# THREE-BODY PROBLEM – A DECEPTION

According to 'MATTER (Re-examined)'

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*Abstract:* By simple mechanics, it is impossible for a free macrobody to orbit around another moving macrobody in any type of closed geometrical path. However, while considering the two-body problems, relative parameters of macrobodies are considered with one of them steady in space. This simple method of mathematical analysis can give accurate predictions of their future relative parameters. The orbital path of a planetary body appears around its static central body. Circular/elliptical orbits around a static central body, being an imaginary figure, have no value other than to indicate the relative positions of concerned macrobodies. All macrobodies, in nature, are moving. In cases of moving central bodies (real situations) or when there are more than two macrobodies in a system, relative considerations cannot describe their orbital paths. Due to the phenomenal success of the solution to the two-body problem by relative considerations, a firm but erroneous belief has been established that all planetary bodies move around their central bodies. The adamant belief in an imaginary circular/elliptical orbital path is carried forward to a three-body system to create an imaginary but unsolvable problem. The three-body problem (as considered today with respect to planetary motions) is unsolvable because real and imaginary situations are mixed in it. It is nothing but a deception from reality, adopted to create a baseless mystery.

*Keywords:* Relative frame of reference, absolute frame of reference, planetary orbits, orbital path, apparent orbit, real orbit, two-body problem, three-body problem, multi-body problem.

## Introduction:

A planetary system, with a central body, one planet, and one satellite (the Sun, Earth, and Moon), is considered in this article. As radial movements are already accounted for by the curvatures of their paths, only linear motions of the macrobodies are taken into account for this description. The same principle of argument may be carried forward to other multi-body systems, also with appropriate modifications. Figures in this article are not to scale. They are depicted to highlight the points presented. The term 'force' is used in its general meaning to specify 'cause of an action'. Elliptic paths also include circular paths. All conclusions expressed in this article are taken from the book 'MATTER (Re-examined)' [1]. For details, kindly refer to the same.

## Relative motions:

As no absolute reference is currently available, we use relative frames of reference in physics. By using a relative frame of reference, we assume a certain region or a particular macrobody is without translational motion (or is assumed in steady state) and use relative motions of other macrobodies, with respect to a static reference, for all our purposes in mechanics. An alternative concept, advanced in the reference [1], envisages a universal medium structured by matter particles that fills the entire space (outside 3D matter) without voids and encompass all 3D material bodies. As the universal medium is normally homogeneous and reasonably static, it can provide an absolute reference for all actions and movements.

In nature, all macrobodies (except stable galaxies) have linear motion in space. Each macrobody has certain inherent linear motion and a corresponding magnitude of additional work (kinetic energy) associated with it. By choosing a macrobody as a (static) reference, in that instant, the whole of its kinetic energy (associated with linear motion) is wiped out. Simultaneously, magnitudes of kinetic energies (associated work with their linear motions) of all referred macrobodies are modified. Although this is an imaginary situation, it is convenient for the general understanding of mechanics and mathematical analysis with respect to their relative positions. When we start assigning reality to the resulting parameters, other than their relative positions, it invariably distorts ensuing theories/physical laws.

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

Two independent macrobodies can be related only by their relative positions (relative parameters) in space. These are quantified by distance and relative direction between them. Relative considerations can give correct results only in determining their past or future relative positions. They are unable to provide real parameters of other states of the macrobodies (size, associated work, temperature, pressure, 3D matter-content, kinetic energy, etc.) or shapes of their paths.

A moving macrobody can be assumed as a static reference with respect to an observer, provided the observer is assigned imaginary motion in the opposite direction at equal linear speed. By doing so, the magnitude of kinetic energy of the moving macrobody is reduced to zero, and the observer is given an appropriate magnitude of kinetic energy to maintain his apparent motion. Action on the reference macrobody's linear motion by external effort appears to produce its results on the observer's apparent motion rather than on the state of (motion of) the reference body. In order to maintain the moving macrobody as a reference, it is necessary to refrain from changes in its assumed static state (of motion). All real changes in its state of motion are born by apparent motions of the observer. An external effort, on the observer, can change his state of motion. This change is born 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 a system in the same region of space. These results are true only within the system, and it does not constitute physical reality. 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, the apparent changes are in the magnitude of kinetic energy and the corresponding state of (motion of) the observer.

Real physical action by 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 linear speed of the observer encompass both real physical action and apparent motion of the observer. The observer apparently moves in the resultant direction at the resultant linear speed. The magnitude of the resultant action is greatly influenced by the direction of the applied effort. This does not correspond to real physical action on the observer. Real physical actions can take place only with respect to an absolute reference. Only a static universal medium can provide absolute reference. If macrobodies are in different regions of space with differing properties of the universal medium, this type of assumption does not work well.

## Linear motion of a rotating body:

Linear and rotary motions of a macrobody are entirely separate. Each of them is produced by a separate set of associated additional work. However, each point on a linearly moving rotating macrobody has its own path of resultant motion. Motion and path of each point appear as a result of linear and rotary motions of the macrobody. In Figure 1, 'A' shows a rotating macrobody that has no linear motion. Its centre point, 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 constant linear motion, as is shown by 'B' in Figure 1, and let its centre of rotation moves from $O_1$ to $O_2$ at 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 $P_2$.

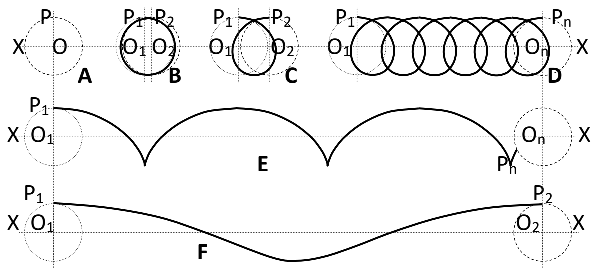

Figure 1

'C' (in Figure 1) shows the path of a peripheral point during one rotation of 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 linear speed increases, for the same rotary speed.

Continuous loops in black from $P_1$ to $P_n$ in 'D' (in Figure 1) show a continuous path traced by the peripheral point in space, while the centre of rotation of the rotating body 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 disappear altogether at a stage.

At this stage, macrobody's linear speed equals π times its radius (distance of a peripheral point from the centre of rotation) per unit time (during every rotation of the macrobody). The black series of semi-circular paths 'E' (in Figure 1) shows the 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. The path of the peripheral point starts from $P_1$ and advances to $P_n$, while the centre of rotation of the rotating macrobody moves linearly from $O_1$ to $O_n$ along the line XX.

As the linear speed of the rotating macrobody exceeds this value, no points in it have motions in the reverse linear direction. All points in the macrobody have displacements only in the forward direction. Requirements that points in a rotating body on opposite sides of the centre of rotation have displacements in opposite directions are no longer satisfied. No point in the 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 the 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 circular path of the peripheral point expands to become a wavy path about the line of motion of the macrobody's 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 moves from $O_1$ to $O_2$ along line XX, during one rotation of the macrobody. At lower linear speeds, the difference between the segments of the curved path (on either side of the linear path) is large. As the linear speed of the rotating macrobody increases (for the same rotary speed), the lower segment becomes larger, and differences between the upper and lower segments of the curve reduce.

Although, depending on the macrobody's linear speed in relation to its rotary speed, a 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 a peripheral point, noticed by the observer, is an illusion due to his inability to consider 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 and assuming it as a (steady) reference. Every point in the rotating macrobody has its own independent path in space. Except when the rotating macrobody has no linear motion, paths of peripheral points do not trace closed geometrical figures in space.

Since both apparent motions of the peripheral point in a circular path around the centre of rotation and the centre of rotation in a circular path around the peripheral point are illusory, no true physical law can be based on them. Such illusions cannot be considered proof of scientific laws. Observers, situated at both these points, have simultaneous apparent motions, contrary to each other. None of them can observe the true motion of their points on a rotating macrobody in space. The real path 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 maintains the relative positions of its peripheral points with respect to the centre of rotation. 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 other points. Therefore, in any system of macrobodies, where the distance between the reference and referred macrobodies is maintained constant (by some means irrespective of their motions) and where each macrobody appears to move in a circular path around the other, the above given explanations are valid.

## Orbital motion:

A planetary system is formed by a group of large macrobodies in space. Macrobodies of this group move together along a median path, while individual macrobodies have independent relative motions within the group. A planetary system that includes the Sun and its planets is the solar system. The path of each macrobody in this system is affected by the presence of all other macrobodies. As they are very small, we may, for the time being, neglect the effects on their paths by the presence of other macrobodies. There may also be smaller macrobodies called satellites in a planetary system. Satellites, being very near to planets, form a (sub) planetary system with their mother planet within a 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 body, while their paths are perturbed by the presence of all other macrobodies in the system.

For the 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 [1]. Galaxies are rotating systems of macrobodies with no translational motion. Hence, a planetary system in a stable galaxy traces a path around the galactic centre. The median path of a planetary system is very large around the galactic centre.

With reference to a planetary body, the central body appears to orbit around the planetary body, and with reference to the central body, the planetary body appears to orbit around the central body. Disregarding the eccentricity of the orbit, the distance between the central body and the planetary body remains constant. By these characteristics, a planetary system functions as a linearly moving, rotating macrobody. 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. The median path of a planetary system is a very large circle. A very small part of this large circle may be considered as a straight line for this explanation.

## Real orbital path:

With respect to an absolute reference, a planet does not orbit around its central body [1]. The planet's path is wave-like along the central body's median path, with the planet periodically moving to the front and rear of the central body. In Figure 2, the path of the central body is shown by a grey arrow in a curved line. This curved path is also wavy to a smaller extent, curving in the same direction as the path of the planet. Arrow in black wavy-line shows planet's orbital path. Unevenness of curvature of this path on either side of the central body's path (in the figure) is due to different scales used for linear and radial displacements. The path of a satellite is a wavy line about the planet's path. The central body and planet are shown by black circles, and their

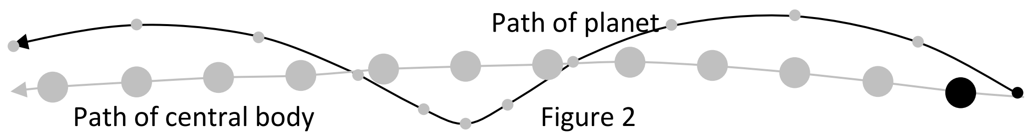

Figure 2

future positions are shown by grey circles. In this sense, it can be seen that a planet (or a satellite) orbits around the centre of the central body's curved path and the wave pattern in its path is caused by the presence of the central body. In reality, all macrobodies in a planetary system (including satellites) are free, and they have their own individual paths in space. Changes in the path of a free macrobody are due 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 absolute reference, there is no natural orbital motion around the central bodies at all, except orbital motions of the macrobodies around (static) galactic centres [1].

As a planet moves in its orbital path, its relative direction to the central body changes through half a circle, alternately in either direction. This is in contrast with the present assumption of a planet moving around a central body in full circles (an assumption created by a change of reference frame). Changes in the relative direction between the macrobodies cause variations in efforts and their actions.

Both the planet and its central body move in the same direction about the same median path in space. 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 [1]. All assumptions, based on the elliptical nature of planetary orbits, are invalid.

## Apparent orbital path:

All planets in the solar system would appear to an observer (on a static sun) as orbiting around the sun. Similarly, an observer on any of the planets would observe all the outer planets and the Sun orbiting around them. Standing on Earth, we see that the sun, outer planets, and the moon orbit around us in complicated geometrical paths. All these orbital motions are mere appearances. Elliptical orbital motion is apparent only with respect to the participating macrobodies.

Apparent planetary orbits can be assumed around any reference point within a system. Since we consider instantaneous parameters of planets, 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 seem to consider the apparent orbit as the true orbital path of a planet. Kepler's laws on planetary motion and 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.

A planetary body moves in the same direction as its central body. It is only when we imagine reversing the direction of the planet'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 planetary 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 [1].

Apparent orbit is a small part of the larger real orbital path, between two identical appearances of the central body, looking from a planet (e.g., one solar year). It is an imaginary concept where the shape of the path, the speed of the planet and the directions of motion are manipulated to suit the observations. As such, it has no logical basis. It depicts the appearance of a system, where the central body is assumed stationary by some imaginary mechanism (change of reference frame) at the centre of apparent orbit, and the planet moves at a (constant) linear speed by an equally imaginary mechanism.

The only cause of action within a planetary system is the 'central force', due to gravitational attraction, which accelerates the planet towards the centre of apparent orbit – the central body. Parameters of this action are mathematically manipulated to produce the required orbital motion around the central body that matches the observations. While doing this, much greater motions of the planetary body, before it became a planet and the motion or path of the central body are ignored. An apparent orbit is convenient to predict cyclic features that take place annually. However, taking an apparent orbit as the path of real motion of a planet is highly illogical and incorrect.

Apparent orbits, determined by using the (static) barycentre method, are also circular paths around the centre of mass of two macrobodies. Even relativistic mechanics subscribes to planetary orbital paths around central bodies. It suggests curvature of space near a very large macrobody, the cause of planetary orbits, rather than an attraction between planetary and central bodies.

Figure 3 compares the real path of an orbiting body and its apparent orbit for the duration of one apparent orbital period, according to Kepler's laws of planetary motion. The grey central line shows the central body's path. A black, wavy line is the path of the planet. The larger black circle shows the central body, and the circles in dotted lines show its future positions. A small black circle shows the planet, and grey circles show its future positions. Double-headed arrows show the 'central force' between them at various positions as they move along their paths. As the planet moves, its apparent orbit moves along with the central body.

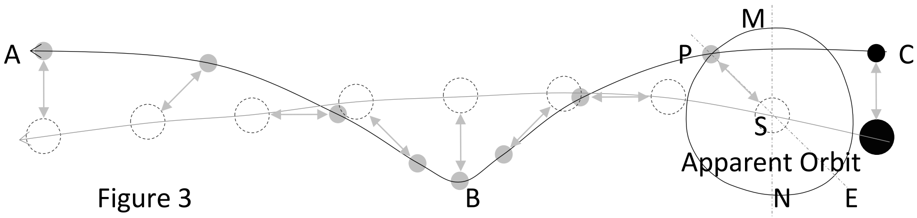


Figure 3

The apparent orbit of a planetary body, when it is at position P with the central body at S, is shown by the oval in Figure 3. The planet's perihelion is at P, and its aphelion is at E. In real motion, the highest and lowest linear speeds of the planet occur when it is at 90° away from the path of the central body, at M and B, respectively. All parameters of apparent orbit and orbiting motion are related to perihelion and aphelion. From its position at C, till position B, the planet is in front of the central body, and hence it is retarded in its linear motion. From B to A, the planet is behind the central body, and hence it is accelerated in its linear motion. Line MSN (extended) is a radial line connecting the central body to the centre of its curved path (galactic centre). Acceleration and deceleration of the planet change at points M and B. These points are fixed relative to the path of the central body.

## Three-body problem:

The derivation of the apparent orbit for a system that has two macrobodies in it is understood as the 'two-body problem'. From the above explanations, an apparent planetary orbit is an ellipse around its central body. Description of the apparent orbit of a planet around its central body (in a system of two free cosmic macrobodies, where the system as a whole has no translational motion in space) is based on definite requirements (as assumptions). They are summarized below, in conjunction with their unsuitability for the three-body or n-body problem.

If a system has more than two macrobodies in it and we wish to simultaneously derive apparent orbits for each of them, it is called a three-body or n-body problem. Despite the above given definite assumptions for the specific purpose of two-body problems, many physicists carry forward the same assumptions while attempting to solve three-body or n-body problems. This is very much against the requirements elicited above for the two-body problem.

1. There are only two macrobodies in consideration.

As there are more than two macrobodies in a system, methods used for a two-body system cannot be used for three-body or n-body problems.

2. The central body of the planetary system or barycentre of macrobodies is stationary in space.

Each apparent orbit has a stationary central body. As the central body moves, the apparent orbit also moves along with it in space. Hence, at least one macrobody in a three-body (or more bodies in n-body) problem has to act simultaneously as a static central body as well as a moving planetary body. This is an impossible goal.

3. In Kepler's method, only a planet traces an apparent orbit. In the barycentre method, both the central body and the planet have apparent orbits around their 'centre of mass'.

While apparent orbits of all planets in a planetary system are with respect to the same central body, in the barycentre method, each planet has its individual apparent orbit, and it is derived from separate sets of parameters. Hence, each pair in a three-body or n-body system has to have separate central bodies. This requirement is not fulfilled. Although many macrobodies may have a single centre of mass, the barycentre, used for apparent orbit, is the point between two macrobodies (where they balance each other) around which both macrobodies orbit each other. This function cannot be fulfilled in the case of systems with more than two macrobodies.

4. There can be only one central body in a planetary system. Other macrobody (bodies) is (are) planetary body (bodies) that traces apparent orbit(s).

As there are more than two macrobodies in a three-body or n-body system, two or more central bodies are required in the system. This is another impossible goal.

5. Apparent orbit is derived from relative parameters of a planet with respect to its central body.

As there are more than two macrobodies in a three-body or n-body system, planets and satellites cannot have relative parameters (required for apparent orbit) with the same central body.

6. Direct relation is only between two objects.

The relation of a third object can be established indirectly through its separate direct relations with the other two objects. Hence, a third macrobody (in the three-body problem) cannot have an apparent orbit with two other macrobodies simultaneously. Searching for one apparent orbit about two central bodies can not yield results.

Almost none of the requirements for deriving apparent planetary orbital paths in the two-body problem are fulfilled in the proposed three-body problem. Unless the three-body problem has its own set of requirements and a special method to derive apparent orbits of the member macrobodies, no such problem can exist in the current state of physics. However, creating fictional problems and solving them by mathematical manipulations is often appreciated by the scientific community. Perseverance on the part of many scientists to find a mathematical solution to this non-existent problem has yielded no comprehensive results yet. Raising a non-existent problem and qualifying it as an ‘unsolvable problem’ or ‘unexplainable physical phenomenon’ is an attempt to mystify physics. Mysterious aura about physics may appeal to many, so that the subject is reserved for a few, and others are compelled to believe in its divine nature.

Unlike apparent planetary orbits, real orbital paths require no assumptions. Hence, real orbital paths of any number of macrobodies may be derived from their true parameters. The only difficulty in deriving the real orbital path is to specify initial conditions accurately, without an accepted absolute reference. Until we can define an absolute reference, apparent planetary orbital paths, derived by considering relative parameters (which help to predict cyclic events), may be used to specify their relative positions and associated phenomena. However, it may be borne in mind that apparent orbits give accurate results only with respect to relative positions of macrobodies in a planetary system and nothing else.

## Conclusion:

The assumptions used to derive apparent planetary orbital paths in the two-body problem are unique to it. They are not suitable when the number of macrobodies in the planetary system exceeds two. As long as a set of assumptions is not defined separately for deriving apparent orbits in planetary systems that have more than two macrobodies, the three-body problem cannot exist. The assertion that a non-existent three-body problem exists and declaring it as an ‘unsolvable problem in physics’ is a deception to mystify physics.

## Reference:

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

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