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Tides

Nainan K. Varghese*

Independent Researcher, India

***Corresponding Author:**

Nainan K. Varghese, Independent Researcher, India.

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Abstract

This article attempts to give a simple and logical explanation of tidal mechanisms based on radically different dynamics presented in the book 'MATTER Re-examined' [1]. Tides are caused by the (accelerating) actions of external efforts on a linearly moving spinning macro body. Each external effort alters the shape of the spinning macro body, separately, to produce its own set of tides. A change in shape of a spinning macro body, rather than displacement of its parts, causes tides. Displacement of ocean water in the direction of the moving tide is superficial, and it cannot produce tidal drag on earth's solid core body.

Keywords: Rotation, Tides, Tidal Mechanism, Solar System, Apparent Orbit, Real Orbit

Introduction

Present explanations of the mechanism of tides are based either on centrifugal action or on gravitational attraction. 'Centrifugal force' (due to the motion of a body in a circular path), being an imaginary effort, explanations based on its actions are not factually correct. One fundamental assumption used to derive the equation for gravitational attraction is that the whole 3D matter-content (mass) of a macro body is concentrated at its centre. This makes it illogical to assume that different parts of the same macro body (of uniform shape) have different magnitudes of gravitational attraction towards another macro body. It is also not justifiable to derive separate 'central force' and 'tide-producing force' of different magnitudes from gravitational attraction between two macro bodies. Therefore, explanations on tides, based on differences in gravitational attractions on different parts of macro bodies, are perversions of present theory on gravitational attraction.

Matter-content of a planetary body, orbiting about a central body, is associated with the 3D matter-content of the central body by 'central force'. The direction of the action of the 'central force' on the planetary body is towards the central body, and there is no other external effort on the planetary body. Every 3D matter-particle in a planetary body is attached to the central body in this way. Hence, all 3D matter-particles in a planetary body, separately and together, are at equilibrium. There can be no relative motion between them due to the 'central force'. Hence, the assumption that tides on planetary bodies are caused by different magnitudes of gravitational attraction towards the central body (and satellites) is not valid.

Apparent orbital motion of macro body about the epicentre of a system is used in some explanations. In nature, no free macro body can orbit around another moving body in a geometrically closed path. The orbital path of Earth about the sun (or that of the moon about Earth) is neither circular nor elliptical around the central body, but it zigzags about the sun's (earth's) median path in space. Hence, an explanation based on the revolution of a planetary body around an epicentre is pure imagination. It is also illogical to assume that equal tides on opposite sides on the surface of a planetary body are produced to balance a shift in 'rest mass' by the same external efforts. According to current rules of dynamics, more than one external linear effort on a rigid macro body produces only one resultant linear motion. Yet, Earth experiences distinctly separate sets of tides from 'central forces' towards the moon and sun. This clearly contradicts any explanation of tide related to the displacement of parts of a macro body in the direction of external effort. The only logical reason for greater lunar tides than the solar tides is that the action of the 'central force' between Earth and the moon is greater than that between Earth and the sun. This cannot be substantiated by current gravitational laws.

The alternative concept, presented in the book 'MATTER Re-examined', envisages a universal medium made of structure-less quanta of matter in 2D latticework formations – the 2D energy-fields. 2D energy-fields in all possible planes, together, form a universal medium that fills entire space (outside basic 3D matter-particles) without voids. It performs all actions currently assigned to apparent interactions between 3D material bodies to do away with the assumption of 'actions at a distance through empty space'. Universal medium, in and about a macro body, contains sufficient structural distortions to sustain the body's integrity and state (of motion). This part of the universal medium is the matter-field of the macro body. Actions by efforts ('forces') are performed by the transfer of structural distortions in latticework structures of the matter-field, separately in each plane. During the transfer of structural distortions in the universal medium, 3D matter-particles in the region are carried along with the structural distortions.

Transfer of structural distortions in the matter-field, in a linear direction, causes linear motion of the macro body. In the matter-field of a non-spinning macro body, latticework squares in its matter-field are symmetrical about the linear effort. Therefore, the whole of external effort is used to invest additional work in a linear direction, which causes linear motion of the macro body. In a spinning macro body, latticework squares in its matter-field are asymmetrical about the line of action of an external linear effort. Asymmetry of the latticework squares splits the action of external linear effort into linear force and torque. Hence, the action of an external linear effort on a spinning body depends not only on its magnitude but also on the symmetry of the latticework squares of its matter-field to the direction of external linear effort and on the locations of individual 3D matter-particles in the macro body. Further, this alternative concept does not recognise the pull nature of external efforts that act through empty space to pull at parts of a rotating body to create tides. In this article, all movements mentioned are with respect to an absolute reference, provided by the universal medium. Figures are not drawn to scale.

Tides

Tide means deformation in the shape of a (linearly moving or static) spinning macro body. Tides are induced by an external linear effort (or torque). Sources of external effort (or torque) or consistency of rotating macro body are immaterial. Therefore, the tide is a localised phenomenon, and it is not directly related to gravitational attraction between the central and planetary bodies, in particular. Any type of external effort can cause tides on a rotating macro body moving in a linear direction along a curved or straight-line path. Tide affects only the absolute paths of 3D matter-particles in an orbiting planetary body in space. Tide is applicable to 3D matter-particles on the central body only as much and when the central body is considered an orbiting planetary body and the planetary body as the central body. Hence, the phenomenon of tide is a product of the parameters of the orbiting planetary body alone. Its parameters may be modified by the presence of other macro bodies in the vicinity. Tide on any particular macro body is its own creation, and no external influences are involved, other than to prepare suitable conditions.

The phenomenon of tide on a free macro body is produced by the combined effect of its simultaneous linear and spin motions. Except for the external effort, tide on one macro body is not related to any other macro body. A macro body need not be a member of a planetary system to develop a tide. All that is required for the formation of a tide is the presence of an external linear effort on a linearly moving macro body that develops spin motion (or on a spinning macro body that develops linear motion). Tides on a macro body depend on its absolute motions. Since we currently have no absolute reference, it is almost impossible to determine absolute speeds of a macro body. In cases of planetary bodies, relative position in the orbital path, direction of spin axis, orbiting plane, magnitude of fluid (water) body on the surface, latitude of the point considered, any independent movements, etc., also affect the magnitudes and relative positions of tides on their surfaces. All these factors, together with influences from a number of other macro bodies in the neighbourhood, which may affect a planetary body's parameters of motion, determine the relative position and magnitude of the resultant tide at any point on the surface of a spinning planetary body.

Gravitational actions and inter-particle field efforts hold the 3D matter-particles of a macro body together. Additionally, the gravitational attraction between 3D matter-particles tends to move them towards the centre of the macro body. Gravitational action aids field efforts to integrate the constituent 3D matter-particles into a single composite macro body. With respect to a macro body, its linear and rotating motions are distinctly separate. Only an external linear effort, applied evenly on a macro body, can modify its linear motion, and only another torque (linear effort applied unevenly) can modify its rotary motion. Although an external effort may simultaneously invoke linear and rotary motion of a macro body, additional work invested in the macro body's matter-field is distinct for each of these motions.

For linear motion, work is in the form of additional linear structural distortions in the latticework structures of the matter-field and for spin motion, work is in the form of additional linear structural distortions but varying in magnitude and direction about the centre of rotation of the macro body. During the macro body's steady state, each nature of additional structural distortions produces their respective motions independently. Even at a very high linear speed of a spinning macro body, additional work corresponding to its spin motion remains latent within its matter-field and rotates the macro body about its centre of rotation. The transition period, between one steady state and another, is the macro body's acceleration stage. During the acceleration stage, external linear effort (or torque) modifies additional structural distortions in the latticework structures of the macro body's matter-field. Modifications of additional structural distortions in the matter-field, during the acceleration period involve reshaping the latticework squares in the 2D energy-fields of the body's matter-field. Modification of additional structural distortions, corresponding to each type of motion, takes

place without interfering with other types of motion of the macro body. A change in a macro body's linear speed does not affect its spin speed, and a change in its spin speed does not affect its linear speed. The combination of these separate motions is exhibited as the resultant motion of the macro body.

All efforts are of push nature. Tides are produced by linear (push) efforts on rotating macro bodies or by rotating (push) efforts on linearly moving macro bodies. Both linear and rotary motions are involved, together. Otherwise, the external linear effort simply produces linear acceleration of the macro body, and external torque produces spin acceleration of the macro body. If a spinning spherical macrobody is under constant action of an external linear effort across its spin axis, cross-sectional planes (perpendicular to spin axis) of the macro body maintain their elliptical shapes. This makes the rotating body bulge outwards in both directions, towards and away from the direction of incoming external linear (push) effort. An increase in the diameter of a rotating spherical body (in cross-sectional planes perpendicular to the spin axis) due to bulges along the direction of external linear (push) effort creates the phenomenon of a tide.

Mechanism of Tide

In a spinning macro body (of uniform consistency and shape), there is no relative displacement of its 3D matter-particles, other than the movements required to curve their paths to suit the macro body's spin motion. 3D matter-particles of the macro body are not attracted towards (or displaced in) any direction to create the phenomenon of tide. Similar action takes place also during the action of a torque on a macro body under linear motion. The phenomenon of tides takes place only during the accelerating stages of a macro body, either rotary or linear. Once the accelerating stage is over, the macro body settles down to its steady states in both linear and rotary motions. Tidal effects are not present any more. In order to sustain tides, it is essential to maintain constant actions of (acceleration due to) external efforts. Since the tide is not related to the macro body's steady state of motion, each of the external efforts acting on the macro body produces its own tides on the macro body separately.

No free macro body (except stable galaxies) in space can remain static without translational motion. They move, mostly in curved paths about some other macro body or group of macro bodies. Let us consider a spherical spinning body in space moving in a linear path. A 3D matter-particle on the equator of the macro body apparently traces a circular path around the macro body's spin axis. Simultaneously, the 3D matter-particle is carried with the macro body in its linear motion.

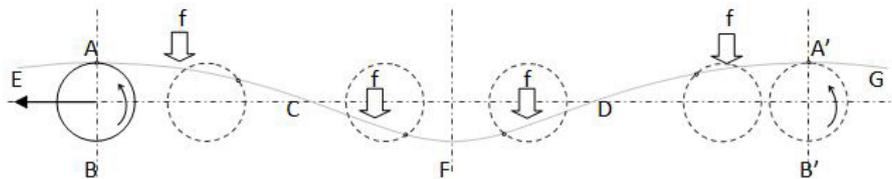


Figure 1

Figure 1 shows the path of a 3D matter-particle on the surface of a rotating macro body, moving along a straight-line path. Circles in the figure show representations of the equatorial plane of a spinning macro body, moving in a linear direction (perpendicular to its spin axis). Macro body moves linearly in the direction of the linear arrow while spinning in the direction of curved arrows. A 3D matter-particle (a plane section of a 3D matter-particle on the equatorial surface of the macro body) at A', shown by a black dot, is carried along the curved path GA'DFCAE. The 3D matter-particle has a constant angular speed, ω , about the spin axis of the macro body.

Let a constant external effort, f , shown by the block arrows, act evenly on the macro body, continuously. The direction of external effort, as shown in the figure, is downwards. Part of external effort, in the equatorial plane, acts on the 3D matter-particle. It is accelerated in the direction of the external effort (downwards, in this case). Additional work, introduced by the action of external effort in the matter-field of the macro body, has to accommodate itself within the additional work already existing in the macro body's matter-field and producing its linear and rotary motions.

Newly introduced additional structural distortions modify the existing structural distortions in the matter-field, during the accelerating stage. Since the action of external effort is continuous, the rate of modification of additional structural distortions in the matter-field is of constant magnitude. Part of additional structural distortions due to external effort f , which has attained stability, causes the 3D matter-particle (and hence the whole macro body) to move at a constant linear speed in the direction of the external effort. Part of additional structural distortions due to the external effort f , which is in a transition stage, causes a constant magnitude of linear acceleration of the 3D matter-particle (and hence that of the whole macro body) in the direction of the external effort.

In a rotating macro body of constant spin speed, all of its 3D matter-particles (except those situated directly on the spin axis) have constant angular speed about its spin axis. Directions of their linear motions, contributing to the spin motion of the macro body, are indeterminate. At any instant, the direction of linear motion of a 3D matter-particle in a rotating body depends on its relative position with respect to the macro body's centre of rotation (in space). Consequently, modifications to instantaneous linear displacements of 3D matter-particles in a rotating macro body by an external

effort in a steady direction depend on their relative (instantaneous) position with respect to the macro body's centre of rotation.

Assuming the direction of instantaneous linear motion of a 3D matter-particle in a rotating macro body is tangential to its curved path, linear acceleration of the macro body in a steady direction modifies angular displacement of the 3D matter-particle along its curved path. The 3D matter-particle experiences additional angular acceleration with respect to the spin axis of the macro body. The direction of resultant angular acceleration depends on the relative position of the 3D matter-particle about the centre of its curved path. The resultant angular speed of the 3D matter-particle along a curved path is modified accordingly, without affecting its tangential linear speed.

Tangential linear speeds of constituent 3D matter-particles, in a rotating macro body are proportional to the spin speed of the macro body. As tangential linear speeds of constituent 3D matter-particles are not affected, the spin speed of the macro body is not affected by its linear acceleration in any direction. Simultaneously, linear acceleration has caused the angular speed of 3D matter-particles to vary. The requirement to change the angular speeds of constituent 3D matter-particles, without varying the spin speed of the macro body, essentially necessitates changes in the shape of the macro body's equatorial (and parallel) plane(s). Changes in their shapes culminate in tides.

As shown in figure 1, from position at A' to position at D, the 3D matter-particle is on the left side of the macro body's centre of rotation. It is travelling along the top-left quadrant. The direction of its instantaneous tangential motion has a downward component, which is in the same direction as the direction of action by the external effort, f . External effort pushes at the 3D matter-particle at the convex side of its curved path to increase the curvature of the path. Downward linear acceleration of the 3D matter-particle tends to enhance its angular speed (by moving the 3D matter-particle downward at a faster rate than the rate due to original spin motion). Resultant action causes the 3D matter-particle's angular acceleration in the anti-clockwise direction. Total angular speed of the 3D matter-particle in its curved path increases. Due to the additional downward displacement, the 3D matter-particle reaches position D earlier than it would have reached under the original angular velocity. Due to increased curvature of its path, the 3D matter-particle is nearer to the central line when it is at D. Centre of rotation of the macro body is displaced downward as well. Effective vertical radius of the macro body increases in length, and effective horizontal radius reduces.

From position at D to position at F, the 3D matter-particle is on the left side of the macro body's centre of rotation. It is travelling along the bottom-left quadrant. The direction of its instantaneous tangential motion has a downward component, which is in the same direction as the direction of action by external effort, f . External effort pushes the 3D matter-particle at the concave side of its curved path to reduce the curvature of the path. Downward linear acceleration of the 3D matter-particle tends to increase its angular speed (by moving the 3D matter-particle downward at a faster rate than the rate due to original spin motion). Resultant action causes an increase in the 3D matter-particle's angular acceleration in the anti-clockwise direction. Total angular speed of the 3D matter-particle in its curved path increases. Due to the action of the external effort on the concave side, the curvature of the 3D matter-particle's path reduces to move it leftward so that it reaches the central line when at position F. Due to additional downward displacement, the 3D matter-particle has moved farther down when it reaches position F than it would have reached under original angular velocity. The centre of rotation of the macro body is displaced farther downwards. Effective vertical radius of the macro body increases in length, compared to horizontal radius.

From position at F to position at C, the 3D matter-particle is on the right side of the macro body's centre of rotation. It is travelling along the bottom-right quadrant. The direction of its instantaneous tangential motion has an upward component, which is in the opposite direction to the action of external effort, f . External effort pushes the 3D matter-particle at the concave side of its curved path to reduce the curvature of the path. Downward linear acceleration of the 3D matter-particle tends to reduce its angular speed (by impeding the 3D matter-particle's upward motion). Resultant action causes the 3D matter-particle's angular deceleration. Total angular speed of the 3D matter-particle in its curved path is reduced from its enhanced value at position F. The 3D matter particle reaches position C with reduced angular speed and later than it would have to under its enhanced angular speed. The 3D matter-particle tends to move away to the right from the macro body's centre of rotation, but it would not yet reach position C. Increased radius of the 3D matter-particle's curved path remains shorter than its original length. The centre of rotation of the macro body remains displaced downwards.

From position at C to position at A, the 3D matter-particle is on the right side of the macro body's centre of rotation. It is travelling along the top-right quadrant. The direction of its instantaneous tangential motion has an upward component, which is in the opposite direction to the action of external effort, f . External effort pushes the 3D matter-particle at the convex side of its curved path to increase the curvature of the path. Downward linear acceleration of the 3D matter-particle tends to reduce its angular speed (by impeding the 3D matter-particle's upward motion). Resultant action causes the 3D matter-particle's angular deceleration. Total angular speed of the 3D matter-particle in its curved path reduces further, to its original value. The 3D matter-particle reaches original position A with respect to the macro body's centre of rotation with original angular speed.

The centre of rotation of the macro body remains displaced downwards with increased length of vertical diameter and reduced horizontal diameter. Relative direction of external effort with respect to the 3D matter-particle changes as it moves along the curved path. Angular acceleration of the 3D matter-particle, produced by the external effort, varies relative to the direction of action of the effort. The magnitude of angular acceleration/deceleration is highest when the line of action of external effort is farthest from the centre of rotation at D or at C, and the 3D matter-particle has no angular acceleration or deceleration when the line of action of the external effort coincides with the centre of rotation, at A, at F or at A'. Magnitude of angular acceleration with respect to the spin axis varies in proportion to the cosine of the angular displacement from D. Therefore, the mean magnitude of angular acceleration in any quadrant is equal to $2/n$ times the highest magnitude (produced at C or D).

An increase in diameter along the direction of action and a reduction in diameter in the direction perpendicular to the direction of action of external effort on the 3D matter-particle deforms the circular path to an elliptical shape, with the major axis along the direction of external effort. The circular path of every 3D matter-particle in a rotating macro body is deformed during the action of a linear external effort across its spin axis. Macro body bulges in both directions along the direction of action of external effort while reducing its diameter in a perpendicular direction. This kind of change in the shape of a spinning macro body forms tides on it.

As a result of the tide, the centre of rotation of the macro body effectively shifts in the direction of external effort, and the macro body has effectively bulged outwards (about the macro body's new centre of rotation) in both directions along the line of action of the external effort. In appearance, the whole of the macro body has shifted in the direction of external effort, carrying its centre of rotation to a new position. An increase in the length of the macro body's diameter in the direction of external effort varies in proportion to the magnitude of its action and to the tangential speed of the 3D matter-particle (spin speed of the macro body). Magnitude of external effort being constant, a higher rotational speed of the macro body tends to increase magnitudes of tides. As rotational speed increases to higher values, magnitudes of tides increase considerably and may affect the integrity of a spinning macro body.

As long as external efforts are in planes parallel to the equatorial plane (the direction of external effort is perpendicular to the macro body's spin axis), the relative direction of external effort to the path of linear motion of the macro body does not affect the magnitude of tides formed on the macro body. Directions of tides depend on the direction of external effort, f . All 3D matter-particles in the macro body are affected identically. Change in the shapes of paths of 3D matter-particles on one side of the macro body is undone when they are on the other side. The magnitude of total additional work in the matter-field of the macro body remains constant and maintains its altered shape, without consuming additional work, as long as the magnitude of external effort remains constant.

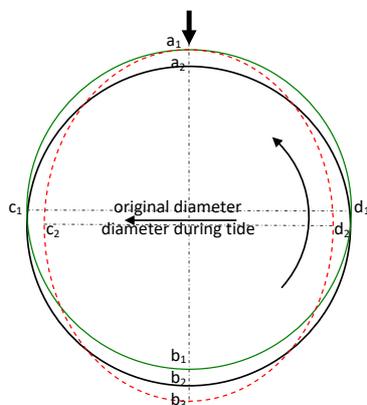


Figure 2

Figure 2 shows the transformation of the equatorial plane of a (spherical) spinning planetary body, linearly moving along its orbital path, under the action of an external effort. The component of 'central force' that causes a planetary body's radial motion towards a central body, which is acting evenly on the whole of the planetary body, is shown by a thick downward arrow. Curved arrow shows direction of spin, and straight arrow to the left indicates direction of linear motion of planetary body. The backward shift of the centre of gravity of the planetary body due to its linear speed, is not considered [1].

In figure 2, the green circle, $a_1c_1b_1d_1a_1$, is the original shape of the equatorial plane of a spinning spherical planetary body. Ellipse (in red dashed line) shows the path of a 3D matter-particle on the planetary body's surface. Changes in the curved paths of constituent 3D matter-particles of the planetary body (due to the action of the linear 'central force') change the shape of the planetary body's equatorial (and parallel) planes, as shown by the ellipse $a_2c_2b_2d_2a_2$. It has elongated in the direction away from the 'central force'. Similar actions take place in all planes of the planetary body, perpendicular to its spin axis. A spinning planetary body elongates along the direction of the 'central force'.

Circle in the black line, $a_3c_3b_3d_3a_3$, is the assumed median shape of the planetary body, with respect to the centre of rotation, shifted to a new location. With respect to this assumed shape of the equatorial plane, the surface points on

the planetary body are situated at different radii from the new centre of rotation. Points a_1 and b_3 are farther (higher) than the assumed median surface of the planetary body. These points correspond to high tides on the planetary body. Points c_2 and d_2 are nearer (lower) than the assumed median surface of the planetary body. These points correspond to low tides on the planetary body.

As the planetary body spins, the relative direction of the 'central force' changes with respect to the planetary body's surface. Consequently, high and low tides appear to revolve around the planetary body. In reality, directions of tides with respect to the direction of the 'central force' (and central body) are steady, but the observer on the surface of the spinning planetary body is carried through different stages of tides. Since the tides are formed due to linear acceleration of a spinning macro body, rather than due to a change of its state of motion (change in linear speed), no additional work is expended for their creation. Only the shape of the macro body is changed. Mere (temporary) changes in the shape or direction of motion do not constitute additional work. To change the shape of a macro body, original additional work, existing within the macro body's matter-field, is redeployed during the investment of more additional work (acceleration) in the matter-field by an external effort.

No additional work (energy) is used from any source to produce tidal effects on a spinning macro body, and hence, tidal effects cannot do any work. Additional work (energy) from other sources (like gravity, during changes in levels of ocean water) may be derived to do other works during tides. Additional work, invested by the external effort in a planetary body, is used solely to change its state (of motion) by modifying its linear or spin speeds in its orbital path. 'Central force' on a planetary body is used to produce its orbital motion and spin motion. The action stage (acceleration period) of the 'central force' causes tides.

During tides, the introduction of additional structural distortions (work) changes the matter-field of a planetary body. Changes in the matter-field vary the planetary body's shape in correspondence with the 'central force' on it. Magnitude of change depends on the magnitude of the component of the 'central force', acting to move the planetary body (radially) towards the central body. No additional structural distortions from the action of the 'central force' are consumed during the development of tides. Additional structural distortions, which temporarily increase the angular speed of constituent 3D matter-particle on one side of the centre of rotation of the planetary body, are returned to the matter-field during the motion of 3D matter-particles on the other side of the centre of rotation.

The change in shape of a planetary body is simply due to the rearrangement of its matter-field during the acceleration period rather than due to any motion of the planetary body or displacement of its parts. Paths of constituent 3D matter-particles are rearranged by the structural distortions in the matter-field to reflect the modified shape. Hence, any number of external efforts on a planetary body are able to introduce as many sets of tides in a planetary body. Even while a planetary body is moving linearly, it is able to have tide effects simultaneously in many directions, corresponding to the direction of each external effort on it.

The spin component of 'central force' acts on the rear hemisphere of the planetary body [1]. Hence, its action is not evenly distributed on the planetary body, as envisaged in the above-given description. Imbalance in the action of external effort additionally modifies angular speeds of constituent 3D matter-particles of the spinning planetary body. Due to the shift of the centre of gravity of a planetary body to the rear, angular acceleration of 3D matter-particles, when they are in front, is relatively less compared to the angular deceleration of 3D matter-particles, when they are in the rear part of the planetary body. During both half-cycles in a real orbital path, the action of the spin component of the 'central force', with respect to tide formation, tends to have a resultant acceleration and move the planetary body towards its central body. As the magnitude of this displacement is too small and it is in the same direction as the displacement caused by the radial component of the 'central force', it may be integrated with the planetary body's radial motion due to the 'central force' and neglected for all practical purposes.

Terrestrial Tides

Earth is a spinning planetary body, moving linearly along its real orbital path about the sun. 'Central force' between sun and earth guides earth along its wavy orbital path about the sun. Earth is also under another 'central force' towards the moon, which is orbiting about the earth. These two external efforts are independent of each other. 'Central forces' towards the sun and the moon, due to gravitational attractions, act evenly and continuously on earth to provide external linear efforts on the spinning planetary body of earth. 'Central forces' due to other cosmic bodies are too small to be considered for practical purposes. Each of the 'central forces', independently, transforms the shape of the earth to increase its diameter along the directions of their actions, each one in its own direction. Since the centre of the earth's orbital path is too far from earth, for practical purposes, a small part of the earth's orbital path can be assumed as a straight line. Hence, tides on both sides of the earth can be considered to have the same height. Small differences in their heights due to the curvature of the orbital path may be ignored. Variations in the parameters due to eccentricity or inclination of orbital paths are also too small.

Actions of efforts in the universal medium in each plane are distinct, and they have to be considered separately. Gravitational attraction ('central force'), calculated according to the equations for the 3D spatial system, is not valid for calculations in the 2D spatial system. The magnitude of the 'central force', calculated for a 2D spatial system, between

the earth and the moon is higher (by about 2.3 times) than the magnitude of the 'central force' between the earth and the sun. This accounts for the greater magnitude of lunar tides compared to the solar tides. To find the magnitude of the tide on Earth, 'central force' should be determined separately for each common plane, parallel to the equator. Currently estimated average distances from earth to the sun and the moon are used for these calculations. By doing so, when measured from datum, average magnitudes of solar tide (by rough calculations) give two high tides of heights 0.132 m each and two low tides of depths 0.132 m each. Similarly, when measured from datum, average magnitudes of lunar tide (by rough calculations) give two high tides of heights 0.304 m each and two low tides of depths 0.304 m each. Magnitudes of lunar tides are approximately 2.3 times higher than magnitudes of solar tides.

For convenience, we regard Earth as a spheroid or a sphere. All cross sections of Earth, perpendicular to its spin axis, are considered as perfect circles. In order to account for the differences in diameters of Earth's cross sections due to tides, the mean length of Earth's diameter is used as a datum to set Earth's shape as a sphere. Water levels on earth's surface are then related to this datum. Earth, in its nature, has an uneven surface of land masses and oceans. Although tidal effects felt by rigid land masses and fluid oceans are similar, their reactions are slightly different. Ocean water conforms to tidal effects freely, whereas landmass does it reluctantly. This difference tends to create differences in ocean levels more easily. Gravitational actions due to Earth's 3D matter-content try to overcome differences in ocean levels and create a superficial flow of ocean water from one place to another, locally.

However, there is no overall displacement of ocean water along with the progressing tides. If ocean water were to move to create tides, there would have been a constant westward flow of ocean water (at least, in cases where there are no land masses to break the flow). The tendency of such water flow is not observed on Earth. When Earth as a whole is considered, it may appear that crests and troughs of a large-scale travelling wave system comprised of tides strive to sweep continuously around Earth, following the relative positions of the moon and the sun. This is mere appearance due to the motion of the observer in the opposite direction. While Earth spins, its shape remains steady in space, with respect to the sun or the moon. An observer, static with respect to Earth's surface, moves through high and low tide regions in an easterly direction and experiences the feeling of tides traversing him in the opposite direction. Changes the observer experiences are not caused by lateral displacement of ocean water but due to vertical changes in the shape of the earth.

As there is no flow of ocean water from one part of earth's surface to another, laws of fluid dynamics do not apply to tides (except for local actions). Since there is no relative linear motion between ocean water and land mass at the ocean floor, there is no frictional effect at the ocean floor. The assumption that the earth's spin speed slows down due to such friction is baseless. In fact, Earth's orbital motion has an accelerating effect on its spin motion [1]. Not all-natural phenomena that cause a temporary rise or fall of water level in the ocean can be interpreted as tidal effects. Tides are the rise and fall of a point on the surface of the earth with respect to a datum, in the same direction of or away from an external linear effort on it.

In the case of terrestrial tides, effects due to the eccentricity of Earth's orbital path, inclination of orbital planes, topography on the ocean floor, flow of water into confining channels or nearly closed oceanic basins, dynamic considerations during local flow of water due to level differences, atmospheric conditions and contiguous currents in oceans also need to be taken into account. All of the above (and other less important influences) can combine to create a considerable variety (of many magnitudes) in observed magnitudes and phase sequences of tides – as well as variations in times of their arrival at any location.

Of a more local and sporadic nature, which may cause important meteorological contributions to the tides. They are known as 'storm surges'. They are caused by a continuous strong flow of winds, either onshore or offshore, which may superimpose their effects upon normal tidal actions to cause variations in the magnitudes of tides on earth. High-pressure atmospheric systems may depress tides, and deep low-pressure systems may cause them to increase height. Higher inclination of the lunar orbit makes a large variety between the tides in the equatorial region and higher latitudes of Earth.

Conclusion

Tidal effects on a spinning macro body take place separately in each plane, perpendicular to its spin axis. Acceleration (linear or rotational) due to external efforts produces tides on a spinning macro body. A change in the shape of a macro body causes tides on it. There are neither displacements of body parts nor flow of ocean water during tidal formation. Superficial flow of ocean water during tides is caused by effective level differences of the earth's surface due to the presence of land masses and their distribution. Since there is no relative motion between Earth's core and ocean water, tidal drag on Earth's solid body is a fallacy. Phenomenon of tides on planets should be interpreted on facts rather than on their appearances.

Reference

1. Nainan K. Varghese: MATTER (Re-examined).