

NIKOLA TESLA: THE MOON'S ROTATION

Tomić¹ A. and Jovanović² B. S.

¹ *People's Observatory, Kalemegdan, 11000 Belgrade*

² *Museum of Nikola Tesla, Proleterskih brig. 57, 11000 Belgrade*

ABSTRACT: The review of three articles by N. Tesla, published in the year 1919 in the journal "*Electrical experimenter*" is given, with special reference to the astronomical contents and to circumstances in which they appeared. We conclude that the famous experimenter Nikola Tesla was a serious theoretician, and popularizer, as well.

1. INTRODUCTION

Nikola Tesla, this great engineer – physicist died 50 years ago. Since his life's work has a lot of practically important inventions his three papers on the rotation of the Earth's Moon published in 1919, have fallen into oblivion. Because of their actuality up to our days we shall give extended excerpts of them. Yet, Tesla has had a more general, philosophical approach to the universe.

2. THE CONVICTION OF THE COSMICAL LINKAGE

N. Tesla published in "*New York Herald*" on October, 12, 1919 the article "**Signals to Mars based on Hope of Life on Planet**". There it is said: "The idea that other planet are inhabited by intelligent beings might be traced to the very beginnings of civilization. This, in itself, would have little significance, for many of the ancient beliefs had their origin in ignorance, fear or other motives - good or evil, and were nothing more than products of untrained or tortured imagination. But when a conviction lives through ages in the minds, growing stronger and stronger with increasing knowledge and intellectual development, it may be safely concluded that there is a solid truth, underlying the instinctive perception."

Indirectly, there are contained founds of Tesla's interest in astronomy manifested in the early ninetieths of the past century. Within the frames of wireless telegraphy investigations, Tesla had the idea of interplanetary communication. In the great polemics in the American press, after publication of P. Lowell's photos of Mars and Martian canals and of his papers on the possibility of life on Mars, Tesla advocated Lowell's opinion. Concretely, Tesla was on the side of those in the polemic, who belived, in principle, in the chance of the existence of the extraterrestrial intelligent life, and accordingly of the Martian life.

Prehistory of this position of Tesla can be found in his two scientific - philosophical viewpoints:

- (1) All living beings are automats, kept in motion by external impulses, and
- (2) The matter contains no energy but the one got from outside.

In this, vertical line, lie the psychophysical phenomena inadequately clean and somewhat shaded, living in depth of brain, as hallucinations, mental pictures and another, on which Tesla spoke. Looking for explanation of it, Tesla concluded that its origin lies in the surrounding objects and events, and their influence. Connecting this with Descarte's thesis on beings as automats, and developing it, arised viewpoint (1) quoted above.

This viewpoint, formed probably in his European days, has been the starting point for the explanation of phenomena and occurrences, around and within himself.

A successful application of it up to events concerning Lowell, suggested him an extrapolation that some causes might not originate on the Earth. I.e.- they can be due to an extraterrestrial, cosmic, origin.

In 1899 in Colorado Springs Tesla experimented on 12 million volt emitting/receiving station, at that time only one on the Earth's globe. Detecting a regular series of pulses, in form 1, 2, 3... Tesla was inclined to the cosmical origin, to explain it.

The crossing of psychological (out of time) verticale, with sociological (chronological) horizontale, gives just a point with events about P. Lowell. In this point the conception born in depth of soul appears at surface, changed the flow of affairs, not only forthcoming than preliminary, as well. How it happened?

Old phenomena were seen in a new light. This is the milieu of Tesla's courageous claims. In these frames it is needed to see the articles about Moon's rotation, published in the journal "*The Electrical Experimenter*" in 1919. They are a story in a cycle of autobiographical essays ("**Famous Scientific Illusions**", part I, February, 1919, p. 692-4) and two appendices challenged by the readers' reactions in form of letters flow titled to Tesla and Hugo Gernsback, editor of journal, published separately but under the same title ("**The Moon's Rotation**", issue of April, 1919, p. 866 and 892, and of June 1919, pp. 132, 133, 156, 157 and 160.). Note that H. Gernsback, engineer, and editor of "**The Electrical Experimenter**", is the same H. Gernsback, the father of modern science-fiction literature. Engineer and fantasist, spiritus movens of the movement for connection of fantasy and scientific facts. Would have they a better combination to express fully their sense and intentions? We give a negative answer. The American public was very disturbed, the journal multiplied its tirage and readability. On one side, this S.F. was born and on another side Tesla gave detailed explanations of this opinion and knowledge about the Moon's rotation. These are his only papers talking on astronomy, precisely and directly.

3. THE MOON'S ROTATION

It is well known that the Moon shows always the same side to the Earth. The research work on the Moon's rotation was found the three laws, published by D. Cassini in 1693. We quote the first and second laws, which are concerned by Tesla's comments.

(1) The Moon revolves around the Earth, from west to east, about polar axis, with constant angular speed and period of rotation equal to the period of revolution about the Earth.

(2) The inclination of lunar equator to the ecliptic is constant.

How obtained these laws, it is unknown. But it can be proved that from all of possible dynamical solutions, just this describes the motion with minimal losses of energy in the internal heating by friction. (Colombo, 1967) The dynamical interpretation of Cassini's laws is given by Lagrange in 1764 (Lagrange, 1780). He derived the theory of compulsory oscillations in the lunar rotation. If the primary period of rotation was different for the revolution period, after some time both give same values, because of terrestrial tidal action to the Moon.

The Moon's Rotation

By NIKOLA TESLA

SINCE the appearance of my article entitled the "Famous Scientific Illusions" in your February issue, I have received a number of letters criticizing the views I express regarding the moon's "axial rotation." These have been partly answered by my statement to the *New York Tribune* of February 23, which allow me to quote:

In your issue of February 2, Mr. Charles E. Manierre, commenting upon my article in the *Electrical Experimenter* for February which appeared in the *Tribune* of January 26, suggests that I give a definition of axial rotation.

I intended to be explicit on this point as may be judged from the following quotation: "The unailing test of the spinning of a mass is, however, the existence of *energy of motion*. The moon is not posset of such *vis viva*." By this I meant that "axial rotation" is not simply "rotation upon an axis nonchalantly defined in dictionaries, but is a circular motion in the true physical sense—that is, one in which half the product of the mass with the square of velocity is a definite and positive quantity. The moon is a nearly spherical body, of a radius of about 1,087.5 miles, from which I calculate its volume to be approximately 5,300,216,300 cubic miles. Since its mean density is 3.27, one cubic foot of material composing it weighs close on 205 lbs. Accord-

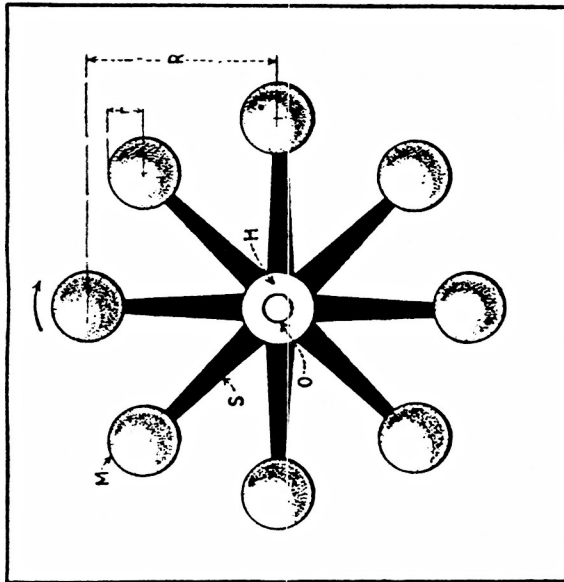
conclusions I have drawn. It is well known, of course, that the two bodies revolve around a common center of gravity, which is at a distance of a little over 2,899 miles from the earth's center.

—ling. In this case a *much more rapid* rotation is imparted to it in the *opposite sense*. There is no true analogy to these in the motion of the moon. *If the gravitational string, as it were, would snap, the satellite would go off in a tangent without the slightest swerving or rotation, for there is no moment about the axis and, consequently, no tendency whatever to spinning motion.*

Mr. Manierre is mistaken in his surmise as to what would happen if the earth were suddenly eliminated. Let us suppose that this would occur at the instant when the moon is in *opposition*. Then it would continue on its elliptical path around the sun, presenting to it steadily the face which was always exposed to the earth. If, on the other hand, the latter would disappear at the moment of *conjunction*, the moon would gradually swing around thru 180° and, after a number of oscillations, revolve, again with the same face to the sun. In either case there would be no periodic changes but eternal day and night, respectively, on the sides turned towards, and away from, the luminary.

Some of the arguments advanced by the correspondents are ingenious and not a few comical. None, however, are valid.

One of the writers imagines the earth in the center of a circular orbital plate, having fixedly attached



If You Still Think That the Moon Rotates on Its Axis, Look at This Diagram and Follow Closely the Successive Positions Taken by One of the Balls. While It is Rotated by a Spoke of the Wheel, Substitute Gravity for the Spoke and the Analogy Solves the Moon Rotation Riddle.

The lunar rotation at first glance appears as an elementary, but problem of classical mechanics, which was intensively examined in the past, it has not been fully solved. A simple form of the equations of motion can easily result in a confusion. (Moutsoulas, 1971) Other specialists for lunar motion have not come out from these frames. (Jakovkin, 1960).

What about the Moon's rotation where the subject of Nikola Tesla, a non - astronomer, in 1919 ?

In his first article (p. 692) Tesla said: "The greatest triumphs of man were those in which his mind had to free itself from the influence of delusive appearances." In the under - title: "1. The Illusion of the Axial Rotation of the Moon" (p. 693) Tesla is more concrete: "The spinning motion of a heavenly body must necessarily undergo modifications in the course of time, being either retarded by resistances internal or external, or accelerated owing to shrinkage and other causes. An unalterable rotational velocity thru all phases of planetary evolution is manifestly impossible." This is fully in concordance with the conclusion of Lagrange, but not the next one:

"But many astronomers have accepted as a physical fact that such rotation takes place. It does not, but only appears so; it is an illusion, a most surprising one, too."

Nikola Tesla, famous as experimenter, thinks in a manner of physicist - theoretician, finding fishionably detailes which escaped from attention of others: "The truth is, the so called "axial rotation" of the Moon is a fenomenon deceptive alike to the eye and mind and devoid of physical meaning. It has nothing in common with real mass revolution characterized by effects positive and unmistakable. Volumes have been written on the subject and many erroneous arguments advanced in support of the notion. Thus, it is reasoned, that if the planet did not turn on its axis it would expose the whole surface to terrestrial view; as only one half is visible, it *must* revolve. The first statement is true but the logic of the second is defective, for it admits of only one alternative. The conclusion is not justified as the same appearance can also be produces in another way. The Moon does rotate, not on its own, **but about an axis passing thru the center of the Earth, the true and only one.** The unfailling test of the spinning of a mass is, however, the existence of energy of motion. The Moon is not possesst of such *vis viva*."

At the next step Tesla asked himself about the intention of his discovery, in connection with the Moon's origin.: "Three theories have been advanced for the origin of the Moon. According to oldest, suggested by the... **Kant**, and developed by **Laplace**., the planets have been thrown off from larger central masses by centrifugal force... Prof. **George H. Darwin** in an masterful essay on tidal friction furnished mathematical proofs, deemed unrefutable, that the Moon had separated from the Earth. Recently, his established theory has been attacked by Prof. **T. J. J. See** in a remarkable work on the "*Evolution of the Stellar Systems*", in which he propounds the view that centrifugal force was altogether inadequate to bring about the separation and that all planets, including the Moon, have come from the depths of space and have been captured. Still a third hypothesis of unknown origin exists which has been examined and commented upon by Prof. **W. H. Pickering** in "*Popular astronomy of 1907*", and according to which the Moon was torn from the Earth when the later was partially solidified, this accounting for the continents which might not have been formed otherwise. Undoubtedly planets and satellites have originated in both ways

and, in my opinion, it is not difficult to ascertain the character of their birth. The following conclusions can be safely drawn:

1. A heavenly body thrown off from a larger one cannot rotate on its axis. The mass, rendered fluid by the combined action of heat and pressure, upon the reduction of the latter immediately stiffens, being at the same time deformed by gravitational pull. The shape becomes permanent upon cooling and solidification and the smaller mass continues to move about the larger one as though it were rigidly connected to it except for pendular swings or librations due to varying orbital velocity. Such motion precludes the possibility of axial rotation in the strictly physical sense. The Moon has never spun around as is well demonstrated by the fact that the most precise measurements have failed to show any measurable flattening in form.

2. If a planetary body in its orbital movement turns the same side towards the central mass this is a positive proof that it has been separated from the latter and is a true satellite.

3. A planet revolving on its axis in its passage around another cannot have been thrown off from the same but must have been captured."

As arguments to Tesla's point of view we quote further. Usually in further approximation the Moon has been assumed to be sphere. In the cited tractate, Lagrange demonstrated that the form of the Moon must be rotational ellipsoide with the largest axis orientated to the Earth. But, how been shown from analyses of determinations of the axis - amounts, triaxial ellipsoid as approximation gives noly better representation than the sphere model. (Podobed, Nesterov, 1978, p. 309). The "Lunar Orbiter" data give semi - axis which differs not more than 0.5 km.

How it can be occured, Tesla's article was provocation for many readers. As reaction and his answer to letters, Tesla has written second, and finally third article, with in detaile explanation of his opinions.

Here Tesla gave one correction, too. (April issue, p. 866): "I have stated in my article that the Moon rotates about an axis passing thru the center of the Earth, which is not strictly true, but it does not vitiate the conclusion I have drawn. It is well known, of course, that the two bodies revolve around a common center of gravity, which is at a distance of a litle over 2899 miles from the Earth's center."

In details he explained the rotation (p. 866, April issue): "" Axial rotation" is not simply "rotation upon an axis nonchalantly defined in dictionaries, but is a circular motion in the true physical sense - that is, one in which half the product of the mass with the square of velocity is a definite and positive quantity."

At page 892. Tesla said:

"Even the well - known experiment with the Foucault pendulum, altho exhibiting similar phenomena as on our globe, would merely demonstrate a motion on the satellite about *some* axis. The view I have advanced is NOT BASED ON A THEORY but on facts *demonstrable by experiment*. It is not a matter of *definition* as some would have it. A MASS REVOLVING ON ITS AXIS MUST BE POSEST OF MOMENTUM. If it has none, there is no axial rotation, all appearances to the contrary notwithstanding."

His conception Tesla demonstrated in the mechanical models, writing:

"Consider first the case of two equal weights w and w_1 , in Fig. 1. (Fig. 1) whirled about the center O on a string s as shown. Assuming the later to break at a both weights will fly off on tangents to their circles of gyration, and, being animated with

different velocities, they will rotate around their common center of gravity o ." ... "The weights continue to rotate at the original rate and in the same direction. I know this to be a fact from actual experiments." Tesla showed it precisely mathematically in the third article. "The kinetic energy would then be equal to the sum of the energies of the translatory and axial motions, not merely in the abstract mathematical meaning, but as a physical fact." ... "I shall first undertake to demonstrate that there is no torque or rotary effort about center C and that the kinetic energy of the supposed axial rotation of the ball is mathematically equal to zero. This makes it necessary to consider the two halves separated by the tangential plane pp wholly independent from one another." ... "These are the distance from center O , at which the masses of the half spheres may be concentrated and then the algebraic sum of their energies - which are wholly translatory those of axial rotation being nil- will be exactly equal to the total kinetic energy of the ball as a unit." (The proof is correct derived, and we quote it not.)

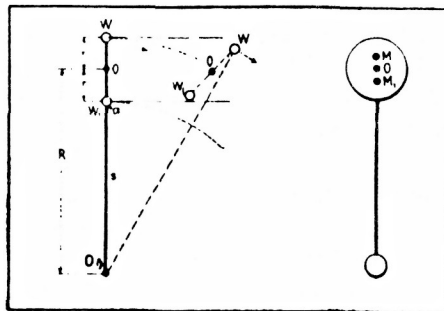


Diagram Illustrating the Rotation of Weights Thrown Off By Centrifugal Force.

The consideration was finished by the words: "It will be readily seen that if both strings are cut in the same instant the masses will fly off in tangents to their circular orbits, the angular movement becoming rectilinear without any transformation of energy occurring. Let us now inquire what will happen if the two masses are rigidly joined, the connection being assumed imponderable. *Here we come to the real bug in the question under discussion.* Evidently, so long as the whirling motion continues, and both the masses have precisely the same angular velocity, this connecting link will be of no effect whatever, not the slightest turning effort about the common center of gravity of the masses or tendency of equalization of energy between them will exist. The moment the strings are broken and they are thrown off they will begin to rotate but, as pointed out before, this motion neither adds to or detract from the energy stored. **The rotation is, however, not due to an exclusive virtue of angular motion, but to the fact that the tangential velocities of the masses or parts of the thrown off are different.**" (p. 156)

But, it is not the end of the story. Tesla showed the problem more generally. "Virtually all satellites rotate in like manner and the probability, that the acceleration

or retardation of their axial motions - if they ever existed - should come to a stop precisely at a definite angular velocity, is infinitesimal while it is almost absolutely certain that all movement of this kind would ultimately cease. The most plausible view is that no true Moon has ever rotated on its axis, for at the time of its birth there must have been some deformation and displacement of its center of gravity thru the attractive force of the mother planet so as to make its peculiar position in space, relative to the latter, in which it persists irrespective of distance, more or less stable." (p. 157)

Here we can cite Savić's hypothesis about the origin of rotation of celestial bodies, developed in SK - theory (Savić, Kašanin, 1965, p. 70) giving the same results for the lunar rotation: "By studying the ionisation of various elements we reached the conclusion that the ionisation due to pressure can be brought about at the earliest moment during transition from phase 2 to phase 3... If, thus, a certain celestial body has not the phase 3 in its interior, because of its small mass, then it certainly does not have a magnetic moment... This is the case, for instance, with our Moon, since its mass is small for such a process... This is why the Moon has neither a magnetic moment nor a rotation of its own."

Tesla opposed the wide spreaded opinion about the cause of optical libration in longitude. "Referring to the librations of longitude I do not see that they have any bearing on this question. In astronomical treatises the axial rotation of the Moon is accepted as a material fact and it is thought that its angular velocity is constant while that of the orbital movement is not, this resulting in an apparent oscillation revealing more of its surface to our view. To a degree this may be true, but I hold that the mere change of orbital velocity, as will be evident from what has been stated before could not produce these phenomena, for no matter how fast or slow the gyration, the position of the body relative to the center of attraction remains the same. The real cause of these axial displacements is the changing distance of the Moon from the Earth owing to which the tangential components of velocity of its parts are varied." ... "The Moon actually swings on the axis passing thru its center of gravity on which it is supported like a ball on a string. The forces involved in these pendular movements are incomparably smaller than those required to effect changes in orbital velocity." (p. 160)

This opinion we find in modern textbooks on general astronomy: "The libration on longitude can be geometrically interpreted as the consequence of uniform rotation about ITS axis and about variable velocity of revolution along the ellipse." (Podobed, Nesterov, 1975, p. 295). From the next cited text (on page 892, April issue): "From the character of motion of the satellite it may be concluded with certitude *that it is devoid of momentum about its axis*. If it be bisected by a plane tangential to the orbit, the masses of the two halves are inversely as the distances of their centers of gravity from the Earth's center." (p. 892), we see that Tesla was very near to the conclusion that even nearly half of the Moon must be with higher mass than farther half. "Even after the calculation of the libration effects, it is not correct to assume that the mean position of the Moon's center is in fact the same as the centre of mass". (Podobed, Nesterov, p. 312) The existence of masscons under surface of lunar maria of the visible half is an argument in favour of the said before.

Our attention is devoted to the astronomical contents in Tesla's articles. But,

these texts are very interesting from the view point of models used in explanation, with applied well-known physical laws. It is a theme for separate analysis, pedagogical and methodological.

From all, it follows that famous experimenter, Nikola Tesla was a serious theoretician, methodicist too, which well marked the peculiarities, where are invisible to other explorers. For the end of the story we quote the words of H. Gernsback, editor of "Electrical Experimenter": "Dr Tesla explains... in a masterly way, so that everyone can understand them". (p. 692.)

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