Torque× angular displacement in unit time

$$= \pm \frac{3MGmr}{8D^2V} \times \frac{\gamma}{2} \tag{5}$$

Kinetic energy due to spin, for a spherical body = [Moment of inertia × (angular speed)^2] / 2

Change in (spin) kinetic energy in unit time = I × (change in angular speed in unit time)^2 / 2

$$= \frac{I\gamma^2}{2} \tag{6}$$

where ‘I’ is the moment of inertia of the spherical planetary body.

Equating magnitude of work in equation (5) to kinetic energy in equation (6);

$$\frac{I\gamma^2}{2} = \pm \frac{3MGmr}{8D^2V} \times \frac{\gamma}{2}$$

$$I\gamma = \pm \frac{3MGmr}{8D^2V}$$

Planetary body being spherical on shape, putting the value of $I = \frac{2mr^2}{5}$;

where ‘m’ is mass and ‘r’ is the radius of planetary body.

$$\frac{2mr^2}{5}\gamma = \pm \frac{3MGmr}{8D^2V}$$

$$\gamma = \pm \frac{15MG}{16D^2Vr} \tag{7}$$

Considering magnitude of action in unit time; ‘γ’ is the angular acceleration of planetary body’s spin motion (due to radial work) at datum points on orbital path. Direction of radial work, being invested into planetary body’s matter field, reverses when the planetary body crosses median path.

In equation (7), V and D are variables, varying continuously as a sine function of relative angular position of planetary body with respect to central body. For approximate calculations, their average values may be taken. Taking a point on the median path as reference, linear component of planetary body’s relative velocity varies in proportion to sine function of planetary body’s relative angular displacement with respect to central body. Mean value of relative linear speed = 2v / π, for the highest value of relative velocity, v, at datum point.

To get mean linear speed of planetary body on outer half-apparent-orbit, V_{out}, mean value of its relative speed during its travel in outer half-apparent-orbit is added to value of absolute linear speed of the planetary body, when it is on the median path (which is same as the absolute linear speed of the central body, V_c along median path).

Mean linear speed of planetary body on the outer half-apparent-orbit, $$V_{out} = V_c + \frac{2v_{out}}{\pi} \tag{8}$$

To get mean linear speed of planetary body, V_{in}, during its travel on the inner half-apparent-orbit, mean value of its relative speed during its travel in inner half-apparent-orbit is added to the value of absolute linear speed of the planetary body, V_{aphe}, when it is at the inner datum point (considered here to coincide with aphelion of apparent orbital path), which is same as difference between absolute linear speed of central body and relative linear speed of planetary body at aphelion.

Mean linear speed of planet on the inner half-apparent-orbit, $V_{in} = V_{aphe} + \frac{2v_{in}}{\pi}$ (9)

Similarly, we may calculate mean distances between planetary and central bodies, D_{out}, when planetary body is in outer curved segment of its orbital path and D_{in}, when planetary body is in inner curved segment of its orbital path, by using the multiplicand factor '$2/\pi$'. D_m is the distance between planetary and central bodies, when both bodies are on median path.

If deflection of perihelion from outer datum point is very small, mean distance between the bodies in outer curved segment of orbital path, D_{out}, may be found by using distance from central body to planetary body, D_{peri}, when it is at perihelion of the apparent orbital path.

Mean distance between planetary and central bodies, on outer side of median path,

$$D_{out} = D_{peri} + \frac{2(D_m - D_{peri})}{\pi} \tag{10}$$

If deflection of aphelion from inner datum point is very small, mean distance between planetary and central bodies in inner curved segment of orbital path, D_{in}, may be found by using distance from central body to planetary body, D_{aphe}, when it is at aphelion of the apparent orbital path.

Mean distance between planetary and central bodies, on inner side of median path,

$$D_{in} = D_m + \frac{2(D_m - D_{aphe})}{\pi} \tag{11}$$

Putting these values in equation (7) we get approximate average spin accelerations, γ_{out} and γ_{in}, of planetary body when on the outer half-apparent-orbit and when on the inner half-apparent-orbit respectively. Spin acceleration on the outer half-apparent-orbit, γ_{out}, is in clockwise (negative) direction and spin acceleration on the inner half-apparent-orbit, γ_{in}, is in anti-clockwise (positive) direction.

$$\gamma_{out} = -\frac{15MG}{16D_{peri}^{\;2}V_{out}r} \tag{12}$$

$$\gamma_{in} = +\frac{15MG}{16D_{aphe}^{\;2}V_{in}r} \tag{13}$$

Since spin accelerations in outer half-apparent-orbit and inner half-apparent-orbit are in opposite directions, magnitudes of spin angular displacements produced by them during each half-apparent-orbit are in opposite directions. If it is clockwise, when the planetary body is on the outer side of median path, it will be anti-clockwise, when the planetary body is inside the median path. When considering over a full apparent orbit, planetary body may have an overall resultant angular displacement in any one direction or (in the rare cases, when they are equal to each other) it may not have a resultant spin motion at all. Spin acceleration in outer half-apparent-orbit is in opposite angular direction to planetary body's orbital motion around galactic centre. Spin acceleration in inner half-apparent-orbit is in the same angular direction as planetary body's orbital motion around galactic centre. Hence, overall resultant spin displacement of a planetary body depends on the duration it spends in either of the half-apparent-orbits. In outer half-apparent-orbit, a planetary body travels at a greater absolute linear speed but the distance travelled is much greater (from O_1 to O_2 in figure 2). In inner half-apparent-orbit, a planetary body travels at a lower absolute linear speed but the distance travelled is much shorter (from O_2 to O_3 in figure 2). As described above, average linear acceleration/deceleration of the planetary body may be considered to be uniform in both half-apparent-orbital paths. Hence, time spent by a planetary body on either side of its median path is proportional to the highest/lowest relative velocity (at datum points), with respect to central body, achieved by the planetary body. Let 'T' be (apparent) orbital time period of planetary body (to complete one apparent orbit) and let 't_{out}' and 't_{in}' be the time spend by planetary body on outer and inner sides of median path, respectively. 'v_{in}' is its relative velocity at inner datum point and 'v_{out}' is its relative velocity at outer datum point, with respect to central body.

Time spent by planetary body on outer side of median path, $$t_{out} = \frac{v_{out}}{v_{out} + v_{in}} \times T \quad (14)$$

Time spent by planetary body on inner side of median path, $$t_{in} = \frac{v_{in}}{v_{out} + v_{in}} \times T \quad (15)$$

Angular displacement, due to spin acceleration, in outer half-apparent-orbit,

$$\theta_{out} = -\gamma_{out} \times \frac{t_{out}^{2}}{2} \quad (16)$$

Angular displacement, due to spin acceleration, in inner half-apparent-orbit,

$$\theta_{in} = \gamma_{in} \times \frac{t_{in}^{2}}{2} \quad (17)$$

Smaller planets and satellites may be solid throughout their bodies. Medium sized planets and satellites may have thin outer crust in solid state. Otherwise, all large bodies are fluid in composition. Alternating spin accelerations of these bodies are effectively dampened by churning of fluid parts in these bodies. Only an overall resultant spin motion is noticed over a long period of time. It may be averaged for a full apparent orbital period (one planetary year) to give overall average spin acceleration, Γ, of the body.

$$\Gamma = 2\left(\pm \theta_{in} \mp \theta_{out}\right) \div T^{2} \quad (18)$$

Direction of this spin motion depends on the orbital characteristics of planetary body. Hence it is quite natural for planets to spin in either direction in its orbital plane or not to spin at all. Usually, all planets tend to spin in the same direction as their orbital motion. As eccentricity of apparent orbit reduces, difference in linear speeds of the planet on either side of median path and difference in time spend by them on either side of median path become less. Difference between clockwise and anti-clockwise spin motions of planets reduces. In case, $v_2\gamma_{in} = v_1\gamma_{out}$, spin displacements in either direction are equal and the planet will have no resultant (absolute) spin motion at all. At very low eccentricity of apparent orbit, clockwise (counter-orbital) spin motion produced on the outer side of median path may be greater than anti-clockwise spin motion produced on the inner side of median path. Such planetary bodies angularly accelerate in opposite direction to their orbiting direction. They spin in counter direction to their orbital motion. Should a planet have one or more satellites, these bodies also exert central forces on the planet to produce its spin motions. Average spin motion of a planet is resultant of all spin motions produced on it by central forces due to all other external bodies.

Spin acceleration of a planetary body is caused by the perturbations in its path. There is no effort (except efforts due to occasional external interference) available to oppose or modify this phenomenon of spin acceleration. Hence, a planetary body with overall resultant spin acceleration will continue to accelerate in its spin motion indefinitely. Energy for this spin motion is derived directly from the kinetic energy of the body due to action of central force. Therefore, development of spin motion does not affect planetary body's linear motion. Perpetual spin acceleration of a planet will ultimately lead towards its disintegration under tidal stress. This phenomenon prevents eternalness of planetary systems in nature and contributes towards re-cycling of three-dimensional matter to reduce universal entropy.

Exemptions to above explanations may be observed in the following cases. In case, a planetary body already had a spin motion (before entering into its orbit) in opposite direction to that is created by its orbital motion, the body will first slow down its spin motion to a stop and then reverse as directed by the torque acting on it. Spin motions in any other directions will also be modified in due course of time. Original spin motion and spin motion produced by orbital motion combine to produce wobbling of planetary body's spin axis. Bodies with spin motions in planes other than their orbital plane are relatively new additions to the planetary systems. (Disregarding its initial spin-parameters), time spend by a planet in a planetary system may be estimated from its current spin speed, orbital parameters and body parameters.

Unequal spin motion of a planetary body:

Equations (12) and (13) give overall spin accelerations of a planetary body on either side of its median path. Additional works, acting to produce these accelerations, are concentrated towards equatorial regions (at the rear) of the body. Hence, due to integrity of the body, these parts of the body tend to move first and carry the rest of the body, gradually, along with it. How fast rest of the body attains the same spin speed as the equatorial region (at the rear) depends on rigidity and consistency of its body-matter.

Usually, all planets are of spherical shape. Action of additional (spin) work is concentrated at its equatorial region, towards body's rear. Since parts of a solid body cannot have considerable relative motion between them, action of additional work at one part of the body is transmitted to other parts very fast and whole of the body tend to move at same spin acceleration. If a planetary or central body is in fluid state or it has large fluid outer cover, its equatorial region towards rear of the body, where additional (spin) work is concentrated will move first and rest of the body will gradually develop appropriate spin motion to follow equatorial region. More viscous a planetary body is, less delay in following up. In less viscous bodies, there will always be a delay in the motion of the rest of the body. In other words, equatorial region of a fluid planet will lead other parts in planetary spin motion. All very large celestial bodies are in fluid state or have fluid outer surfaces. So equatorial regions, of all large bodies in a multi-body system, have higher spin speed compared to spin speeds at their polar regions or inner parts.

Apparent spin motion:

As a planetary body apparently revolves around its central body, there is no effort on it to maintain relative positions between surface-points on it and a corresponding surface-point on central body. As a planetary body appears to move around its central body in circular/elliptical path, the body makes one apparent rotation about its axis during every apparent revolution in its orbit around central body. This apparent spin motion of a planetary body requires no external effort or energy. Planetary body appears to spin about one of its diameters, perpendicular to the plane of orbit, once during every completed apparent orbit. This is not real spin motion of the planetary body. Only in relativistic terms, the planetary body appears to have turned through one revolution with respect to a surface-point on the central body. With respect to absolute reference (2D energy fields / space) planetary body does not rotate at all. This apparent rotation of a planetary body, which appears when the body is assumed to orbit around a central body in closed geometrical path, is an apparent spin motion of a planetary body.

Direction of this apparent spin motion is such that a surface-point on planetary body, away from central body, will appear to move in an angular direction opposite to the orbital motion of the planetary body. In case of planetary bodies, which have real spin motion in the direction of their orbital motion, apparent spin motion is in opposite angular direction to its real spin motion. Spin speed of the planetary body will appear to be of lesser magnitude than its real spin speed by the magnitude of its apparent spin motion. Should apparent spin motion be equal to real spin motion, the planetary body will appear to have no spin motion at all. That is: same face of the planetary body remains permanently towards the central body. However, over extended periods, planetary body's own real spin motion will supersede its apparent spin motion. In case of those planetary bodies, which have real spin motion in opposite angular direction to their orbital motion, apparent spin motion is in the same direction as its real spin motion. Spin speed of the planetary body will appear to be of greater magnitude than its real spin speed by the magnitude of its apparent spin motion.

Figure 4 shows relative positions of a spinning planet and its central body, one planetary-day apart. Arrow ED is a small part of curved median path of the planetary system. Central body moves from E towards D. Curved arrow BA is a small part of planetary orbital path. Planetary body moves from O_1 towards O. O_1 and C_1 are centres of planetary and central bodies at a particular time. O and C are centres of the same bodies at the same time on the following (planetary) day. Line PC and P_1C_1 join the centers of these bodies. H_1 shows position of a reference surface-point on the planetary body, facing the central body, situated at C_1. H is a surface-point on the planetary body, facing the central body, at the same time on the following (planetary) day.

A planetary-day is the time elapsed between two subsequent instants when surface-point H_1 faces the central body. For this, surface-point H_1 has to be on line PC after a lapse of one planetary-day from the time it was on line P_1C_1. Let angular speed of spinning planetary body be a constant, in the direction shown by the dashed arrows (anti-clockwise, in the figure). By the time the central body moves from C_1 to C, the planetary body moves from O_1 to O. In the mean time, planetary body would have turned (in its real spin motion) through 2π radians, which is its rotation-day. This takes the reference surface-point, H_1, to position G in the figure 4. Although the planet has rotated through one full turn (2π radians), in order to complete a planetary-day, the planetary body has to have an additional angular displacement from G to H. Surface-point H_1 has to reach position H instead of position G. Angular displacement, θ, is the additional angular displacement required every day to maintain constant length of planetary day. This deficiency of angular displacement is apparent because the body only appears to have lost its spin motion through the angle, θ, relative to the central body. No real loss of angular displacement or spin motion of planetary body takes place. A planetary body has similar apparent discrepancies in its spin motions due to its orbital motion about the central body and due to its orbital motion around the galactic centre. If these discrepancies are in same direction, they augment each other. If they are in opposite angular directions, they reduce each other.

Since a planetary-day is related to apparent spin motion of planetary body with respect to the central body; for a planetary body spinning at a constant angular speed, the above discrepancies produce constant difference between planetary day and planetary body's rotation day. In order to

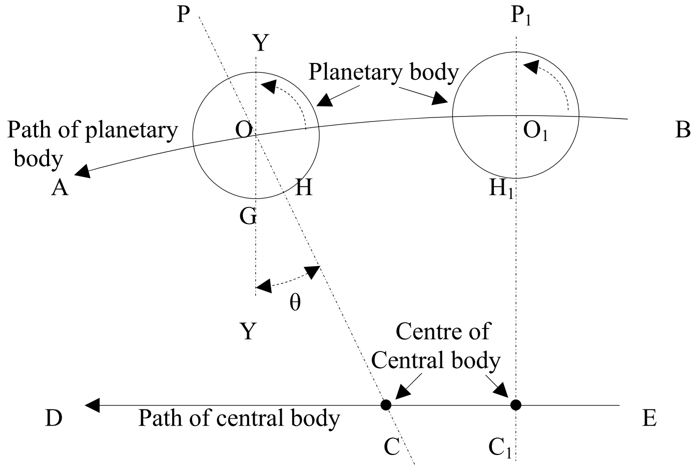


Figure 4

compensate for this difference, the planetary body has to have an additional angular displacement equal to θ, every day. If the compensation provided for additional angular displacement of the planetary body in a planetary-day, is equal to the apparent angular displacement, θ, lengths of planetary-days remain constant. Any variation in difference between planetary day and planetary body's rotation day appears to vary length of its planetary-day from that of its rotation-day. Due to constant angular acceleration of a planetary body's spin motion, even if difference between planetary day and planetary body's rotation day is compensated at one stage, it is bound to re-appear shortly. Since the magnitude of this difference is too small, it may be some planetary years before it is realised. Periodical corrections are required to keep the length of planetary-day a constant.

If additional angular displacement, added for a planetary day (for those planetary bodies, which spin in the same angular direction as their orbital motion), is more than apparent angular displacement (it over-compensates θ), reference point will cross surface-point H before a planetary-day is completed. Length of a planetary-day appears to have shortened and the planetary body appears to be accelerating in its spin motion. If additional angular displacement, added for a planetary-day, is less than the apparent angular displacements (it under-compensates θ), reference point will not quite reach the surface-point H on completion of a planetary-day. Length of a planetary-day appears to have increased and the planetary body appears to be decelerating in its spin motion. This is the apparent condition in which we currently observe the earth.

Anomalies:

Once, a planetary body has settled into its stable orbital path about a central body, its spin motion is automatically developed, maintained and accelerated. Variations in the parameters of central or planetary bodies modify inertial actions on them and thereby alter spin speeds of both bodies. If these bodies are massive and spinning at relatively high speeds, they will also have the property of gyroscopic precession. Depending on external effort's point of application (by collision with another body) inertial action may invoke precessional response on these bodies. Precessional response by spinning bodies causes wobbling of axes of constituent bodies in multi-body systems. In extreme cases this wobbling may reach up to 90° to the line of orbit (as in the case of Uranus). Wobbling, introduced by an external effort, can be removed from a planetary body only by applying an equal and opposite external effort on the body. If magnitude of wobbling is high, magnitude and directions of a planetary body's natural spin motions may be greatly altered.

Should there be more than one planetary body orbiting a central body in nearby orbits, moving in the same direction and these bodies are near enough, they will gradually approach each other under gravitational attraction. Since their momentum towards each other is relatively small, these planetary bodies will gradually collide into each other and merge. If these planetary bodies were in orbits long enough, they would have gained and adjusted their spin speeds according to their orbital properties and effective diameters. Collision between two spinning bodies (with similar spin direction) is bound to reduce or nullify spin motion of both bodies. Due to opposite directions of motion of touching surfaces, most parts of these planetary bodies will be torn off. Fragments flying away from the site of such collision and moving in the same direction as other planetary bodies of the system at the right linear speed could form a dust belt about the central body, moving in a common orbital path. It is possible for the remnant body of collision to spin at very low speed or even spin in opposite direction. In due course of time this will be rectified by its own inertial actions.

Variations in the length of a terrestrial solar day:

Irrespective of its constant spin acceleration, earth is imagined to decelerate in its spin motion. This is an apparent phenomenon due to inability of additional angular displacement, currently provided to compensate for earth's apparent spin motion, to fully compensate apparent spin motion of earth. Earth's spin acceleration requires constant up-grading of compensation required to keep length of its solar day constant. Earth's spin acceleration continuously increases difference between lengths of its rotation day and solar day. In effect, as time progresses, compensation provided at one stage of history falls short to compensate difference between lengths of its rotation day and solar day. This shortage, being extremely small, is not normally noticed. But over extended periods of time, earth's solar day appears to expand. Earth appears to take more time to complete one solar day. This phenomenon is misinterpreted as 'slowing down' of earth's spin motion.

Without rational explanations to development of earth's spin motion, its spin acceleration is an unknown fact. This makes the imaginary 'slowing down' of earth's spin speed as an accepted fact. This belief leads to many other irrational fallacies. While slowing down of earth's spin motion requires an external effort, no such efforts could be found. Although mechanics forbids internal efforts within a system to affect the system, such a 'frictional force' is derived from imaginary tidal drag between water system on earth's surface and its core body. Imaginary energy transfer between earth-moon combine is also assumed to slow down of earth's spin motion.

From explanations, given above, it is seen that lengthening or shortening of a planetary-day or apparent deceleration or apparent acceleration of spin speed has no relation to variations in real spin speed of a planet. Spin motion of a planet can only accelerate (other than in cases, where the original spin motion of a planet is in opposite direction to its natural spin motion). Magnitude of a planet's spin motion depends on magnitude of central force, its absolute linear speed, curvature of its orbital path and effective diameter of the body. Curvature at different points along a planet's orbital path varies. Such variations are bound to vary spin acceleration of the planet on periodical basis. Other than these constant factors (in stable orbital motion), there are no external factor that may effectively slow down a planetary body's spin motion.

All arguments, applicable to spin motion of a planetary body, are also applicable to spin motion of a central body. In this case, central body has to be regarded as a planetary body with respect to each of the planetary body in the planetary system and all other bodies in the neighbourhood. Spin motion of the central body will be resultant of all spin motions provided by these bodies. A central body develops spin motion about one of its diameter perpendicular to the plane of its own orbital path about galactic centre. Central body of a planetary system is under central force towards galactic centre due to gravitational attraction towards all other bodies in a galaxy. This central force, in conjunction with central body's absolute linear speed, contributes larger share of central body's spin motion about its diameter, perpendicular to its orbital plane.

A central body acts as an orbiting body about each of its planets. Central forces, with each of these planets, create additional spin motions in central body. If there are more than one planetary body, about a central body, spin speed of the central body will be the resultant of spin speeds produced by all its planetary bodies and spin speed due to its own orbital motion. A stable central body cannot accommodate planets in orbital planes, differing from its own orbital plane. If a planet pairs up with a central body in a different plane, central force between them will have additional component acting on the planet to modify its orbiting parameters. Gradually they will fall in line to orbital paths in same plane. Hence, in a planetary system, there is only one stable orbital and spinning plane, common to all bodies in the system. Central body and all planets in the system have their spin axes perpendicular to this plane. Uneven distribution of mass in bodies of collective system may introduce smaller individual movements (periodical or otherwise) of these bodies within small limits.

Terrestrial solar day:

Following approximate calculation, in case of earth, may illustrate the conclusion of this article. Deflection of perihelion of apparent orbital path of earth, from its outer datum point, is ignored. Quantum of compensation for apparent spin motion of earth is determined from observation. Hence, it naturally includes variations produced by earth's spin acceleration. But in the following illustration, it is assumed that apparent displacement due to spin acceleration is not taken into account. Original error in compensation, mentioned below for illustration, is a hypothetical case. From data given in data sheets available on www;

Time, earth spends in its orbital path on the outer side of median path = 16044057.3 sec

Mean distance between sun and earth when earth is in the outer half-apparent-orbit = 147818817035 m

Mean linear velocity of earth when on the outer half-apparent-orbit = 269283 m/sec

γ_{out} by equation (12) = $3.3156037959876404886474039561728 \times 10^{-15}$ rad/sec^2

Clockwise angular displacement in one year = 0.42673772857357129379337181144996 rad

Time, the earth spends in its orbit on the inner side of median path = 15514375.6 sec

Mean distance between sun and earth when earth is in the inner half-apparent-orbit = 150298817035 m

Mean linear velocity of earth when on the inner half-apparent-orbit = 239356 m/sec

γ_{in} by equation (13) = $3.6080750843543127958492933196257 \times 10^{-15}$ rad/sec^2

Anticlockwise angular displacement in one year = 0.43422435011145834042386045362443 rad

Resultant angular displacement due to real spin acceleration in one year (anti-clockwise)

= 0.43422435011145834042386045362443 – 0.42673772857357129379337181144996

= 0.0074866215378870466304886421740419 rad

This is the result of an approximate calculation, taking earth and sun as the only members of a planetary system. Earth's satellite, the moon, and other planets in solar system also cause certain resultant spin motion of the earth that needs to be added to the above. However, we shall proceed with calculation for a planetary system, considered above.

Let us take that (hypothetical) compensation provided for apparent spin motions of earth

= 0.007486622704626809348948597965335 rad / year

Part of compensation used for real spin motion = Resultant displacement in one year (anti-clockwise) = 0.0074866215378870466304886421740419 rad / year

Uncompensated discrepancy between apparent and real spin displacement in one year

= Compensation provided for apparent spin motions − Resultant displacement in one year (anti-clockwise) $= 1.16673976271845995579133499216544 \times 10^{-9}$ rad.

This yearly discrepancy is added to the apparent angular displacement in a solar day on earth. Length of a terrestrial solar day increases by time corresponding to angular displacement of earth's spin motion by $1.16673976271845995579133499216544 \times 10^{-9}$ rad

Rotational speed of earth = $7.29212351699037472369584370103408 \times 10^{-5}$ rad/sec

Increase in length of a day in one year

$= 1.166739762718459955791334992165 \times 10^{-9} \div 7.292123516990374723695843701034 \times 10^{-5}$

= 0.000016 sec

Accumulated increase in length of a day in 100 years = 1.6 millisec.

Conclusion:

Use of relative reference frame in celestial mechanics (for purposes other than to determine relative positions of planetary bodies) prevents us from realising true nature of orbital motions and the cause of planetary spin motion. Spin motion of a planetary body is a natural outcome of perturbations in its path, which produce its orbital motion. Additional work, required to produce a planetary body's spin motion, is derived from a component of its radial momentum (caused by central force on it). A planetary (and its central) body continues to accelerate in spin motion throughout its life in its stable orbital path, until it will disintegrate under tidal stress. This gradual destruction of planetary systems makes sure that no cosmic system of bodies has infinite life and causes cyclic creation and destruction of macro matter bodies in nature.

Orbital characteristics of a planetary body determine magnitude and direction of body's spin acceleration. A planetary body may spin in forward or rearward direction or it may have no spin motion at all. All planetary bodies and their central body, in a planetary system, spin in their common orbital plane (with their spin axes perpendicular to orbital plane). Concentration of spin-effort towards rear part of equatorial region causes higher spin speed to equatorial region of all large planetary bodies with fluid outer cover.

In addition to their real spin motions, all planetary bodies have apparent spin motions related to characteristics of observer. Average length of a planetary (solar) day will remain constant only during the period, when there is no discrepancy in adequate compensation provided for its apparent spin motion. There is no (real) physical action involved. Continuous spin acceleration of a planetary body gradually widens difference between planetary-rotational day and planetary-solar day. Hence, to maintain constant length of a planetary body's solar day, it is necessary to vary compensation to apparent spin motion also accordingly. Under-compensation of apparent spin motion produces apparent lengthening of average planetary-solar day and over-compensation of apparent spin motion produces apparent shortening of average planetary-solar day. It is incorrect to attribute lengthening of terrestrial-solar day to slowing down of earth's spin speed. An apparent variation in the length of a terrestrial-solar day is directly attributable to inaccurate magnitude of compensation provided for earth's apparent spin motion.

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