# PLANETARY SPIN

According to 'MATTER (Re-examined)'

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*Abstract:* A part of action by 'central force' between planetary and central bodies causes their spin motions. All macro bodies in planetary systems develop mean accelerating spin motion. Depending on their orbital parameters, planets and central bodies may spin forward, rearward or, in rare cases, may have no spin motion at all. All macro bodies in a planetary system tend to spin in common orbital plane. Angular accelerations of orbiting macro bodies continue indefinitely until centrifugal actions disintegrate planets and planetary system. In an orbiting macro body, consistency of its matter-content and radial size determines relative spin speeds at different parts. Equatorial region of all very large orbiting macro bodies spin faster than their polar regions 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 sun.

*Keywords:* Terrestrial spin, planetary spin, planetary orbit, solar system, terrestrial-day.

Most celestial macro bodies have certain rotary motions along with their linear motions and gyroscopic precession. Major part of this rotary motion is apparent only when considered with the body's central axis in static state. In rotary motion of a body, diametrically opposite points on it needs to move in opposite linear directions. Due to very high linear speeds of celestial bodies, every point on them moves in the direction of their linear motion. Small differences in linear speeds of diametrically opposite points on the body produce real rotary motion of the body. This article deals only with actions that cause these small differences in linear speeds, which produces real rotary motion of the body in the space about its central axis that is in linear motion along with the body.

In case of (artificial) satellites, spin motion is often attributed imaginary 'frame dragging' by earth. As earth rotates, it is assumed to gently drag functional entities 'space' and 'time' along with it. This imaginary action is assumed to rotate satellites in same direction as earth's rotation. Celestial macro bodies, including satellites, are real physical entities. Imaginary efforts cannot physically affect real entities. Real efforts are required to spin real entities. 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 macro 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 illusory entities cannot produce mechanical motions of real macro bodies. There is a definite mechanism that spins planetary bodies and it is related to their orbital motion. This article attempts to give a brief but logical explanation to phenomenon of planetary spin, as given in book, 'MATTER (Re-examined)' [1]. Same explanation is valid for spin motions of all central and satellite bodies also.

For details, kindly refer to reference [1]. Figures, in this article, are not drawn to scale. They are depicted to highlight points presented.

## Planetary orbital motion:

Although planetary bodies appear to move in orbital paths around a central body, in reality, they move along with central body. With respect to absolute reference, path of planetary body is wave-like, along central body's path. Planetary body periodically moves to front and to rear of central body [2]. Present 'planetary laws' are derived for their apparent motion about a static central body.

In figure 1, a small part of central body's curved path is shown by grey line. Black wavy-line shows path of a planetary body about central body. Central body and planetary body are shown by black circles and their future positions are shown by grey circles. In this sense, a planetary body orbits around center of central body's curved path (galactic centre). Wave pattern in its path is caused by presence of central

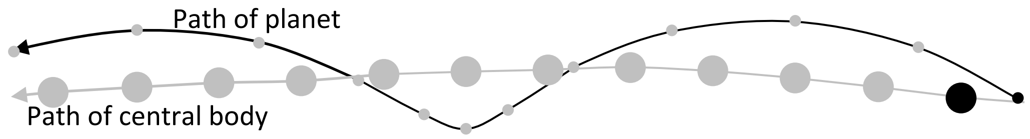


Figure 1

body. [Difference in shapes of paths on either side of median path, in figure, is due different scales used].Two consecutive (semi-circular) segments of these perturbations appear like orbital motion around a static central body. 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 central body. In real orbital motion, both central and planetary bodies move about a common median path.

## Action of 'central force':

In this article, all actions on planetary body due to its inherent inertial motion are credited to linear motion (additional work in its matter-field, attained before entering stable orbital path). All actions due to 'central force' are credited to radial motion (additional work invested its matter-field) towards central body. A macro body is defined by measurements of space, occupied by its matter-content and matter-field. Due to inertia of associated universal medium, a free macro body tends to move in a straight-line. While inertia maintains a moving planetary body in its straight-line motion, it is the 'central force' between planetary and central bodies (by separate actions on each of them) that changes direction of planetary body's linear motion and produces its spin motion. Although gravitational action on each macro body is separate, when actions on central and planetary bodies are considered together, they provide 'central force' of apparent attraction between them.

Although there are differences in magnitudes of additional work, introduced by 'central force' in different planes in matter-field of planetary body, resultant action of 'central force' continues towards central body. As magnitude of additional (radial) work, in planetary body's matter-field increases, it continuously accelerates to increase radial velocity towards central body, until its matter-field is saturated with additional (radial) work in the direction considered. Magnitude of additional (radial) work at saturation level corresponds to absolute linear speed of planetary body. Higher the absolute linear speed of planetary body, lower is the saturation limit. In saturated state, magnitudes of additional (radial) work, introduced into planetary body's matter-field and additional work lost from it, due to forward displacement of planetary body, balance each other. Changes in magnitude of additional (radial) work due to changes in distance between macro bodies are ignored. Difference in magnitudes of additional (radial) work in forward and rearward hemispheres of planetary body shifts its centre of gravity to rear. Shift of centre of gravity from centre of matter-content of a free body causes part of 'central force' to act as a couple and spin planetary body in the plane of its orbital motion. Axis of spin is perpendicular to orbital plane. Since all macro bodies in a planetary system have a common orbital plane, this phenomenon ensures that all macro 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 effort in its own direction and plane, to produce resultant magnitude and direction of macro 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 distortions in universal medium. 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 macro body. Certain magnitude of original work, invested in a macro body's matter-field maintains its integrity. Additional work, invested by external efforts, maintains its linear motion in a straight line at constant linear speed and maintains its spin motion at constant angular speed and direction.

Original additional work, associated with a planetary body, was invested into its matter-field by external efforts (forces), including gravitational attraction towards central body, before its entry into stable orbital path about central body. Additional external effort is required to change its state of constant motions after it has entered into stable orbital path. These changes convert inherent linear motion of planetary body (in straight line) to its linear motion along curved orbital path.

We shall consider only those additional distortions (work), introduced into planetary body's matter-field, by external efforts to change its state of motion (after its entry into stable orbital path), to transform its linear motion in straight-line into motion along curved paths as required for orbital motion. Further, we shall limit our investigation to magnitude of spin acceleration of a planetary body, when it is at either of its orbital datum points. At datum points, spin accelerations experienced by planetary body is of highest magnitude. Magnitudes of spin accelerations at other points on orbital path depend of relative positions of planetary and central bodies and they are less than magnitudes of spin accelerations at datum points.

As per calculations on actions by 'central force', magnitude of additional (radial) work invested into matter-field of a planetary body at datum points in its orbital path [1];

$$\begin{pmatrix}\text{Magnitude of total additional (radial) distortions}\\ \text{in forward hemisphere of planetary body}\end{pmatrix} = \frac{3MGm}{4r^3D^2V}\times\frac{5r^4}{12} = \frac{5MGmr}{16D^2V} \quad \textbf{(1)}$$

$$\begin{pmatrix}\text{Magnitude of total additional (radial) distortions}\\ \text{in rearward hemisphere of planetary body}\end{pmatrix} = \frac{3MGm}{4r^3D^2V}\times\frac{11r^4}{12} = \frac{11MGmr}{16D^2V} \quad \textbf{(2)}$$

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 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 matter-content) cause planetary body's radial motion towards central body. Left-over part pf (radial) work in matter field about rear hemisphere of planetary body produces torque about centre of matter-content.

$$\begin{pmatrix}\text{Total left-over (radial)}\\ \text{additional work}\end{pmatrix} = \begin{pmatrix}\text{(Radial) additional work}\\ \text{in rear hemisphere}\end{pmatrix} - \begin{pmatrix}\text{(Radial) additional work}\\ \text{used for radial motion}\end{pmatrix}$$

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

Radial additional work $5MGmr \div 8D^2V$ in rear hemisphere of planetary body acts to produce its radial motion towards the central body and remaining additional work $3MGmr \div 8D^2V$ acts to spin the planetary body. Direction of radial motion, in relation to planetary body's linear motion, varies throughout orbital path. Hence, magnitude and direction of torque produced by additional (radial) work depend on relative position of planetary and central bodies in their orbital paths. However, with respect to spin axis of planetary body (perpendicular to orbital plane), direction of torque changes every half of apparent orbit. For whole period of each half part of apparent orbit (one curved segment of real orbital 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 real 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, $O_1O_2$ $O_3$ P, shows part of real orbital path of planetary body, with arrow in the direction of its linear motion. Uneven sizes of segments of real orbital path on either side of median path are due to difference in scales used for horizontal and vertical coordinates in the drawing. Practically, parts of segments of real orbital path on both sides of median path are almost similar. (Vertical) thickness of shaded regions shows relative magnitude of torque on planetary body at any point on its real orbital path. For directions of motion of central and planetary bodies as shown in the figure, when planetary body is on outer side of median path (moving from $O_1$ to $O_2$), it experiences clockwise torque and when it is on inner side of median path (moving from $O_2$ to $O_3$), torque is anti-clockwise, as shown in figure 3.

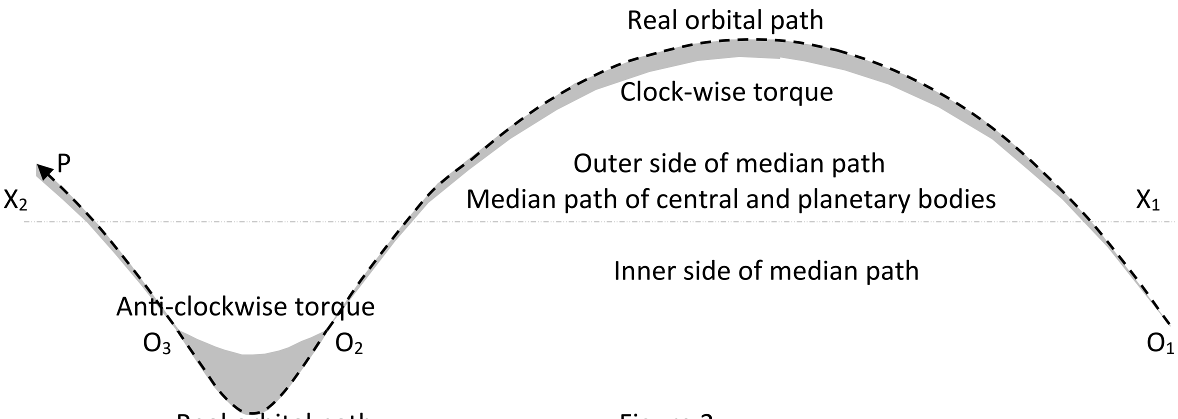


Figure 2

Points $O_1$, $O_2$, $O_3$, etc. are situated very near to median path. At these points, 'central force' and hence planetary body's radial motion is co-linear with its linear motion. At point $O_2$, 'central force' acts in opposite direction to planetary body's linear motion. Action of 'central force' is purely decelerates planetary body in its linear motion. At points, $O_1$ and $O_3$, 'central force' acts in same direction as linear motion of planetary body. Action of 'central force' is purely accelerates planetary body in its linear motion. At these points in real orbital path, centre of matter-content and centre of action of 'central force' (centre of gravity) of planetary body are situated on the line connecting it to central body. Whole of 'central force' acts through centre of matter-content. At these points, planetary body experiences no torque but has only radial acceleration or deceleration due to 'central force'. At all other points on real orbital path, 'central force' has two components; one component causes planetary body's acceleration towards or deceleration away from central body and another component causes clockwise or anti-clockwise torque on planetary body. Relative magnitudes of these components vary and depend on relative positions of central and planetary bodies.

Since planetary body is large and made of composite materials, it cannot attain constant spin speed appropriate to torque on it [produced by additional (radial) work in its matter field], instantaneously. Instead, spin-component of additional (radial) work is stored in planetary body's matter-field as compression energy, which is gradually converted to rotational kinetic energy. Since direction of 'central force' on planetary body is towards the central body, direction of additional work (producing spin motion) is towards central body and it is applied on rear hemisphere of planetary body. As planetary body develops spin motion, this additional work is distributed throughout its matter-field in various directions. Additional work (spin) is continuously replenished by 'central force'. Thus, irrespective of development of spin motion by planetary body, additional work (producing spin acceleration) is augmented at a rate related only to 'central force' and its relative direction to linear motion.

## Spin motions of a planetary body:

Once a planetary body has settled into real orbital path (apparent orbit around) about central body, both macro bodies develop spin motions about parallel axes, which are perpendicular to their (common) orbital plane. If planetary body was already spinning before it entered into its orbital path, spin motion is gradually modified towards spin speed and direction of spin as required by inertial efforts, to suit present conditions. 'Absolute spin motion' of a macro body is with respect to universal medium in space. It is the result of additional (spin) work invested into its matter field.

Development of absolute spin motion requires effort and is usually produced by action of 'central force'. '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 change of reference. While considering planetary spin motions, currently, we use both, absolute and apparent 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 matter-field of planetary or central body by 'central force', creates its absolute spin motion. Magnitudes and directions of absolute spin acceleration depend on magnitude and directions of absolute torque on planetary body. They are with respect to static universal medium (absolute reference) in space.

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

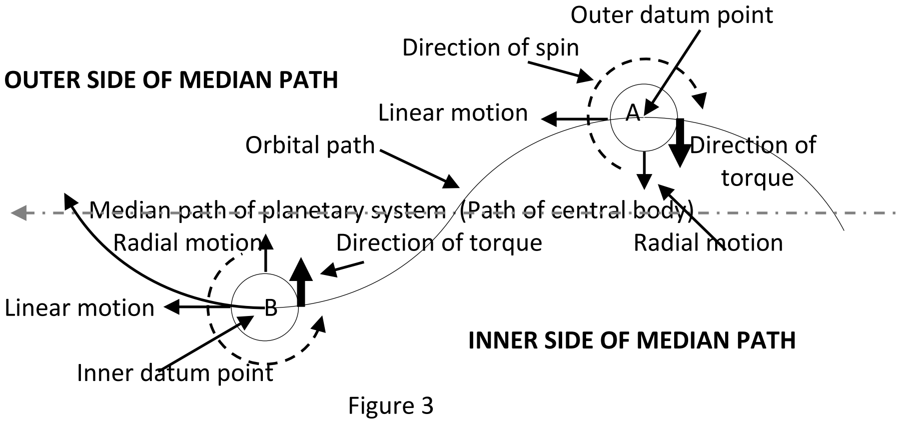


Figure 3

Due to changes in relative direction between direction of 'central force' and direction of linear motion of 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 of 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 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. Stored spin-component of additional (radial) work is gradually converted into kinetic energy of spin. 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 compressibility and consistency of its body-matter. 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 relative direction) of spin-component of additional (radial) work, required to maintain planetary body's spin acceleration, in magnitude and direction.

As planetary body moves about its central body, for every completed apparent orbit, action of 'central force' on it is towards median path; in the direction towards galactic center for half-duration of apparent orbit (shown in figure 3, position A). Direction of torque on planetary body during this period is clockwise (as shown in figure by thick short arrow), in angular direction opposite to orbital motion about 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 action of 'central force' is in direction away from 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 figure by thick short arrow), same angular direction as orbital motion about '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 inner datum point to median path.

Since spin accelerations in outer half of apparent orbit and inner half of apparent orbit are in opposite directions, magnitudes of angular displacements produced by them during each half-period of apparent orbit are in opposite directions. If it is clockwise, when planetary body is on outer side of median path, it is anti-clockwise, when planetary body is inside 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) it may not have a resultant spin motion at all.

Spin acceleration in outer half of apparent orbit is in opposite angular direction to planetary body's orbital motion around galactic centre. Spin acceleration in inner half of 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 duration it spends in either side of median path. In outer half of apparent orbit, planetary body travels at a greater absolute linear speed but distance travelled is much greater (from $O_1$ to $O_2$ in figure 2). In inner half of apparent orbit, planetary body travels at a lower absolute linear speed but distance travelled is much shorter (from $O_2$ to $O_3$ in figure 2).

Smaller planets and satellites may be solid throughout. Medium sized planets and satellites may have thin outer crust in solid state. Otherwise, all large macro bodies are fluid in composition. Alternating spin accelerations of them are effectively dampened by churning of fluid parts. 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 of planetary body.

Direction of spin motion depends on 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 and difference in time spend on either side of median path become less. Difference between clockwise and anti-clockwise spin accelerations reduces. In case, spin displacements in either direction are equal, planetary body will have no resultant (absolute) spin motion at all. At very low eccentricity of apparent orbit, clockwise (counter-orbital) spin motion, produced on 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, they also exert 'central forces' on planetary body to produce its spin motions. Average spin motion of a planetary body is resultant of all torques produced on it by 'central forces' due to all other external macro bodies.

Spin acceleration of a planetary body is caused by 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, continues to accelerate in spin motion indefinitely. Energy for spin motion is derived directly from its kinetic energy due to action of 'central force'. Development of spin motion does not affect planetary body's linear motion. Perpetual spin accelerations of planetary bodies ultimately lead towards their disintegration under centrifugal stress. This phenomenon prevents eternalness of planetary systems in nature and contributes towards re-cycling 3D matter to reduce universal entropy.

Exemptions to above explanations may be observed in following cases. In case, a planetary body already had a spin motion (before entering into its orbital path) in opposite direction to that is created by its orbital motion, it will first slow down its spin motion to a stop and then reverse as directed by torque on it. Spin motions in other directions also are 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. Planetary bodies with spin motions in planes other than their orbital plane are relatively new additions to planetary systems. (Disregarding its initial spin-parameters), time spend by a planetary body in planetary system may be estimated from its current spin speed, orbital-parameters and body-parameters.

### Unequal spin motion of a planetary body:

Additional works, producing spin accelerations, are concentrated towards equatorial (at rear) regions of a planetary body. Hence, equatorial region of planetary body tend to move first and (due to integrity of macro body) gradually carry rest of macro body along with it. How fast rest of macro body attains same spin speed as equatorial region depends on rigidity and consistency of its matter-content.

Usually, all planets are spherical shape. Action of additional (spin) work is concentrated at its rearward equatorial region. Since parts of a solid body cannot have considerable relative motion between them, action of additional work at one part is transmitted to other parts very fast and whole of macro 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 rearward equatorial region, where additional (spin) work is concentrated moves first and rest of macro body gradually develops appropriate spin motion to follow equatorial region. More viscous a planetary body is, less delay in following up. In less viscous macro bodies, there is always a delay in spin motion of rest of it. In other words, equatorial region of a fluid planet leads other parts in planetary spin motion. All very large celestial bodies are in fluid state or have fluid outer surfaces. Therefore, equatorial regions of all large macro 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 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 planetary body appears to revolve around its central body in circular/elliptical path, it makes one apparent rotation about its axis during every apparent revolution around central body. Apparent spin motion of 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 planetary body. Only in relative terms, planetary body appears to have turned through one revolution with respect to a surface-point on central body. With respect to absolute reference (universal medium/space) planetary body does not rotate at all. Apparent rotation of planetary body, which appears when it is assumed to orbit around a central body in closed geometrical path, is its apparent spin motion.

Direction of apparent spin motion is such that a surface-point on planetary body, away from central body, appears to move in an angular direction opposite to orbital motion of planetary body. In case of planetary bodies, which have real spin motion in direction of their orbital motion, apparent spin motion is in opposite angular direction to its real spin motion. Spin speed of planetary body appears lesser in magnitude than its real spin speed by magnitude of its apparent spin motion. If apparent spin motion is equal to real spin motion, planetary body appears to have no spin motion at all. That is: same face of planetary body remains permanently towards 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 planetary body appears greater in magnitude than its real spin speed by magnitude of its apparent spin motion.

Figure 4 shows relative positions of a spinning planetary body and its central body, one planetary-day apart. Arrow ED is a small part of curved median path of 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 same macro bodies at same time on following (planetary) day. Lines PC and $P_1C_1$ join centers of macro bodies. $H_1$ shows position of a reference surface-point on planetary body, facing a reference surface-point on central body, situated at $C_1$. H is position of surface-point $H_1$ on planetary body, at same time on following (planetary) day.

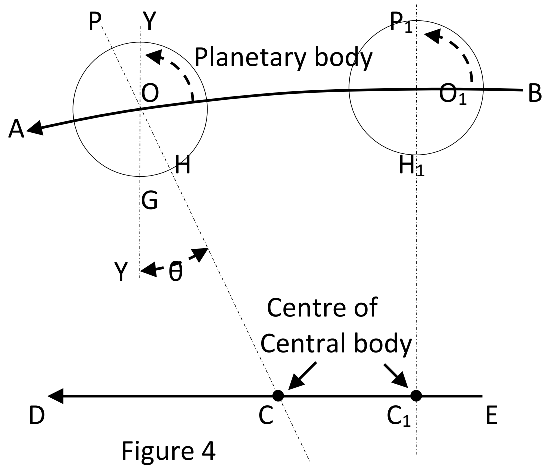

Figure 4

A planetary-day is the time elapsed between two subsequent instants when surface-point $H_1$ faces central body. For this, surface-point $H_1$ has to be at position H 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 is a constant, in the direction shown by dashed arrows (anti-clockwise, in the figure). By the time central body moves from $C_1$ to C, planetary body moves from $O_1$ to O. In the mean time, planetary body would have turned (in its real spin motion) through $2\pi$ radians, which is its rotation-day. This takes reference surface-point, $H_1$, to position G in figure 4. Although planetary body has rotated through one full turn ($2\pi$ radians), in order to complete a planetary-day, it has to have additional angular displacement from G to H. Surface-point $H_1$ has to reach position H instead of position G. Angle, θ, is additional angular displacement required every day to maintain constant length of planetary day. This deficiency of angular displacement is apparent because planetary body only appears to have lost its spin motion through angle, θ, relative to 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 central body and due to its orbital motion around 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 central body; for a planetary body, spinning at a constant angular speed, above discrepancies produce constant difference between planetary-day and rotation-day. In order to compensate for this difference, planetary body has to have an additional angular displacement equal to θ, every day. If compensation provided for additional angular displacement of planetary body in a planetary-day, is equal to apparent angular displacement, θ, lengths of planetary-days remain constant. Variation in difference between planetary-day and its rotation-day appears to vary length of 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 rotation-day is compensated at one stage, it is bound to re-appear shortly. Since magnitude of this difference is too small, it may be some planetary-years before it is realised. Periodical corrections are required to keep length of planetary-day a constant.

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

## Real planetary spin motion:

Figure 5 shows relative positions of the sun and the earth in our solar system during one day. Sizes and distances in the figure are not shown to scale. Sun, the central body of our solar system, is assumed to move along the arrow ss. $S_0$, $S_1$, …….., $S_{12}$ show positions of the sun at an interval of 2 hours each. Curved line ee with an arrow shows part of earth's orbital path about sun's mean path during one day. $E_0$, $E_1$, ………, $E_{12}$ show positions of earth relative and corresponding to positions of the sun at $S_0$, $S_1$, ……., etc.

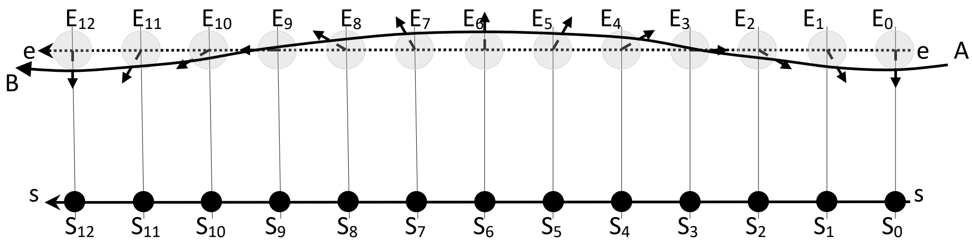


Figure 5

Consider a fixed point on the equator of earth. Direction of this point relative to the sun is shown by dashed arrow. Real path of this point in space is shown by the curved line AB. The point does not trace a circular path but traces a wavy path about mean path of the earth. Its displacement is always forward (to the left in the figure) and never in opposite direction. Therefore, every point on earth moves only in forward direction. As diametrically opposite points on earth's equator do not move in opposite directions, earth does not really rotate in space.

However, this point traces an apparent circular path with respect to earth's central point that is moving at the linear speed of earth. This point directly faces the sun once every day and produces the illusion that 'days and nights' are caused by rotation of earth. From a point on the equator of earth, the sun appears to revolve around the earth and thus providing alternating day and night. On the other hand, by considering heliocentric solar system as whole, changes of day and night appears as a result of earth's rotation about its central axis.

## 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 parameters of central or planetary bodies modify inertial actions on them and thereby alter spin speeds of both. If these macro bodies are massive and spinning at relatively high speeds, they will also have property of gyroscopic precession. Depending on external effort's point of application (by collision with another body) inertial action may invoke gyroscopic precession on them. Gyroscopic precession on spinning macro bodies causes wobbling of spin axes of constituent macro bodies in multi-body systems. In extreme cases 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 equal and opposite external effort on it. 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 about a central body in nearby orbits, moving in the same direction and they are near enough, they may gradually approach each other under gravitational attraction. Since their momenta towards each other are relatively small, they 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 parameters and effective diameters. Collision between two spinning macro bodies (with similar spin direction) is bound to reduce or nullify each other's spin motion. Due to opposite linear directions of motion of touching surfaces, most parts of these planetary bodies will be torn off. Fragments flying away from the site of collision and moving in same direction as other macro bodies of planetary system at the right linear speed could form a dust belt about central body, moving in a common orbital path. It is possible for remnant planetary 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 its apparent spin motion. 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 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 exist. 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 planetary body can only accelerate (other than in cases, where the original spin motion is in opposite direction to natural spin motion). Magnitude of a planetary body's spin motion depends on magnitude of 'central force', its absolute linear speed, curvature of its orbital path and its effective diameter. Curvature at different points, along a planet's orbital path, varies. Such variations are bound to vary spin acceleration of planetary body 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 central body. In this case, central body has to be regarded as planetary body with respect to each of planetary bodies in planetary system and all other macro bodies in neighbourhood. Spin motion of central body is resultant of all spin motions provided by these macro bodies. Central body develops spin motion about one of its diameter perpendicular to plane of its own orbital path around galactic centre. Central body of a planetary system is under 'central force' towards galactic centre due to gravitational attraction towards all other macro bodies in 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 orbiting body about each of planetary bodies in the system. 'Central forces', with each of planetary bodies, create additional spin motions in central body. If there are more than one planetary body, about a central body, spin speed of central body is 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 planetary bodies in orbital planes, differing from its own orbital plane. If a planetary body pairs up with a central body in a different plane, 'central force' between them will have additional component acting on planetary body to modify its orbiting parameters. Gradually their orbital paths will coincide in same plane. Hence, in a planetary system, there is only one stable orbital and spinning plane, common to all macro bodies in the system. Central and planetary bodies in the system have their spin axes perpendicular to this plane. Uneven distribution of matter-content in macro bodies of collective system may introduce smaller individual movements (periodical or otherwise) within small limits.

## Conclusion:

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 disintegrates under centrifugal stress. This gradual destruction of planetary systems makes sure that no cosmic system of macro 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 its 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 (and central) 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 remains 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, correspondingly. Under-compensation of apparent spin motion produces lengthening of average planetary solar day and over-compensation of apparent spin motion produces shortening of average planetary solar day. It is incorrect to attribute lengthening of terrestrial solar day to slowing down of earth's spin speed. Apparent variation in length of a terrestrial solar day is directly attributable to inaccurate magnitude of compensation provided for earth's apparent spin motion.

## Reference:

[1] Nainan K. Varghese: *MATTER (Re-examined)*. http://www.matterdoc.info

[2] Nainan K. Varghese: *Shape of orbital path*: http://vixra.org/pdf/1311.0018v1.pdf

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