Research Article *Open Access*

Journal of Modern Classical Physics & Quantum Neuroscience

ISSN: 3068-4196

DOI: *doi.org/10.63721/25JPQN0133*

The Epistemology of the Experiment for the Validation of the Pendulum-Type Oscillator at Rest (Contribution to the Optimization of the Pendulum -Type Oscillator)

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Citation: Dumitru Crivoi, Maria Rediu, Dimitrie Olenici (2025) The Epistemology of the Experiment for the Validation of the Pendulum-type Oscillator at Rest (Contribution to the optimization of the Pendulum -type Oscillator). J.of Mod Phy & Quant Neuroscience 1(4), 1-12. WMJ/JPQN-133

Abstract

The objectives of indirect observation programs are generally achieved with the help of a 'test body.' The pendulum is used as a test body of the gravitational field. The viability of the Newtonian pendulum model is affected by the lack of control, causality and other properties specific to a system. A pendulum-type oscillator is the physical system that has a cosine term in the potential energy formula, similar to the potential of a simple pendulum. Without optimizing the physic model, methods to approximate the equations of motion are used to describe the dynamics of the oscillators. The paper briefly presents the main stages used for optimizing the Pendulum-type oscillator at Rest. The analytical method allowed the adoption of models that were successively verified experimentally. By applying creative methods and techniques, the pendulum-type oscillator model was synthesized by eliminating it contradictions. Both the analytical method and the tehnical creation methods used allowed for the adoption, for the purpose of experimental validation, of the complex pendulum -type oscillator composed of three subsystems, namely: S1 –the environment (electromagnetic) subsystem at the experiment location , S2- the actual (technical) instrument , S3 – the subsystem of predominant influence of celestial bodies (and S4 – the disturbing celestial bodies rotating from east to west near the ecliptic area, etc.).In order to better highlight solutions for optimizing the pendulum-type oscillator, two research stages are undertaken, namely: the pendulum at rest and respectively the pendulum in mechano-electric oscillation. For stage 1, the main activities required by the epistemology of a viable experiment are presented. The research results materialized in a new model of the pendulum-type oscillator at rest, as well as a new paradigm for construction, data collection, and analysis of experimental results.

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Submitted: 05.10.2025 **Accepted:** 09.10.2025 **Published:** 26.10.2025

Keywords: Oscillator, Pendulum, Experiment, Anomaly, Technical Creation, Optimization, System, Perturbation

Introduction

No model, no matter how simple or sophisticated, is valid unless its predictions are consistent with experimental measurement results. In physics, an oscillator is a system capable of performing vibrations when displaced from its equilibrium position. Such physical systems are very common in physics, as well as in mechanics, electricity (RLC circuit), or even in solid-state physics (the vibration of an atom in the crystal lattice) [1,4]. Consider a system with n degrees of freedom with generalized coordinates $q = [q_1 ... q_n]$ and let q*(t) be a motion that must be determined with the initial conditions q ̇(0) and (q^*) ̇(0), respectively, in the particular case q*(t) = q*(0) =0, an equilibrium position. At the initial conditions, the modification of q (0) and q ̇(0) corresponds to a modified motion q(t). The deviations

$$y(t) = q(t) - q^*(t) \text{ and } \dot{y}(t) = \dot{q}(t) - \dot{q}^*(t) \quad (1)$$

they are called disturbances of movement, or of the equilibrium position q* (t) [1]. Galileo Galilei established the three laws of the pendulum (the law of isochronism, the law of the substance, the law of constant ratios) based on observational data obtained with the rudimentary measuring instruments of the time. Vincenzo Viviani (1622 – 1703, Galileo is disciple and biographer) Galilei is the first to observe, in the dynamics of the pendulum, a deviation from the laws of the pendulum. Viviani's observation (without giving it much attention) refers to the angular deviation of the pendulum's plane of oscillation. This effect observed by Viviani was verified experimentally by Jean Bernard Léon Foucault (1819-1868). Foucault, in the absence of a causal explanation, associated the observed anomaly with the Earth's rotational movement. The specialized literature highlights a multitude of anomalies of the pendulum observed in the results of measurements carried out with the pendulum. In the absence of a complete theory of the pendulum, the observed anomalies were associated with astronomical events occurring during the measurements (the eclipse effect, the anti-eclipse effect, the lunar-solar effect, the syzygy effect, …) [2,16,18-22]. A pendulum-type oscillator is the physical system that has a cosine term in the potential energy formula, similar to the potential of a simple pendulum. Science operates according to the scheme: hypothesis/model-prediction-refutation-rejection of the hypothesis/model. The presence of anomalies indicates reduced viability of the pendulum measurement system, a fact attributed to the lack of control over measurements, absence of causality, and other properties characteristic of a physical system [4,11,14,24]. Additionally, the presence of anomalies shows reduced physical consistency of the paradigm used in constructing the experiment, in data collection, and in analyzing the measurement results. An anomaly can be considered a discrepancy or deviation of the results from established rules, trends, or models. The design of the pendulum experiment (data collection, analysis of measurement results) is usually based on a scientific hypothesis of interaction recognized in science, such as, for example, Newtonian theory of gravitation in the case of the pendulum [1, 4, 8, 20-22, 26]. The pendulum's oscillations are described by the differential equation

$$\ddot{\alpha} + \omega_0^2 \alpha = 0, \quad (2)$$

where α is the angle of oscillation, ω_0 -is the rotational speed, α¨= acceleration, it is of the type

$$\ddot{q} + g(q, \dot{q}) = 0 \quad (3)$$

The solutions of equations of type (3) can be obtained through approximation methods, as the principle of superposition is not applicable. Approximation methods of the equations are used, respectively, for calculating the solutions of equation [1]. Thus, through approximation methods of the equations of motion, and by using

various mathematical techniques, the pendulum model is preserved. According to recent studies, it is stated that theories in science in general, and in physics in particular, are confirmed (temporarily) through experiments that test the claims and predictions of the theories, thus laying the foundations of scientific knowledge [Allan Franklin and Slobodan Perovic, in Experiment in Physics, 7]. Various strategies have been proposed for validating observational data, which, together with Hacking's strategy (unconventional growth solutions), constitute a epistemology of the viable experiment. A systemic way of analyzing and eliminating observed anomalies involves optimizing the structure, organization, and functions of the pendulum-type oscillator model according to the epistemology of a viable experiment [23,25].

Epistemology of the Experiment

In the process of optimizing, testing, and refining the mechanical oscillator model, the steps below were followed in accordance with the epistemology of a viable experiment.

Analysis of the Results of Previous Experiments Conducted within the Mechanical Paradigm

For the analysis of measurement results, various "effects" recognized in science were considered (the Airy effect, the Coriolis effect, the Euler effect, etc.). For example, Maurice Allais assumes that the rotation of the major axis A of the precession ellipse by an angle (azimuth) φrelative to the Y direction (the direction of the pendulum mass launch) is caused by the Airy effect and the Coriolis effect, namely:

$$\Omega = \frac{d\varphi\ \text{Airy}}{dt} + \frac{d\varphi\ \text{Cor}}{dt} = \mp p(1 - a^2/16l^2) \cdot \frac{3}{8} \cdot \frac{A}{l} \cdot \frac{a}{l} - \omega_{\text{Earth}} \cdot \sin(L) \quad (4)$$

where, ωEarth - the Earth's rotational speed, L - the latitude of the pendulum's location, l - the length of the string, A, a - the axes of the precession ellipse, figure 4 a. It was estimated that the paraconical pendulum rotations show (especially during the eclipse) an angular velocity of the pendulum's oscillation plane ω much higher than that assumed by equation (5), namely:

$$\omega = \omega_{Cor} + \omega_{Allais} = -\omega_{Earth} \sin(L) \pm k \sin[2(x - \varphi)] \quad (5)$$

where x- is the south-direction axis Sx of the rectangular coordinate system tied to the Earth at the suspension point of the pendulum SXYZ, φ - is the latitude, Figure 1a. According to M. Allais, the increase in angular velocity, $\omega_{Allais} = \sin(L) \pm k \sin[2(x - \varphi)]$ would be due to the "eclipse effect," without specifying the nature of k (the perturbation). To explain the variable values of the measured azimuth, Maurice Allais refers to the following effects: the Foucault effect, a restoring effect due to the suspension, the random influence of the sphere, and a periodic influence ["Doit-on reconsiderer les lois de la gravitation?", Perspectives X, 1958]. The analysis of the results of pendulum experiments carried out by Professor Javerdan, G.and others in Romania highlighted anomalies in the oscillation period of the pendulum during the February 1961 eclipse [18]. Javerdan's research was continued by D. Olenici, who proposes new 'effects' of the pendulum related to the anomalies highlighted in the results of measurements carried out during astronomical events (syzygy effect, etc.) [16,21,22]. The presence of anomalies reported by experimenters raises serious questions regarding the mechanical (gravitational) model of the pendulum [2, 18,19].

The Construction of One's Own Experiments within the Newtonian Paradigm of Interaction

The analysis of the results of measurements from one's own experiments built within the Newtonian paradigm highlights anomalies in the measurement results during and around eclipses, as well as other astronomical events, Figure 1. The presence of anomalies shown by the measurement results of the pendulum oscillation plane during the experiments, (around certain astronomical events) is confirmed. [1,18,22].

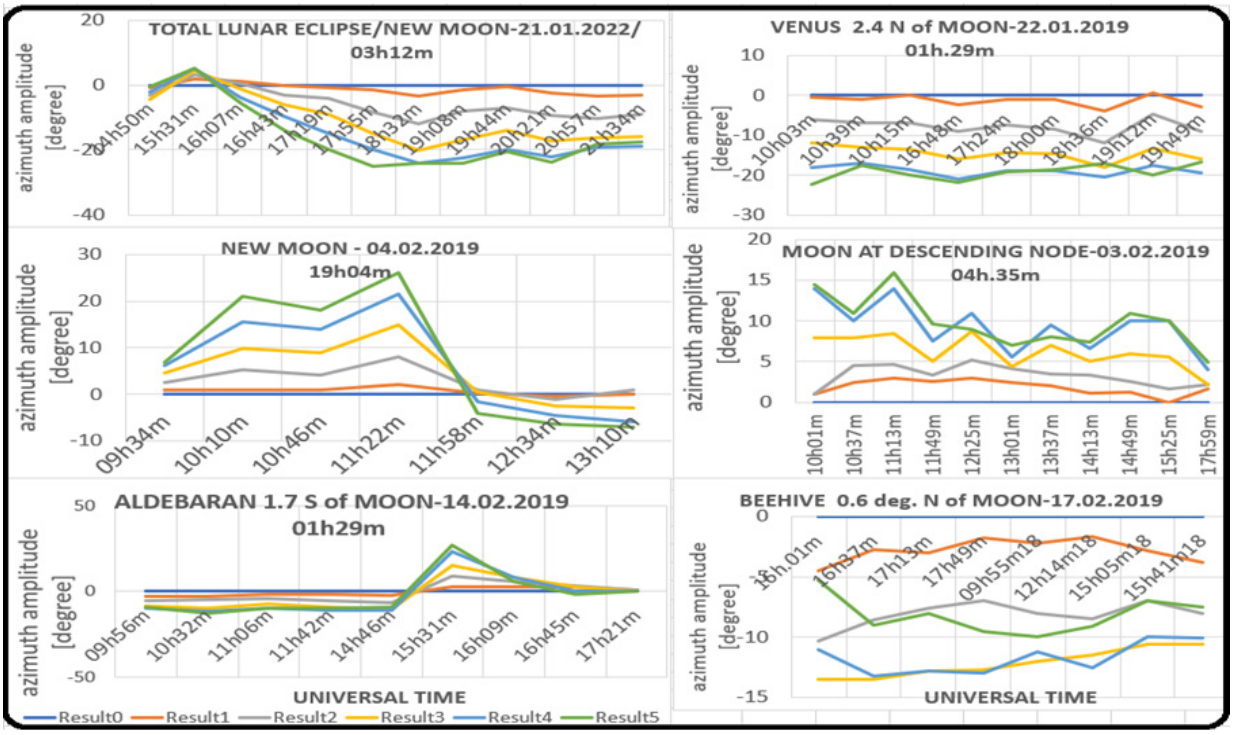

Figure 1: Diagram showing the variation of the pendulum's oscillation plane azimuth during the experiments

Eliminating Plausible Sources of Error and Alternative Explanations of the Outcome ('the Sherlock Holmes Strategy')

To eliminate sources of error, a new method is used for analyzing the measurement results from both categories of experiments (previous and original ones). The analysis of the results of the azimuth of the oscillation plane during the experiment was carried out in correlation with the relative position of celestial bodies on the celestial sphere with respect to the experiment's location (for example, sunrise, sunset, transit, midnight, etc.), and in relation to the relative positions of the celestial bodies themselves (for example, eclipse/conjunction/occultation, opposition, etc.) during the experiment, Figure 2. The analysis highlights, as a novel element, the existence of a correlation between the presence of unexpected results and the relative positions of celestial bodies in relation to the location of the experiment (sunrise, sunset, transit, etc.) [11]. At the same time, the analysis of the results of our own experiments confirms the hypothesis of a possible link between the relative position of celestial bodies during the experiment and the presence of unexpected results during the occurrence of an event with an astronomical event (close position of a celestial body to the Moon, conjunctions/eclipses, etc.). The novelty lies in the fact that these anomalies are predominantly present when celestial bodies near the ecliptic are at the horizon (sunrise, sunset) or at the zenith (transit).

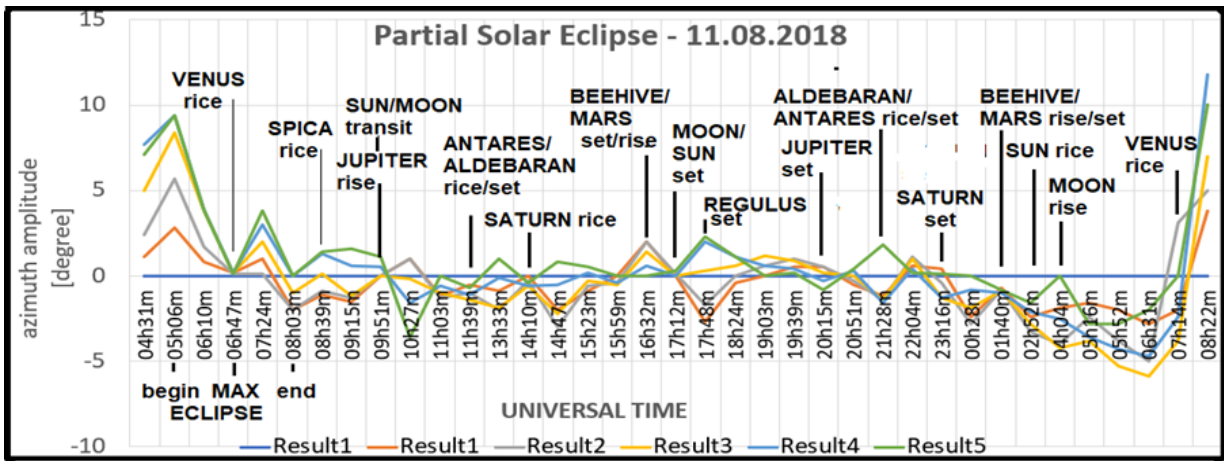

Figure 2: Correlation between the azimuth values of the pendulum's plane of oscillation and the position of celestial bodies near the ecliptic during the pendulum experiment

Using the Conclusions of the Results Analysis to Argue their Validity.

With the aim of eliminating plausible sources of error and alternative explanations of the result (the 'Sherlock Holmes strategy'), own experiments were designed to collect data regarding the non-gravitational interaction of the pendulum.

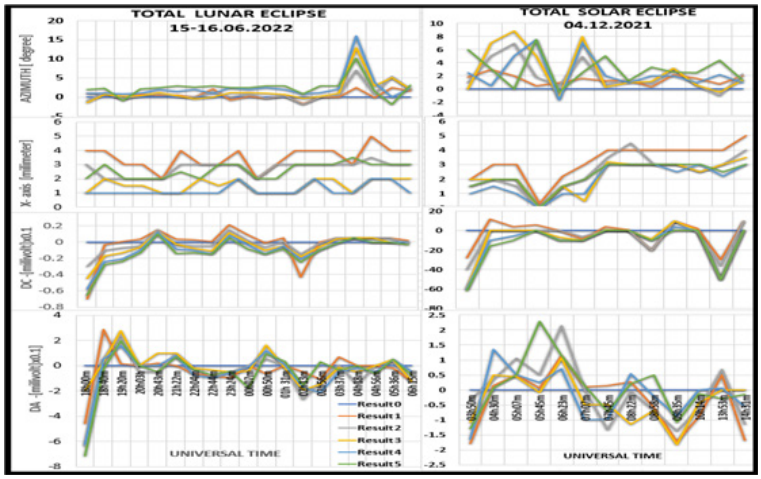

Figure 3: Variation of the precession ellipse parameters (azimuth, semi-major axis) and, of DC Voltage, AC Voltage

For a clearer highlighting of non-gravitational disturbances, the measurements were taken with the pendulum at mechanical rest. Data were collected on the electrical variables of the grounded pendulum conductor circuit (DC - direct voltage, AC - alternating voltage). The variables were collected to highlight the disturbances of the electric circuit parameters of the pendulum conductor, placed at the interface between the atmosphere and the Earth's surface, during the experiment. Analysis of the measurements of DC voltage and AC voltage shows a correlation between voltage disturbances (DC voltage, AC voltage) and the relative position between the pendulum and the celestial body in the area near the ecliptic (sunrise, sunset, transit, etc.) during the experiment. Additionally, a correlation is observed between the period of voltage disturbance and the period of the maximum relative position between the celestial bodies at the time of measurement (conjunctions, eclipse, occultation, etc.). Conclusion – A correlation is observed between voltage disturbances (DC, AC) and the relative positions of the pendulum with respect to celestial bodies, as well as between the relative positions of the celestial bodies themselves, at the time of measurement Figure 3.

Adopting a New Paradigm with Optimal Physical Consistency for the Construction of Experiments, Data Collection, as Well as for the Analysis of Measurement Results.

In electrical systems, a clear distinction is made between the steady-state and transient behavior. This distinction is based on the concept that steady-state behavior is considered normal, whereas the transient process occurs due to a fault. The operation of most electronic circuits (such as oscillators, switching capacitors, rectifiers, resonant circuits, etc.) relies on their transient behavior, and therefore, transients here can be considered 'desirable' or normal. Dielectric relaxation (dispersion) represents the dynamic response of matter to the application of an electric field. For the description of the transient behavior of the electronic circuit composed of the conduction current and the polarization current specific to the dielectric at the interface between the atmosphere and the Earth's crust, data related to the two different potential drops (the direct current voltage and the alternating current voltage) across the two electrodes of the capacitor (the lower surface of the disc/ pendulum electrode, and the terrestrial surface equivalent to the lower surface of the disc) are collected. For a series RC circuit, it is convenient to use the impedance Y(ω).

$$I(\omega) = V(\omega)/ Z(\omega) \qquad (6)$$

where $Z(\omega)= 1/ Y(\omega)$ is admittance..

The experiments were conducted within the complex gravitational-electric paradigm (Newton-Mach, Maxwell-Hertz) of interaction between bodies in the Universe [11-14]. Among the typical cases of disturbances that propagate via galvanic means (through conduction) is also the case of transient currents in electronic circuits (through coupling based on the electromagnetic field associated with an external disturbance) [17]. In this paradigm of conductor coupling, the pendulum is considered a current.

$$I = -d\, q/dt \qquad (7)$$

created by the disturbance source (disturbing subsystem S3) produces a voltage drop across the common impedance Z that overlaps with the useful signal from the RLC electric circuit of the pendulum, constituting a disturbing element, Figure 4.

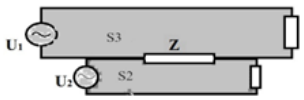

Figure 4. Diagram of the conduction (galvanic) coupling between two circuits with common impedance

The voltage drop caused by current I is calculated in the time domain, namely:

$$U(t) = R\, i(t) + L\, di(t)/dt \qquad (8)$$

Respectively, in the field of frequency according to the relationship

$$\underline{U}\,(\omega) = \underline{I}(\omega)\ \ \underline{Z}(\omega) \qquad (9)$$

where, $\underline{I}(\omega)$ is the effective complex value of the current quantity i. In the case of comparable powers between the two circuits, the current i in circuit 2 can, in turn, cause interference in the surrounding environment. The same observed effects can be explained both by the rotational movement of the Earth's globe relative to the stars of the entire universe (the immobile celestial sphere) and by an overall movement of the celestial sphere around the Earth's globe considered immobile. By this, the necessity of absolute space, whose only effect is the appearance of centrifugal forces, would be reduced, and the relativity of movements would

become complete. In the analysis of the results, the Earth's globe is considered fixed and the celestial sphere rotating from east to west Figure 6.a.

The Application of a Tool based on a Well-Grounded Theory Namely, the Natural Bodies of Universe (Electrical)Convergence.

The terminology used follows that presented in [10,11,24]. The theory of (electrical)convergence refers to the body as a primordial entity and to the interactions of classes of micro/macro bodies. The body is the referent of the theory, and the interaction of classes of bodies structurally and phenomenologically defines any place in the Universe. Each body has a interaction matrix. The matrix of the natural body is defined by the space for the manifestation of its causal and random potential. The interaction of the forms of motion of the matter of the analyzed body (system of bodies) with the forms of motion of the matter in the surrounding environment defines the state parameters of its matrix. Depending on the flow parameters in the matrix of a body, from the point of view of generalized thermodynamics, the matrix can be entropic or ge-entropic matrix. The primordial body that is in the structure of a place of the Universe's plenum has no matrix. The body of predominant influence represents the body whose matrix interacts and maximizes the causal potential and the random potential of a body in the Universe. Matter's conjugated movement form assures the interaction between natural matrix of the celestial bodies. The theory of (electrical)convergence of natural bodies in the Universe, well corroborated with observed phenomena, constitutes the new interaction paradigm used for constructing pendulum experiments [10,11]. According to the energy transfer mechanism in the Earth's (electrical)convergence theory, the entropic matrix of the Sun (the body of predominant influence) interacts with the entropic matrix of the Earth (the Earth-Moon dipole) in accordance with the forms of movement of conjugate matter (electric, magnetic, electromagnetic, ..., entropic) in compliance with the laws of generalized thermodynamics [10,11].

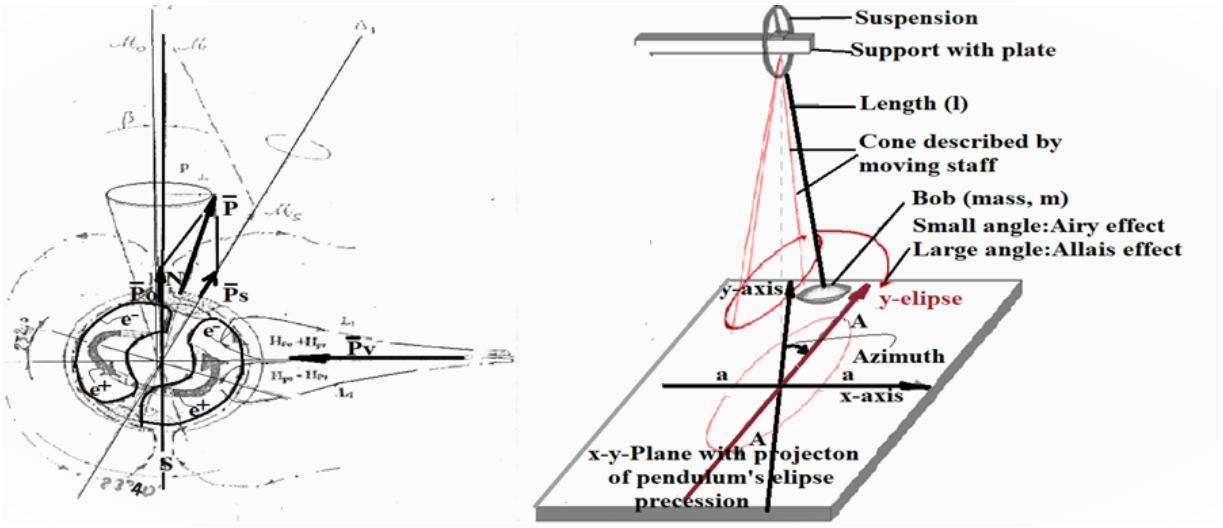

Figure 5. a,b. The electromagnetic fields(Pv) $\vec{}$, (Po) $\vec{}$, (Ps) $\vec{}$ corresponding to the Earth's entropy matrix, the parameters of the precession ellipse of the pendulum [11].

a) Electromagnetic (peri)terrestrial fields of magnetic moment (Pv) $\vec{}$ (generated by Earth's electro-convergence in the night zone), of magnetic moment ((Po) $\vec{}$, (generated by the variation of the electron circuit e-), and of magnetic moment Ps ((generated by the variation of the internal ionic circuit e+). b) Components of the precession ellipse of the pendulum.

In accordance with the theory of (electrical)convergence of natural bodies, the qualitative local variations of the state of (micro)bodies of natural structures within vvortexes (electromagnetic fields) P v , P0, Ps, (P v , P0 Ps) are the basis of the perturbations There are numerous empirical confirmations of this transfer mechanism (theories) [24]. Analysis within the paradigm of (electrical)convergence of natural bodies highlights the (non)gravitational disturbances of the pendulum, which are based on variations of the electromagnetic fields

(Pv) $\vec{}$, (Po) $\vec{}$, (Ps) $\vec{}$ in the entropic matrix of the Earth during the experiment. Any transfer (… electric, magnetic, mass/chemical, thermal, …) into the Earth's entropic (interaction) matrix occurs as a result of its interaction with the entropic matrix of an influence body (solar activity, …,). in the electric circuit of the pendulum conductor during the experiment, figure 6 a, b [10,11]. The activity of natural bodies of influence (Sun, planets, …) exhibits variations over time (daily, monthly, …), which, depending on the relative position between the analyzed terrestrial location and the position of the body of influence, manifest as specific impact flows. Those variable flows (- electric flux , - mass flux , - entropy flux, - boost mechanical flux) affects the (electromagnetic) environment of the paraconical pendulum location. The interaction of the fluxes with the structural elements of the Po, Ps, P_V vortices sustains (disturbs) the electromagnetic fields of momentum (Pv) $\vec{}$, (Po) $\vec{}$, (Ps) $\vec{}$. Thus, a disturbance of the resultant of these fields occurs, which can be revealed with the help of the pendulum conductor. To highlight the disturbance, one can choose one of the parameters of the electrical circuit of the pendulum, namely: voltage, current, phase, etc. Magnetic component of the electromagnetic field, is detected on Earth, while the magnetic component of the electromagnetic field, , is detectable referential not involved in the rotation of our planet. Experimental resulted that vortexes (electromagnetic fields) P v , P0, Ps, (P v , P0 Ps) is on average = = 7,9 .1025 gauss cm3 [24]. The electromagnetic interaction of the Earth's entropy matrix with celestial bodies is decisively modulated by solar activity.

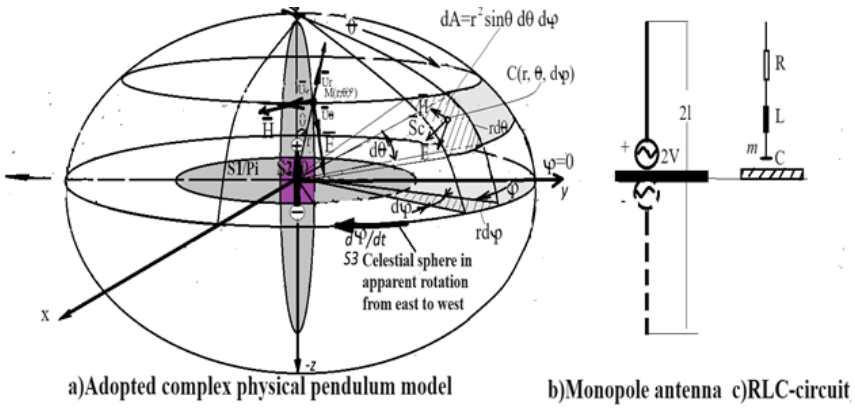

Figure 6: a, b. Model of complex pendulum at rest adopted for validation [14]

a) Sketch with the natural bodies (electrical)convergence paradigm of constructing experiments where, S1 - natural subsystem of the experiment location characterized by the electrical parameters of the material Pi, namely electrical conductivity σ, electrical permittivity ε and, respectively, magnetic permeability μ, S2 - technical subsystem pendulum, and at point M (r,θ,φ) without electromagnetic field parameters (H $\vec{}$,E $\vec{}$) and , S3 - natural subsystem of the celestial sphere without disruptive electromagnetic fields components (dE/dt and dH/dt) of the predominantly influential bodies. b) electrical subsystem with distributed parameters S2-monopole antenna

As a result of the interaction between the Earth's entropic matrix and the Sun's entropic matrix, in the peri-terrestrial nocturnal plasma zone, the plasma vortex Pv arises as a structural and functional element of the planetary (electrical)convergence theory, generating the electromagnetic field (of magnetic moment) (Pv) $\vec{}$ [10, 11]. The use of the analytical method, specifically the application of technical creation methods and techniques, allowed the synthesis of an optimal model of the pendulum-type oscillator by eliminating the contradictions of the mechanical pendulum. [12-14]. The physical solution and, respectively, the technical solution found using Altshuller's creation method to eliminate the pendulum's contradictions confirms the gravitational-electric model adopted analytically [3, 6, 12-14]. The analytically adopted model of the complex physical pendulum consists of three subsystems, namely: the environment subsystem of the experiment location S1, the oscillator subsystem S2, and the influence subsystem of the celestial sphere S3. In subsystem S3 are included the perturbing celestial bodies (with predominant influence, such as, for example, the celestial bodies from the

area near the ecliptic, namely sS4 perturbating system). Through the analytical method and respectively, heuristic methods and techniques, the complex oscillator system model of the pendulum-type oscillator has been optimized and adopted for experimental validation, where the electromagnetic environment (near, distant) plays a crucial role as part of the complex system, Figure 6. A, b.

Instruments and Equipment Used in Pendulum Experiments

For measuring the parameters of the precession ellipse, the equipment from the Pendulum Laboratory in Horodnic de Jos, Suceava was used (see Journal of Modern Physics > Vol.13 No.12, December 2022 - Confirmation of 24 h 50 min Lunar Periodicity, Apparently Inexplicable by Classical Factors, in Precession of Allais Pendulum). A pendulum donated by D. Olenici is installed in Voinesti, Iașsy. It is made of brass in the form of a horizontal biconvex lens with a mass of 5.75 [kg], suspended by a stainless-steel wire with a thickness of 1 mm and a length of 5.60 [m]. The suspension mechanism consists of a ring-shaped stirrup fixed to a hardened steel ball with a diameter of 6 mm that rolls in a cup, also made of hardened steel and optically polished.

Data Collection and Processing

Each experiment has a number of bob pendulum launch series depending on the purpose, objective, and duration of the astronomical event being investigated. A series usually has a duration of around 2500 seconds. According to the gravitational -electric paradigm, data related to the parameters of the electrical circuit (DA-voltage, DC-voltage) and to the parameters of the precession ellipse (azimuth, period, semi-axes of the precession ellipse, etc.) are collected. The results of the measurements of each series are averaged over 7-minute intervals. Thus, the averaged values R1, R2, R3, R4, R5, R6, R7 are obtained, which are highlighted on the ordinate of the diagram corresponding to the start time of each series within the experiment. For example, series 1 has on the x-axis the pendulum launch (period, DC-Voltage, AC-Voltage).

Analysis of Measurement Results in Electric-Convergence Paradigm

The analysis of measurement results is carried out in accordance with the gravitational-electric paradigm of experiment construction. Depending on the purpose of the analysis, a certain reality can include various systems (mechanical, electromagnetic, chemical, etc.), whether or not they are correlated. Achieving the proposed goal for the system is accomplished through the contribution of the human operator (as part of the environment) who works with the different components of the system. According to the hypothesis of Newtonian theory of gravitation, centrifugal force is the result of Earth's rotation in absolute space (void of matter). In Newtonian mechanics, transformations are conservative, reversible, not allowing qualitative transformations of the interacting bodies. According to the (hypothetical) structure of the proposed complex physical system, a new (non) gravitational paradigm is necessary to analyze the measurement results in accordance with the proposed purpose, namely: identification of non-gravitational interactions. Mach considers that a place in the Universe is characterized by physical laws due to its interaction with all matter (bodies) in the Universe. Maxwell, on the other hand, optimizes the physical consistency of Mach's paradigm through the hypothesis that the transmission of electromagnetic interactions is due to stresses that are not related to deformations of the substance and that can propagate even in free space (in vacuum). Completing Maxwell's equations written in scalar form with the equations of the laws of matter allows the complete determination of an 'electromagnetic system. Mach's hypothesis has a superior physical consistency compared to the paradigm proposed by Newton, in that the physical laws of a place are not solely related to mechanics but are the result of all interactions with matter in the Universe. The theory of electro-convergence of natural bodies in the Universe optimizes the physical consistency of the above paradigm in the spirit of Maxwell-Mach's principle, the same effects observed in a natural body (physical system) can be explained both by the rotation of the body relative to the stars of the entire universe (the immobile celestial sphere) and by a collective movement of the celestial sphere around the body (physical system) considered immobile. The analysis of the measurement results is based on the theory of electro-convergence of natural bodies in the Universe, capable of highlighting the electrical disturbances of the pendulum at rest during an experiment. Figure 8

The use of Statistical Arguments

From the over 300 hours of experiment built and executed in the non-gravitational paradigm of interaction of the pendulum at rest, we present below 2 (two) diagrams, figures 7 a, b. The analysis of the results in the paradigm of the Earth's electrical-convergence highlights disturbances of the voltages of the electronic circuit of the pendulum at rest. A correlation is observed between the moment of occurrence of the voltage disturbances and the relative position of the bodies of preponderant influence in the area close to the ecliptic in relation to the place of the experiment.

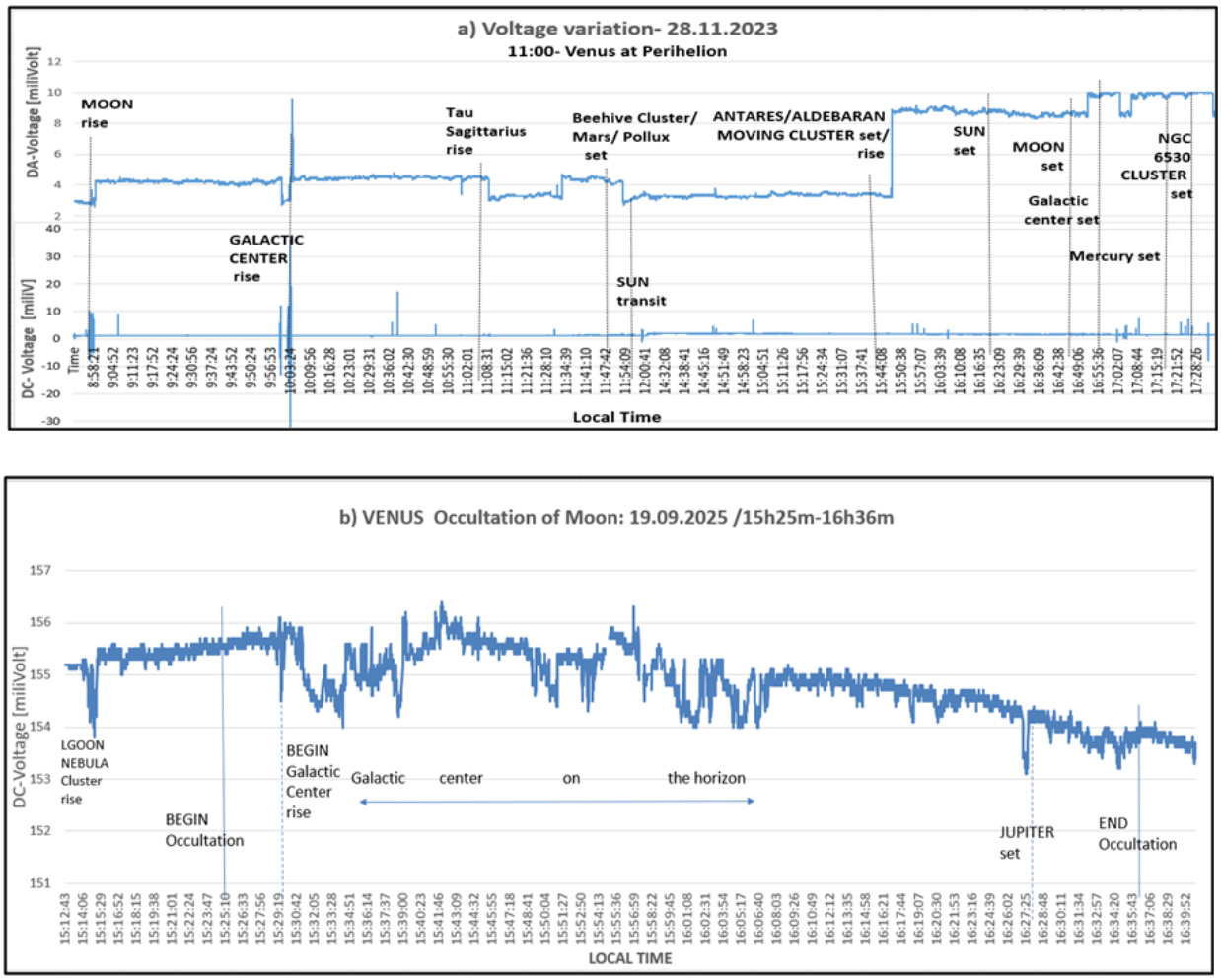

Figure 7 a-d., Figure 8 a-c**.** Diagram of the variation of DA-Voltage and DC-Voltage in correlation with the position of the celestial bodies of influence a) at the perihelion of Venus and b) at Venus occultation of Moon.

Discussion

In the process of optimizing the pendulum-type oscillator, the stages corresponding to the epistemology of a viable experiment were followed [23]. An important stage of this strategy focused on a systemic analysis of the Earth's non-gravitational interactions. The goal of this first attempt to redefine the pendulum model was to find a theoretical connection between the observed "effects" (disturbances) and the variation of the local resultant, namely:

$$P = Ps + Pv + Po \qquad (10)$$

of the Earth's electromagnetic fields (vortices) with the magnetic moment $(Ps)^{\rightarrow}$ (inside the Earth's globe), $(P0)^{\rightarrow}$ (around the Earth), respectively, $(Pv)^{\rightarrow}$ (induced on the night side in Earth's plasma envelope as part of its entropic matrix), [10, 11].

The theoretical and experimental results of this endeavor to understand the interactions of the Earth's entropic matrix have created the premises for optimizing and increasing the viability of the pendulum at rest as the first stage in the optimization of the pendulum-type oscillator. The experimentally validated model of the pendulum-type oscillator at rest highlights structures, organization, and functions specific to the non-gravitational interaction of the pendulum-type oscillator. Additionally, the presence of the electronic circuit in the pendulum conductor (subsystem S2) shows that the pendulum-type oscillator is an open system that interacts non-gravitationally with the environment, specifically with the variation of the resultant vector P = Ps +Po +P v during the experiment at the experimental site. This variation is due to the interaction of the Earth's entropic matrix with the (resultant) entropic matrices of influencing celestial bodies. The structure, organization, and functions of the complex oscillator- type pendulum at rest, composed of subsystems S1, S2, and S3, highlight in S2 subsystem of either an electric circuit with lumped parameters (RL, RC, RLC) or an electric circuit with distributed parameters (monopole antenna), depending on the strength of the electric interactions. [12,13,14]. The system properties related to the respective antenna, the RLC electrical circuit (controllability, observability, etc.), increase the viability of the optimized pendulum model. The results and conclusions from this first stage of optimizing the pendulum-type oscillator at rest facilitate the process in the second stage of optimizing the pendulum-type oscillator. It can be concluded that this first stage of optimization created the premises for the synthesis of a new class of oscillators, namely, the mechanical-electric oscillator class. The new proposed mechanical-electric oscillator model has optimal viability conferred by the presence of system properties (controllability, observability, robustness, etc.).

Results

The theoretical and experimental analysis, as well as the application of methods and techniques of technical creation, allowed the optimization and adoption of the complex physical system of the pendulum- type oscillator (at rest), consisting of three subsystems S1-S3. Also, a modern paradigm for constructing the experiment with the pendulum at rest has been adopted, namely, the paradigm of (electrical)convergence of natural bodies in the Universe, Figure 6. a.b. According to the new paradigm, variables of the electronic circuit were collected, namely: DC Voltage and AC Voltage. For the analysis of the results, the paradigm of the (electrical) convergence of natural bodies in the Universe was adopted for highlighting electrical disturbances. The results and conclusions from this first stage of optimizing pendulum-type oscillator at rest facilitate the process in the second stage of optimizing the pendulum-type oscillator. It can be concluded that this first stage of optimization created the premises for the synthesis of a new class of oscillators, namely, the mechano-electric oscillator class.

Authors' contribution

Dumitru Crivoi: Designer of the experiments in the non-gravitational and gravitational paradigm, responsible for the acquisition of electrical data, responsible for the analysis of the measurement results and the overall exploitation of data, responsible for the design and writing of the article.

Dimitrie Olenici: co-organizer of experiments, responsible for the acquisition and analysis of measurement results in the gravitational paradigm, main designer of designer of laboratory and pendulum.

Maria Rediu: co-organizer of experiments, co- responsible for the acquisition of electrical data, co- responsible for the writing and editing of the article.

Research Directions

Completion of the optimization process of the pendulum-type oscillator.

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