SHAPE OF ORBITAL PATH

According to 'MATTER (Re-examined)'

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Abstract: In any system of macrobodies, relative considerations can provide only parameters of their relative positions. Use of a reference frame related to a static central macrobody causes the planetary orbital path to appear as a closed geometric figure around the central macrobody. As the central macrobody is a moving macrobody, this does not reflect physical reality. Although this helps to explain cyclic phenomena, properties attributed to elliptical/circular planetary orbital paths are unreal. Due to constant linear motions of free macrobodies in space, it is practically impossible for a free macrobody to orbit around another in any type of closed geometrical path. However, they may orbit about each other and follow a common median path in space. The real orbital path of a planetary body is wavy about the median path of the central body, with the planetary body moving to the front and rear of the central body, cyclically.

Keywords: Orbits, Planetary orbits.

Relative motions:

Since no absolute reference is currently available, in physics, we use relative frames of reference. By using a relative frame of reference, we assume a certain region or a particular macrobody is static (or is in an assumed steady state of motion) and use relative parameters of other macrobodies, with respect to the static reference, for all purposes in mechanics. An alternative concept, presented in the book 'MATTER (Re-examined)', envisages a real universal medium structured by matter particles that fills all of space, encompassing all material entities. As the universal medium is normally homogeneous and static, it can provide an absolute reference for all actions and movements of all macrobodies.

In nature, no material macrobody can remain static in space. To survive, it has to have translational motion with respect to the universal medium. Each macrobody has certain inherent motion and an appropriate magnitude of work (kinetic energy) associated with it. By choosing a macrobody as a (static) reference, in that instant, we wipe out the whole of the reference macrobody's kinetic energy, associated with its particular motion. Simultaneously, we modify the magnitudes of kinetic energies associated with all referred macrobodies. Although this is an unreal situation, it is convenient for the general understanding of mechanics and mathematical analysis with respect to relative positions. When we start assigning reality to resulting parameters, other than relative positions, it invariably distorts ensuing theories and physical laws.

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

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

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

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

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

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

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

Linear motion of a rotating macrobody:

Linear and rotary motions of a macrobody are entirely separate. Each of them is produced by a separate set of additional work in the macrobody's matter-field. However, each point on a linearly moving rotating macrobody has its own path of resultant motion. Its motion and path appear as a resultant of linear and rotary motions of the macrobody. In Figure 1, 'A' shows a rotating macrobody that has no linear motion. The centre point of the macrobody 'O' is steady in space. Point P on its periphery traces a circular path, as shown by the circle in dashed line. Let the macrobody develop linear motion, as is shown by 'B' in Figure 1, and let its centre of rotation move from O_1 to O_2 at a constant linear speed, while the macrobody turns through one revolution. Point P_1 on its periphery traces a loop, as shown by the black curved line starting from P_1 and ending at P_2.'C' in Figure 1 shows the rotating macrobody moving at a higher linear speed. The centre of rotation of the macrobody moves linearly through a larger distance from O_1 to O_2, while the macrobody turns through one revolution. The loop traced by a peripheral point becomes narrower as the linear speed increases, for the same rotary speed. 'C' shows the path of the peripheral point during one rotation of the macrobody.

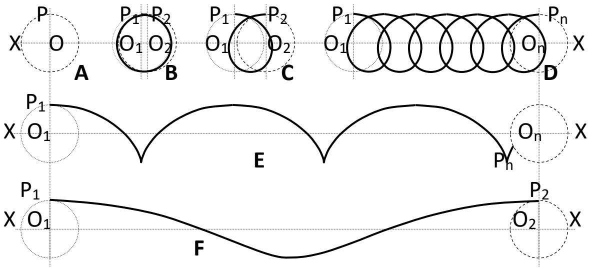

Figure 1

Continuous loops in black from P_1 to P_n in ‘D’ show a continuous path traced by the peripheral point in space, while the centre of rotation of the rotating macrobody moves linearly from O_1 to O_n along line XX. As the linear speed of the macrobody increases, in relation to its rotary speed, the loops in the path of the peripheral point gradually become narrower until the loops altogether disappear at a stage. At this stage, the linear speed equals π times the radius of the rotating macrobody (distance of the peripheral point from the centre of rotation of the macrobody) during every rotation of the macrobody. The black series of semi-circular paths ‘E’ in Figure 1 shows a curved path traced by a peripheral point. The resultant path of the peripheral point consists of semi-circular curves with their convex sides in the same direction. Path starts at P_1 and proceeds to P_n in ‘E’, while the centre of rotation of the rotating macrobody moves linearly from O_1 to O_n along line XX.

As the linear speed of the macrobody exceeds this value, no point in the macrobody has motion in the reverse linear direction. All points in the macrobody have displacements in the forward direction. Requirements that points in a macrobody on opposite sides of the centre of rotation have motion in opposite directions are no longer satisfied. No point in macrobody has a circular or elliptical path in space. All points in the macrobody move in a forward linear direction only. However, with respect to any point in macrobody, all other points in its plane of rotation appear to move in a circular path around the point of reference.

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

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

The center of rotation of the macrobody has linear motion along a straight line XX as shown in Figure 1. For an observer situated at one of its peripheral points, the centre of rotation of the macrobody appears to move around his location. He cannot observe his own true motion in space. He also cannot observe the linear motion of the rotating macrobody (centre of rotation). The observed motion of the centre of rotation in a circular path around a peripheral point is an illusion.

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

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

Shape of planetary orbital paths:

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

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

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

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

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

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

Kepler’s laws on planetary motions came into prominence and were widely accepted after they were used to verify and establish Newton’s ‘laws of motion’ and the ‘law of universal gravitation’. Newton’s theories provided much-needed cause and an imaginary mechanism for planetary orbital motion around a central body. Although Newton clarified that planetary orbital paths (under ‘central gravitational force’) need not always be elliptical, but they can also be parabolic or hyperbolic, the general shape of a planetary orbit is accepted as an elliptical curve around the sun (central body).

Belief in elliptical planetary orbits around their central bodies played a crucial role in establishing the current theories on motion. It is from these closed geometrical figures of planetary orbits around a central body that proofs of contemporary gravitational laws were derived. The power of these laws to explain and predict various phenomena (with respect to relative positions) was confirmed later. This made Newton’s ‘laws of gravitation’ and ‘laws of motion’, foundations of quantitative mechanics; all the while forgetting that mathematical treatments, used for their validation, are apparent planetary orbital motions, as observed around an assumed static central macrobody and not the true orbital paths of planets in space, about their central body.

Even relativistic mechanics subscribes to planetary orbital paths around central bodies. It suggests curvature of an imaginary space near a very large macrobody as the cause of planetary orbits rather than an ‘attractive force’ between planetary and central bodies.

Orbital motion:

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

A planetary system is essentially a part of a galaxy. All stable galaxies are static in space. Galaxies are rotating systems of macrobodies with no translational motion [1]. Hence, a planetary system in a galaxy traces a circular path around the galactic centre. The median path of the planetary system is a very large circle around the galactic centre.

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

Actions of the ‘central force’ on a planetary body and the orbital motion it causes are independent of all other macrobodies, including the central body. The role of the central body or any other macrobody in the vicinity is to limit the extent of the universal medium, acting on one side of the planetary body. The rest of all actions on the planetary body are performed by the universal medium. Although a planetary body appears to move in an orbital path around a central macrobody, in reality, it has an independent path of motion of its own. Gravitational attraction towards the central body causes its path to deviate from a straight line, moving it about and along with the central body. Due to gravitational actions, orbiting planetary bodies appear to influence the direction of each other’s motion and create perturbations in their paths. Since the planet is very small compared to the central macrobody, deviations in its path are more prominent. When these deviations are observed about a central body that is assumed static in space, the path of a planetary body appears as an apparent orbit around the central macrobody.

Circular or elliptical orbital motion is apparent only with respect to participating macrobodies. With respect to absolute reference, a planetary body does not orbit around a central body. The planetary body's path is wave-like, along the central body's path, the planetary body periodically moving to the front and to the rear of the central body. In Figure 2, the path of the central body is shown by an arrow in a grey line. This path, also, is wavy to a smaller extent, curving in the same direction as the path of the planetary body. Arrow in black wavy-line shows planetary body's orbital path. Unevenness of curvature of the path on either side of the central body's path (in the figure) is due to different scales used for linear and radial displacements.

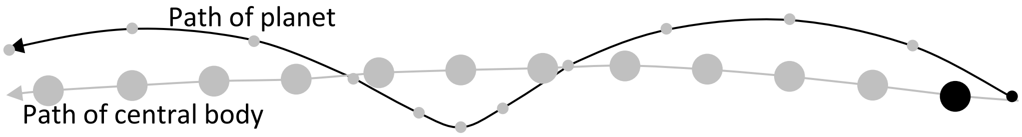

Figure 2

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

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

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

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

Figure 3 shows the real orbital paths of the inner members of the solar system. The planets and the sun, shown in the figure, are not to scale. Eccentricities of orbits are ignored. Relative positions of the sun and planets, shown on the right, are as on 3rd May 2002 [Reference: ESA Website]. Galactic centre is on the lower side, and the solar system is depicted as revolving in an anti-clockwise direction around the galactic centre. Arrows at the ends of orbital paths show the directions of motion of the Sun and planets. The path of the sun is shown as a straight line, and its perturbations caused by planets are not shown in the figure. Curved segments of planetary orbital paths, below the Sun's path (towards the galactic centre), appear narrower because of the very small scale of distance used in the figure. It can be seen from the figure that the sun and planets move together along a common median path around the galactic centre.

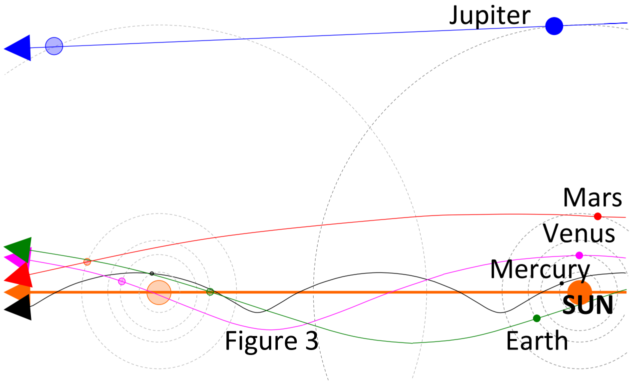

Figure 3

Macrobodies in the system cause certain perturbations to the paths of all members. These perturbations, when observed with respect to any member of the system (which is presumed to be static), give rise to apparent orbits of closed geometrical (circular or elliptical) figures around the member, which is assumed to be static. Apparent orbits are shown by grey dashed lines around the Sun. The dim set of figures on the left shows relative positions of members of the system and their apparent orbits, five months later. Similar apparent orbits and planetary systems can be built about any member of the system. They are imaginary. Until the last days of the 16th century A.D., the solar system was considered with Earth-based apparent orbits. Later on, due to the popularity of Kepler's planetary laws and Newton's support for the same, the present system of heliocentric apparent orbits for the solar system came into prominence. However, the imaginary nature of these orbital systems continues to be disregarded even after realising the movement of the central body in space. All macrobodies in asteroid belts are also planetary bodies with respect to the Sun. Their real orbital paths, in the asteroid belt, are similar to planetary orbits about the Sun.

Figure 4 shows the real orbital path of the moon (a satellite) about Earth. The orange circle shows the sun, and the orange arrow shows the sun's path as a straight line. The green circle shows Earth, and the curved green arrow shows Earth's real orbital path for five lunar months. The blue wavy arrow shows the real orbital path of the moon. A black dashed circle around the sun shows the apparent orbit of Earth. A black circle in dashed line around the Earth shows the apparent orbit of the moon around the Earth. Lower parts of the real orbital path of the moon about Earth are narrower because of the very small scale of distance chosen for the figure. The figure is not according to any particular scale. Relative positions of the sun, the earth, and the moon are shown as for full-moon days. Dim figures, to the left, show relative positions and apparent orbits of Earth and the moon for subsequent full-moon days. Eccentricities of apparent orbits are not considered. The real orbital paths of all satellites about their corresponding planets are similar.

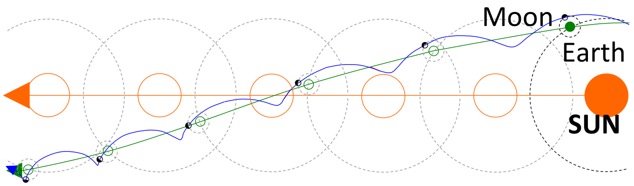

Figure 4

Some planets are found to have many smaller macrobodies orbiting about them. These, when depicted in their apparent orbits, make picturesque rings about the planets. However, their real orbits are similar to the orbital paths of satellites about the planets. These macrobodies form a swarm around a planetary body and move along with it in its motions. Figure 5 shows the real orbital paths of these macrobodies about a planet. Figures on the right show the relative positions of macrobodies and their apparent orbits. The orange circle shows the sun, the black circle shows the planet, and the coloured circles show three smaller macrobodies in the ring, situated in the same radial line from the planet. The orange arrow shows the sun's path in a straight line. The black curved arrow shows the planet's real orbital path . Coloured curved arrows show real orbital paths of smaller macrobodies in the rings. Dim figures, on the left, show relative positions of macrobodies and their apparent orbits after a lapse of certain time.

Planetary bodies have lower angular speeds with respect to their central bodies as their distance from the central body increases. Their orbital paths cross each other at different places in space. Due to their different angular speeds, there is a possibility for any two planets in a planetary system (or for any two satellites of a planet) to come very near to each other. At a certain point in time in the future, it is possible for any two planets in a planetary system (or for any two satellites of a planet) to collide into and destroy each other. In the case of smaller macrobodies, forming rings about a planet, they have identical angular speed with respect to their parent macrobody. This prevents them from colliding with each other during their motion along with their central body.

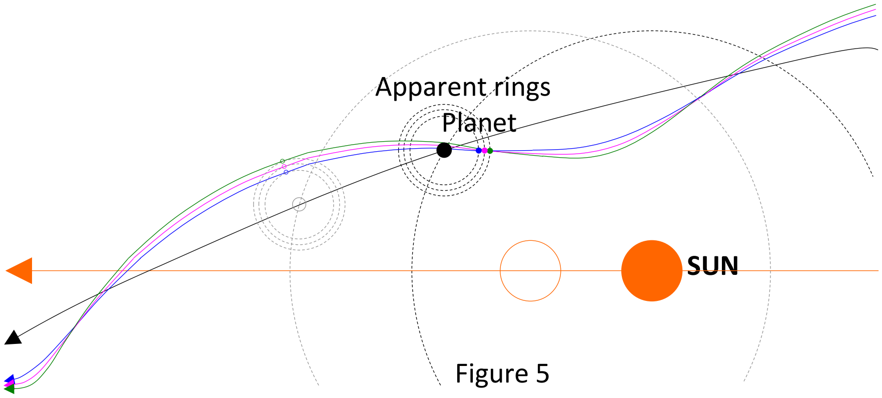

Figure 5

This swarm of smaller macrobodies about a planet also obey all rules of planetary motions. Only those smaller macrobodies in the swarm, which are in (or very nearly in) the orbital plane of the planetary system, can survive in the rings, as explained later in this article. All macrobodies, which do not conform to the planetary laws, are automatically removed from the system by mutual collisions or rejections. Hence, apparent rings about a planetary body are very thin and exist around the planet's equator. Although they are depicted as rotating around the planet, they also move along with the planet in its linear motion, as shown by coloured curved lines in Figure 7. Since their angular speed is the same, the linear speeds of these macrobodies increase as the distance from the planet increases (within the escape velocity corresponding to the planet). Due to centrifugal action caused by their angular speeds, larger (by 3D matter-content) macrobodies tend to distribute farther from the planetary body and smaller (by 3D matter-content) macrobodies remain near the planet's surface.

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

Conclusion:

Elliptical/circular planetary orbits around a central body are apparent geometrical structures, developed from relative considerations and the appearance of planetary motions to an observer (assumingly) based on a static central macrobody. They are created to explain relative positions and observed movements of planets about a (static) central body. In reality, a planet moves along with its central body in a wavy path about the median path of the planetary system around the galactic centre, alternately moving to the front and rear of the central body. A real orbital path does not form a closed geometrical figure.

Reference:

[1] Nainan K. Varghese: *MATTER (Re-examined)*, https://www.matterdoc.in

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