

# PLANETARY SPIN

According to 'MATTER (Re-examined)'

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*Abstract:* A part of the action by 'central force' between planetary and central bodies causes their spin motions. All macrobodies in planetary systems develop a mean accelerating spin motion. Depending on their orbital parameters, planets and central bodies may spin forward, rearward, or, in rare cases, may not spin at all. All macrobodies in a planetary system tend to spin in a common orbital plane. Angular accelerations of orbiting macrobodies continue indefinitely until the centrifugal actions disintegrate the planets and the planetary system. In an orbiting macrobody, consistency of its 3D matter-content and radial size determines relative spin speeds at different parts. Equatorial regions of all very large orbiting macrobodies 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 for Earth's apparent spin motion about the Sun.

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

## Introduction:

Most celestial macrobodies have certain rotary motions along with their linear motions and gyroscopic precession. A major part of this rotary motion is apparent only when considered with the body's central axis in a static state. In the rotary motion of a body, diametrically opposite points on it need to move in opposite linear directions. Due to the 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 produce real rotary motion of the body in space about its central axis that is in linear motion along with the body.

In the case of (artificial) satellites, spin motion is often attributed to an 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 the satellites in the same direction as Earth's rotation. Celestial macrobodies, 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 spin only (almost) in their orbital plane. Spin speed is related to orbital parameters and the size of the macrobody. These common behaviours are neither coincidences nor produced by haphazard actions of external efforts nor other macrobodies in the vicinity. Imaginary causes or illusory entities cannot produce mechanical motions of real macrobodies. 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 of the phenomenon of planetary spin, as given in the book, 'MATTER (Re-examined)' [1]. The same explanation is also valid for spin motions of all central and satellite bodies. 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 the central body. With respect to absolute reference, the path of a planetary body is wave-like along the central body's path. The planetary body periodically moves to the front and to the rear of the central body. Present 'planetary laws' are derived for their apparent motion about a static central body.

In Figure 1, a small part of the central body's curved path is shown by a grey line. Black wavy-line shows

the path of a planetary body about the central body. The 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 the centre of the central body's curved path (galactic centre). The wave pattern in its path is caused by the presence

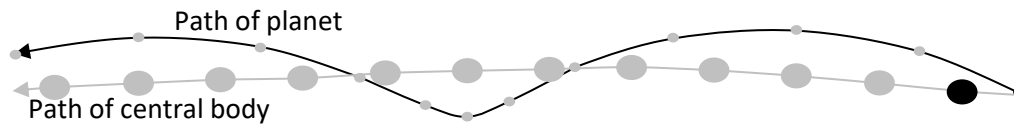


Figure 1

of the central body. [The difference in the shapes of paths on either side of the median path, in the figure, is due to 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 a 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 a planetary body due to its inherent inertial motion are credited to its linear motion (additional work in its matter-field, attained before entering a stable orbital path). All actions due to the 'central force' are credited to the radial motion (additional work invested in its matter-field) towards the central body. A macrobody is defined by the measurements of space occupied by its 3D matter-content and matter-field. Due to the inertia of the associated universal medium, a free macrobody 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 the planetary and central bodies (by separate actions on each of them) that changes the direction of the planetary body's linear motion and produces its spin motion. Although gravitational action on each macrobody is separate, when actions on the central and planetary bodies are considered together, they provide a 'central force' of apparent attraction between them.

Although there are differences in the magnitudes of additional work introduced by the 'central force' in different planes in the matter-field of a planetary body, the resultant action of the 'central force' continues towards the central body. As the magnitude of additional (radial) work in a planetary body's matter-field increases, it continuously accelerates to increase its radial velocity towards the central body until its matter-field is saturated with additional (radial) work in the direction considered. The magnitude of additional (radial) work at the saturation level corresponds to the absolute linear speed of the planetary body. The higher the absolute linear speed of a planetary body, the lower the saturation limit. In a saturated state, magnitudes of additional (radial) work introduced into the planetary body's matter-field and additional work lost from it, due to the forward displacement of the planetary body, balance each other. Changes in the magnitude of additional (radial) work due to changes in distance between macrobodies are ignored. The difference in the magnitudes of additional (radial) work in the forward and rearward hemispheres of a planetary body shifts its centre of gravity to the rear. Shift of the centre of gravity from the centre of 3D matter-content of a free planetary body causes part of the 'central force' to act as a couple and spin the planetary body in the plane of its orbital motion. The axis of spin is perpendicular to the orbital plane. Since all macrobodies in a planetary system have a common orbital plane, this phenomenon ensures that all macrobodies in a planetary system spin in their common orbital plane.

Efforts in different planes do not interfere; they act on the 3D matter-particles independently. Constituent 3D matter-particles of a macrobody are moved by each effort in its own direction and plane to produce the resultant magnitude and direction of the macrobody's motion. The matter-field of a moving macrobody contains additional work required for its original linear and spin motions. Work is stored in macrobody's matter-field in the form of additional structural distortions in its matter-field (universal medium). In this article, we shall neglect all work stored in a macrobody's matter-field for the sustenance of its stability and integrity as a single macrobody. A certain magnitude of original work invested in a macrobody's matter-field maintains its integrity. Additional work invested by external efforts maintains the macrobody's linear motion in a straight line at a 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 the central body, before its entry into a stable orbital path about the central body. Additional external effort is required to change its state of constant motion after

it has entered into a stable orbital path. These changes convert the inherent linear motion of a planetary body (in a straight line) to its linear motion along a curved orbital path.

We shall consider only those additional structural distortions (work), introduced into a planetary body's matter-field by external efforts to change its state of motion (after its entry into a stable orbital path), 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, spin accelerations experienced by a planetary body are of the highest magnitude. Magnitudes of spin accelerations at other points on the orbital path depend on the relative positions of planetary and central bodies, and they are less than the magnitudes of spin accelerations at the datum points.

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

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

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

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 the centre line (that produces equal momenta about the centre of 3D matter-content) cause the planetary body's radial motion towards the central body. Left-over part of (radial) work in the matter-field about the rear hemisphere of the planetary body produces a torque about the centre of 3D matter-content.

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

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

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

Figure 2 shows a representation of part of the real orbital path of a planetary body about its central body. Central line  $X_1X_2$  shows a small part of their curved median path. Wavy (dashed) line,  $O_1O_2O_3P$ , shows part of the real orbital path of the planetary body, with an arrow in the direction of its linear motion. Uneven sizes of segments of the real orbital path on either side of the median path are due to differences in scales used for horizontal and vertical coordinates in the drawing. Practically, parts of segments of the real orbital path on both sides of the median path are almost similar. (Vertical) thickness of shaded regions shows the relative magnitude of torque on the planetary body at any point on its real orbital path. For directions of motion of the 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 clockwise torque, and when it is on the inner side of the median path (moving from  $O_2$  to  $O_3$ ), torque is anti-clockwise, as shown in Figure 3.

Points  $O_1, O_2, O_3$ , etc. are situated very near the median path. At these points, the 'central force' and hence the planetary body's radial motion are co-linear with its linear motion. At point  $O_2$ , the 'central force' acts in the opposite direction to the planetary body's linear motion. The action of the 'central force' is purely to decelerate the planetary body in its linear motion. At points  $O_1$  and  $O_3$ , the 'central force' acts in the same

direction as the linear motion of the planetary body. The action of 'central force' is purely to accelerate a planetary body in its linear motion. At these points in the real orbital path, the centre of 3D matter-content and the centre of action of the 'central force' (centre of gravity) of the planetary body are situated on the line

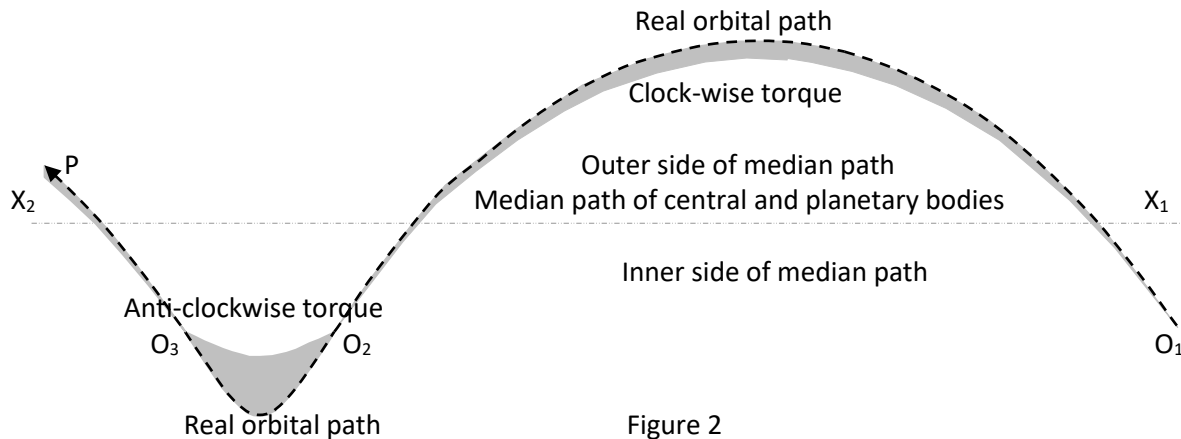


Figure 2

connecting it to the central body. The whole of the 'central force' acts through the centre of 3D matter-content. At these points, the planetary body experiences no torque but has only radial acceleration or deceleration due to the 'central force'. At all other points on the real orbital path, 'central force' has two components: one component causes the planetary body's acceleration towards or deceleration away from the central body and another component causes clockwise or anti-clockwise torque on the planetary body. The relative magnitudes of these components vary and depend on the relative positions of the central and planetary bodies.

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

### Spin motions of a planetary body:

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

Development of absolute spin motion requires effort and is usually produced by the action of the 'central force'. 'Apparent spin motion' of a planetary or central body is with respect to any (moving) reference that 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, we currently use both absolute and apparent spin motions as real. Assigning reality to an apparent spin motion and combining it with the 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 its absolute spin motion. Magnitudes and directions of absolute spin acceleration depend on the magnitudes and directions of the absolute torque on the planetary body. They are with respect to the static universal medium (an absolute reference) in space.

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

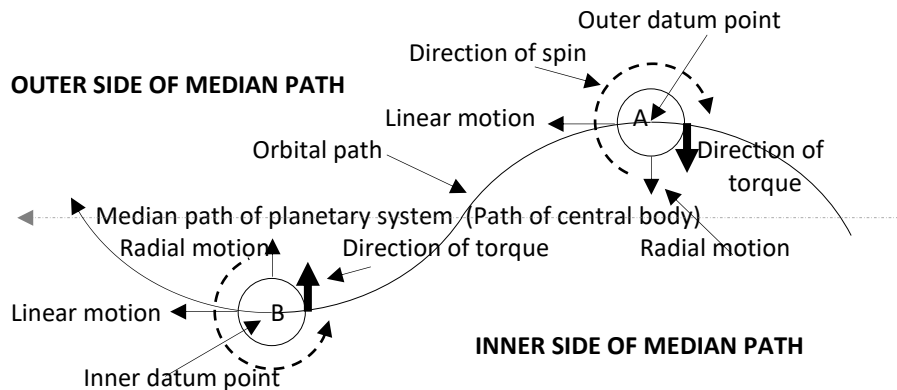


Figure 3

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

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

Similarly, for the other half of the apparent orbit, the planetary body is moving towards the median path. The direction of action of the 'central force' is in the direction away from the galactic centre for half the 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), the same angular direction as the orbital motion about the 'central body' (around the galactic centre). The planetary body develops an anti-clockwise (in positive angular direction) spin acceleration during this half of its apparent orbit, when it is moving from the median path through the inner datum point to the median path.

Since spin accelerations in the outer half of the apparent orbit and inner half of the apparent orbit are in opposite directions, the magnitudes of angular displacements produced by them during each half-period of apparent orbit are in opposite directions. If it is clockwise when the planetary body is on the outer side of the median path, it is anti-clockwise when the planetary body is inside the median path. When considering over a full apparent orbit, the planetary body may have an overall resultant angular displacement in any one direction or (in rare cases) it may not have a resultant spin motion at all.

Spin acceleration in the outer half of the apparent orbit is in the opposite angular direction to the planetary body's orbital motion around the galactic centre. Spin acceleration in the inner half of the apparent orbit is in the same angular direction as the planetary body's orbital motion around the galactic centre. Hence, the overall resultant spin displacement of a planetary body depends on the duration it spends on either side of the median path. In the outer half of the apparent orbit, the 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 the inner half of the apparent orbit, the 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).

Smaller planets and satellites may be solid throughout. Medium-sized planets and satellites may have a thin outer crust in the solid state. Otherwise, all large macrobodies are fluid in composition. Their alternating spin accelerations are effectively damped by the 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 the overall average spin acceleration of the planetary body.

The direction of spin motion depends on the orbital characteristics of the planetary body. Hence, it is quite natural for planets to spin in either direction in their orbital plane or not to spin at all. Usually, all planets tend to spin in the same direction as their orbital motion. As the eccentricity of the apparent orbit reduces, the difference in linear speeds and the difference in time spent on either side of the median path become less. The difference between clockwise and anti-clockwise spin accelerations reduces. In case spin displacements in either direction are equal, the planetary body will have no resultant (absolute) spin motion at all. At a very low eccentricity of apparent orbit, clockwise (counter-orbital) spin motion, produced on the outer side of the median path, may be greater than anti-clockwise spin motion, produced on the inner side of the median path. Such planetary bodies angularly accelerate in the opposite direction to their orbital direction. They spin in the opposite direction to their orbital motion. Should a planet have one or more satellites, they also exert 'central forces' on the planetary body to produce its spin motions. The average spin motion of a planetary body is the resultant of all torques produced on it by 'central forces' due to all other external macrobodies.

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 the spin motion is derived directly from its kinetic energy due to the action of the 'central force'. Development of spin motion does not affect the planetary body's linear motion. Perpetual spin accelerations of planetary bodies ultimately lead towards their disintegration under centrifugal stress. This phenomenon prevents the eternalness of planetary systems in nature and contributes towards the recycling of 3D matter to reduce universal entropy.

Exemptions to the above explanations may be observed in the following cases. In case a planetary body already had a spin motion (before entering into its orbital path) in the opposite direction to that created by its orbital motion, it will first slow down its spin motion to a stop and then reverse as directed by the torque on it. Spin motions in other directions are also modified over time. Original spin motion and spin motion produced by the orbital motion combine to produce wobbling of a 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 a 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 the equatorial (at the rear) regions of a planetary body. Hence, the equatorial region of a planetary body tends to move first and then (due to the integrity of the macrobody) gradually carry the rest of the macrobody along with it. How fast the rest of the macrobody attains the same spin speed as the equatorial region depends on the rigidity and consistency of its 3D matter-content.

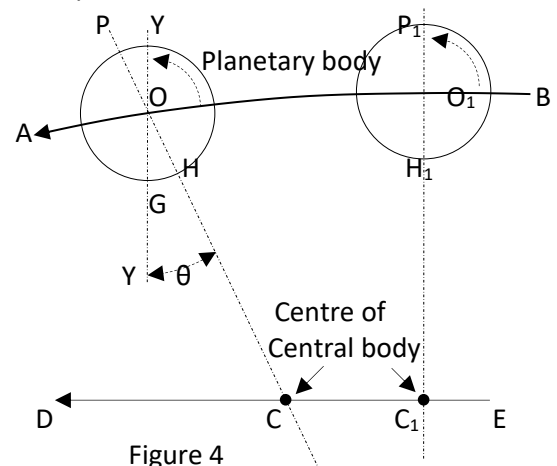
Usually, all planets are spherical in shape. Action of additional (spin) work is concentrated at its rearward equatorial region. Since parts of a solid body cannot have considerable relative motion between them, the action of additional work at one part is transmitted to other parts very fast, and the whole macrobody tends to move at the same spin acceleration. If a planetary or central body is in a fluid state or has a large fluid outer cover, its rearward equatorial region, where additional (spin) work is concentrated, moves first, and the rest of the macrobody gradually develops appropriate spin motion to follow the equatorial region. The more viscous a planetary body is, the less delay in following up. In less viscous macrobodies, there is always a delay in the spin motion of the rest of it. In other words, the equatorial region of a fluid planet leads other parts in planetary spin motion. All very large celestial bodies are in a fluid state or have fluid outer surfaces. Therefore, equatorial regions of all large macrobodies in a multi-body system have higher spin speeds 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 the central body. As a 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 the central body. Apparent spin motion of a planetary body requires no external effort or energy. A 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 the real spin motion of a planetary body. Only in relative terms, a planetary body appears to have turned through one revolution with respect to a surface point on the central body. With respect to absolute reference (universal medium/space), a planetary body does not rotate at all. Apparent rotation of a planetary body, which appears when it is assumed to orbit around a central body in a closed geometrical path, is its apparent spin motion.

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

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



A planetary day is the time elapsed between two subsequent instants when the surface point  $H_1$  faces the 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 the angular speed of the spinning planetary body be a constant, in the direction shown by 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 meantime, the planetary body would have turned (in its real spin motion) through  $2\pi$  radians, which is its rotation-day. This takes the reference surface point  $H_1$  to position G in Figure 4. Although the 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. The surface point  $H_1$  has to reach position H instead of position G. Angle  $\theta$  is the additional angular displacement required every day to maintain a constant length of planetary day. This deficiency of angular displacement is apparent because the planetary body only appears to have lost its spin motion through angle,  $\theta$ , relative to the central body. No real loss of angular displacement or spin motion of the 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 the same direction, they augment each other. If they are in opposite angular directions, they neutralise each other.

Since a planetary day is related to the apparent spin motion of the planetary body with respect to the central body, for a planetary body spinning at a constant angular speed, the above discrepancies produce a constant difference between a planetary day and a rotation day. In order to compensate for this difference, the planetary body has to have an additional angular displacement equal to  $\theta$  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,  $\theta$ , the lengths of planetary days remain constant. Variation in the difference between a planetary day and its rotation day appears to vary the length of the planetary day from that of its rotation day. Due to the constant angular acceleration of the planetary body's spin motion, even if the difference between a planetary day and a rotation day is compensated at one stage, it is bound to reappear shortly. Since the magnitude of this difference is too small, it may be some planetary years before it is realised. Periodic corrections are required to keep the length of the planetary day constant.

If additional angular displacement, added to 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  $\theta$ ), the reference point will cross surface-point H before a planetary day is completed. The length of the planetary day appears to have shortened, and the planetary body appears to be accelerating in its spin motion. If additional angular displacement, added to a planetary day, is less than the apparent angular displacements (it under-compensates  $\theta$ ), the reference point will not quite reach surface point H on completion of a planetary day. The length of the planetary day appears to have increased, and the 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 the 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.  $S_0, S_1, \dots, S_{12}$  show positions of the sun at an interval of 2 hours each. The curved line ee with an arrow shows part of Earth's orbital path about the Sun's mean path during one day.  $E_0, E_1, \dots, E_{12}$  show positions of the Earth relative to and corresponding to positions of the sun at  $S_0, S_1, \dots, S_{12}$ , etc.

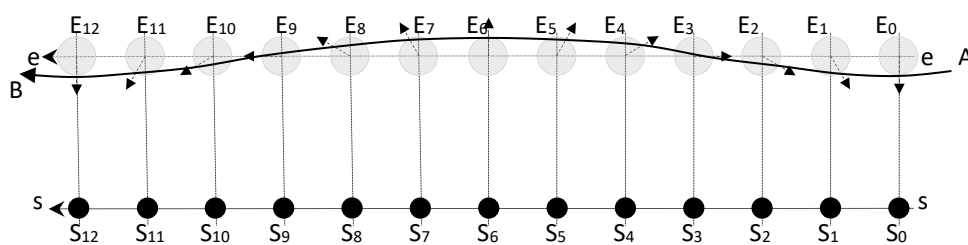


Figure 5

$E_{12}$  show positions of the Earth relative to and corresponding to positions of the sun at  $S_0, S_1, \dots, S_{12}$ , etc.

Consider a fixed point on the equator of Earth. The direction of this point relative to the sun is shown by a dashed arrow. The real path of this point in space is shown by the curved line AB. The point does not trace a circular path, but a wavy path about the mean path of Earth. Its displacement is always forward (to the left in the figure) and never in the opposite direction. Therefore, every point on Earth moves only in the 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 the rotation of the Earth. From a point on the equator of Earth, the Sun appears to revolve around the Earth, thus providing alternating day and night. On the other hand, by considering the

heliocentric solar system as a whole, changes of day and night appear 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 the parameters of the central or planetary bodies modify inertial actions on them and thereby alter the spin speeds of both. If these macrobodies are massive and spinning at relatively high speeds, they will also have the property of gyroscopic precession. Depending on the external effort's point of application (by collision with another body), inertial action may invoke gyroscopic precession on them. Gyroscopic precession on spinning macrobodies causes wobbling of spin axes of constituent macrobodies 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 the magnitude of wobbling is high, the 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 with 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. A collision between two spinning macrobodies (with similar spin directions) is bound to reduce or nullify each other's spin motion. Due to the 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 the same direction as other macrobodies of the planetary 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 a remnant planetary body of collision to spin at very low speed or even spin in the 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 the inability of additional angular displacement, currently provided to compensate for Earth's apparent spin motion, to fully compensate for its apparent spin motion. Earth's spin acceleration requires constant upgrading of the compensation required to keep the length of its solar day constant. Earth's spin acceleration continuously increases the difference between the lengths of its rotation day and solar day. In effect, as time progresses, compensation provided at one stage of history falls short to compensate the difference between the length 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 for the development of Earth's spin motion, its spin acceleration is an unknown fact. This makes the imaginary 'slowing down' of Earth's spin speed 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 the water system on Earth's surface and its core-body. Imaginary energy transfer between the 'earth-moon combine' is also assumed to slow down of earth's spin motion.

From the 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 the 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 the opposite direction to the 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 the spin acceleration of a planetary body on a periodic basis. Other than these constant factors (in stable orbital motion), there are no external factors that may effectively slow down a planetary body's spin motion.

All arguments applicable to the spin motion of a planetary body are also applicable to the spin motion of a central body. In this case, the central body has to be regarded as a planetary body with respect to each of the planetary bodies in the planetary system and all other macrobodies in the neighbourhood. The spin motion of

the central body is the resultant of all spin motions provided by these macrobodies. The central body develops spin motion about one of its diameters perpendicular to the plane of its own orbital path around the galactic centre. The central body of a planetary system is under 'central force' towards the galactic centre due to gravitational attraction towards all other macrobodies in the galaxy. This 'central force', in conjunction with the central body's absolute linear speed, contributes a larger share of the central body's spin motion about its diameter, perpendicular to its orbital plane.

A central body acts as an orbiting body about each of the planetary bodies in the system. 'Central forces', with each of the planetary bodies, create additional spin motions in the central body. If there is more than one planetary body about a central body, the spin speed of the central body is the resultant of the spin speeds produced by all its planetary bodies and the 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, the 'central force' between them will have an additional component acting on the planetary body to modify its orbiting parameters. Gradually, their orbital paths will coincide in the same plane. Hence, in a planetary system, there is only one stable orbital and spinning plane, common to all macrobodies in the system. Central and planetary bodies in the system have their spin axes perpendicular to this plane. Uneven distribution of 3D matter-content in the macrobodies of the collective system may introduce smaller individual movements (periodic 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 a '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 macrobodies has infinite life, and causes the cyclic creation and destruction of macro material bodies in nature.

Orbital characteristics of a planetary body determine the magnitude and direction of its spin acceleration. A planetary body may spin in a 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 the orbital plane). Concentration of spin-effort towards the rear part of the equatorial region causes higher spin speed to the equatorial region of all large planetary (and central) bodies with a fluid outer cover.

In addition to their real spin motions, all planetary bodies have apparent spin motions related to the characteristics of the observer. The 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 the difference between the planetary rotational day and the planetary solar day. Hence, to maintain the constant length of a planetary body's solar day, it is necessary to vary the compensation to apparent spin motion correspondingly. Under-compensation of the apparent spin motion produces lengthening of the average planetary solar day, and over-compensation of the apparent spin motion produces shortening of the average planetary solar day. It is incorrect to attribute the lengthening of the terrestrial solar day to the slowing down of Earth's spin speed. Apparent variation in the length of a terrestrial solar day is directly attributable to the inaccurate magnitude of compensation provided for Earth's apparent spin motion.

### Reference:

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