A few calculations of receding Moon from spherical kinetic dynamics, receding planetary orbits, and the quantization of celestial motions

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Abstract

The present article discusses some interesting phenomena including the Lense-Thirring type anomalous precession, using a known spherical kinetic dynamics approach. Other implications include a plausible revised version of the celestial quantization equation described by Nottale and Rubcic & Rubcic. If the proposition described herein corresponds to the facts, then this kinetic dynamics interpretation of '*frame-dragging'* effect could be viewed as a step to unification between GTR-type phenomena and QM. Further observation to verify or refute this conjecture is recommended, plausibly using LAGEOS-type satellites.

Keywords: Lense-Thirring effect, celestial quantization, LAGEOS satellite, boson condensation, gravitation

Introduction

It is known, that the use of Bohr radius formula to predict celestial quantization has led to numerous verified observations [1]. This approach was based on Bohr-Sommerfeld quantization rules [2][3]. While this kind of approach is not widely accepted yet, this could be related to wave mechanics equation to describe large-scale structure of the Universe [4], and also a recent suggestion to reconsider Sommerfeld's conjectures in Quantum Mechanics [5]. Some implications of this quantum-like approach include exoplanet prediction, which becomes a rapidly developing subject in recent years [6][7].

Rubcic & Rubcic's approach [2] is particularly interesting in this regard, because they begin with a conjecture that Planck mass ($m_p = \sqrt{\hbar c / 2\pi G}$) is the basic entity of Nature, which apparently corresponds to Winterberg's assertion of superfluid Planckian aether comprised of phonon-roton pairs [8]. In each of these pairs, superfluid vortices can form with circulation quantized according to $\oint v_{+-}.dx = n\hbar / m_p$. This condition implies the Helmholtz vortex theorem, $d/dt \oint v_{+-}.dx = 0$. This relationship seems conceivable, at least from the viewpoint of likely neat linkage between cosmology phenomena and various low-temperature condensed matter physics [9][10][11]. In effect, celestial objects at various scales could be regarded as spinning Bose-Einstein condensate; which method has been used for neutron stars [32].

Despite these aforementioned advantages, it is also known that all of the existing celestial quantization methods [1][2][3] thus far have similarity that they assume a circular motion, while the actual celestial orbits (and also molecular orbits) are elliptical. Historically, this was the basis of Sommerfeld's argument in contrast to

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Bohr's model, which also first suggested that any excess gravitational-type force would induce a precessed orbit. This is the starting premise of the present article, albeit for brevity we will not introduce elliptical effect yet [12].

Using a known spherical kinetic dynamics approach, some interesting phenomena are explained, including the receding Moon, the receding Earth from the Sun, and also anomalous precession of the first planet (Lense-Thirring effect). Despite some recent attempts to rule out the gravitational quadrupole moment (J_2) contribution to this effect [13][14][15][16][17], it seems that the role of spherical kinetic dynamics [12] to Lense-Thirring effect has not been taken into consideration thus far, at least to this author's knowledge.

After deriving prediction for some known observed phenomena, this article will also present a revised version of quantization equation of L. Nottale [1] in order to take into consideration this spherical kinetic dynamics effect. If the proposition as described here corresponds to the facts, then this approach could be viewed as a step to unification of GTR-type phenomena and Quantum Mechanics.

Spherical kinetic dynamics, Earth bulging effect

In this section we start with some basic equations that will be used throughout the present article. It is assumed that the solar nebula is disk-shaped and is in hydrostatic equilibrium in the vertical direction. Let suppose that the disk has approximately Keplerian rotation, ω; then the half-thickness of the disk is given by [4d; p.4-5]:

$$d = c_s / \omega \quad (1)$$

and

$$c_s \approx \sqrt{kT/m} \quad (1a)$$

where d and c_s represents half-thickness of the disk and sound velocity, respectively.

In order to find the spherical kinetic dynamics contribution to Lense-Thirring effect, we begin with the spinning dynamics of solid sphere with mass M. Using the known expression [12; p.6, p.8]:

$$E_{kinetic} = -I_{zz}\omega^2 / 2 \quad (2)$$

$$I_{sphere} = 2MR^2 / 5 \quad (2a)$$

where I_{zz}, ω, M, R represents angular momentum, angular velocity, spinning mass of the spherical body, and radius of the spherical body, respectively. Inserting equation (2a) into (2) yields:

$$E_{kinetic} = -MR^2\omega^2 / 5 \quad (3)$$

This known equation is normally interpreted as the amount of energy required by a spherical body to do its axial rotation. But if instead we conjecture that '*galaxies get their angular momentum from the global rotation of the Universe due to the conservation of the angular momentum*' [34], and likewise the solar system rotates because of the corresponding galaxy rotates, then this equation implies that the rotation itself exhibits extra kinetic energy. Furthermore, it has been argued that the global rotation gives a natural explanation of the empirical relation between the angular momentum and mass of galaxies: $J \approx \alpha M^{5/3}$ [34]. This conjecture is also relevant in the context of Cartan torsion description of the Universe [18]. For reference purpose, it is worthnoting in this regard that sometime ago R. Forward has used an argument of non-Newtonian gravitation force of this kind, though in the framework of GTR (*Amer.J.Phys*. **31** No. 3, 166, 1963).

Let suppose this kind of extra kinetic energy could be transformed into mass using a known expression in condensed-matter physics [10b; p.4], with exception that c_s is used here instead of v to represent the sound velocity:

$$E_{kinetic}(n, p) = c_s.p = m_s.c_s^{\,2} \quad (4)$$

where the sound velocity obeying [10b; p.4]:

$$c_s^{\,2}(n) = (n/m)(d^2 \in / dn^2) \quad (4a)$$

Physical mechanism of this kind of mass-energy transformation is beyond the scope of the present article, albeit there are some recent articles suggesting that such a condensed-matter radiation is permitted [35]. Now inserting this equation (4) into (3), and by dividing both sides of equation (3) by Δt, then we get the incremental mass-energy equivalent relation of the spinning mass:

$$\Delta m_s / \Delta t = -\omega.(\Delta\omega / \Delta t).MR^2 / (5.c_s^{\,2}) \quad (5)$$

By denoting $\dot{\omega} = \Delta\omega / \Delta t$, then this equation (5) can be rewritten as:

$$\Delta M / \Delta t = -\dot{\omega}.MR^2\omega /(5.c_s^{\ 2}) \qquad (5a)$$

For $\dot{\omega} = 0$ the equation (5a) shall equal to zero, therefore this equation (5a) essentially says that a linear change of angular velocity observed at the *surface* of the spinning mass corresponds to mass flux, albeit this effect is almost negligible in daily experience. But for celestial mechanics, this effect could be measurable.

If, for instance, we use the observed anomalous *decceleration rate* [30] of angular velocity of the Earth as noted by Kip Thorne [19]:

$$|\omega| / |\dot{\omega}| = 6x10^{11}\ years \qquad (6)$$

And using values as described in Table 1 for other parameters:

Table 1. Parameter values to compute kinetic expansion of the Earth

Parameter	Value	Unit
R_e	$6.38x10^6$	m
M_e	$5.98x10^{24}$	kg
T_e	$2.07x10^6$	sec
ω_e	$3.04x10^{-6}$	rad/s
c_s	0.14112	m/s

It is perhaps worth noting that the only free parameter here is c_s =0.14112 m/sec. This value is approximately within the range of Barcelo *et al.*'s estimate of sound velocity (at the order of cm/sec) for gravitational Bose-Einstein condensate [11], provided the Earth could be regarded as a spinning Bose-Einstein condensate. Alternatively, the sound velocity could be calculated using equation (1a), but this obviously introduces another kind of uncertainty in the form of determining temperature (T) inside the center of the Earth; therefore this method is not used here.

Then inserting these values from equation (6) and Table 1 into equation (5a) yields:

$$\Delta M / \Delta t \approx 3.76x10^{16} kg / year \qquad (7)$$

Perhaps this effect could be related to a recent Earth bulging data, which phenomenon lacks a coherent explanation thus far [36].

Prediction of the receding Moon and the receding planets from the Sun

Now let suppose this predicted value (7) is fully conserved to become inertial mass, and then we could rewrite Nottale's method of celestial quantization [1]. Alternatively, we could begin with the known Bohr-Sommerfeld quantization rule [3]:

$$\oint p_j.dq_j = n_j.2\pi.e^2 /(\alpha_e.c) \qquad (8a)$$

Then, supposing that the following substitution is plausible [3]:

$$e^2 / \alpha_e \rightarrow GMm / \alpha_g \qquad (8b)$$

where e, α_e, α_g represents electron charge, Sommerfeld's fine structure constant, and gravitational-analogue of fine structure constant, respectively. This corresponds to Nottale's basic equations $v_n = \alpha_g.c / n = v_o / n$ and v_o=144 km/sec [1]. And by introducing the gravitational potential energy [12]:

$$\Phi(r,\vartheta) = -GM / r.\left[1 - J_2.(a / r)^2.\left(3\cos^2\vartheta - 1\right)/ 2\right] \qquad (8c)$$

where ϑ is the polar angle (collatude) in spherical coordinate, M the total mass, and a the equatorial radius of the solid.

Neglecting higher order effects of the gravitational quadrupole moment J_2 [13][14][15][16][17], then we get the known Newtonian gravitational potential:

$$\Phi = -GM / r \qquad (8d)$$

Then it follows that the semi-major axes of the celestial orbits are given by [1][3]:

$$r_n = GMn^2 / v_o^{\ 2} \qquad (8e)$$ where n=1,2,….is the principal quantum number.

It could be shown, that equation (8a) also corresponds to the conjecture of quantization of circulation [4b].

By reexpressing equation (8e) for mass flux effect (5) by defining $M_{n+1} = M_n + \Delta M_n / \Delta t_n$, then the total equation of motion becomes:

$$(M + \Delta M / \Delta t) = (r + \Delta r / \Delta t).v_0^{\ 2} /(G.n^2) \qquad (8f)$$

For $\Delta \to 0$, equation (8f) can be rewritten as:

$$dM / dt - \chi.dr / dt + M - r.\chi = 0 \qquad (8g)$$

where

$$\chi = v_0^{\ 2} /(G.n^2) \qquad (8h)$$

Now inserting (5a) into equation (8g), and dividing both sides by χ, yields:

$$dr / dt - M / \chi + r + \dot{\omega}.MR^2\omega /(\chi 5.c_s^{\ 2}) = 0 \qquad (8i)$$

This equation (8i) can be rewritten in the form:

$$\dot{r} + r + \varphi = 0 \qquad (8j)$$

by denoting $\dot{r} = dr / dt$ and

$$\varphi = -M / \chi.[1 - \dot{\omega}.R^2\omega /(5.c_s^{\ 2})] \qquad (8k)$$

if we suppose a linear decceleration at the surface of the spinning mass. Equation (8j) and (8k) is obviously a first-order linear ODE equation [26], which admits exponential solution. In effect, this implies that the revised equation for celestial quantization [1][2] takes the form of spiral motion. This could also be interpreted as a plausible solution of diffusion equation in *dissipative* medium [33], which perhaps may also correspond to the origin of spiral galaxies formation [28]. And if this corresponds to the fact, then it could be expected that the spiral galaxies and other gravitational clustering phenomena [22b] could also be modeled using the same quantization method [39], as described by Nottale [1] and Rubcic & Rubcic [2].

To this author's knowledge these equations (8j) and (8k) have not been presented before elsewhere, at least in the context of celestial quantization.

Inserting result in equation (7) into (8e) by using n=3 and v_o=23.71 km/sec for the Moon [2] yields a receding orbit radius of the Moon as large as 0.0401 m/year, which is very near to the observed value ~ 0.04 m/year [20]. The quantum number and specific velocity here are also free parameters, but they have less effect because these could be replaced by the actual Moon orbital velocity using $v_n = v_0 / n$ [1].

While this kind of receding Moon observation could be described alternatively using oscillation of gravitational potential [30], it seems the kinetic expansion explanation is more preferable particularly with regard to a known phenomenon of continental drift [29], and also perhaps a known periodic geological layering described by Alvarez *et al.* Furthermore, using this kind of approach it seems that we could also offer a plausible explanation for the kinetic origin of volcanoes eruption. Apparently, none of these effects could be explained using oscillation of gravitational field argument, because they are relentless effects.

In this regard, it is interesting to note that Sidharth has argued in favor of varying G [21]. From this starting point, he was able to explain –among other things-- anomalous precession (Lense-Thirring effect) of the first planet and also anomalous Pioneer acceleration. This will be discussed in the subsequent section. In principle, Sidharth's basic assertion is [21]:

$$G = G_{\otimes}.(1 + t / t_{\otimes}) \qquad (9)$$

It is worthnoting here that Barrow [40c] has also considered a somewhat similar argument in the context of varying constants:

$$G = G_{\otimes}.t_{\otimes} /(t - c) \qquad (9a)$$

However, in this article we will use (9) instead of (9a), partly because it will lead to more consistent predictions with observation data. Alternatively, we could also hypothesize using Maclaurin formula:

$$G = G_{\otimes}.e^{t/t_{\otimes}} = G_{\otimes}.(1 + t / t_{\otimes} + (t / t_{\otimes})^2 / 2! + (t / t_{\otimes})^3 / 3! + ...) \qquad (9b)$$

This expression is a bit more consistent with the exponential solution of equation (8j) and (8k). Therefore, from this viewpoint equation (9) could be viewed as first-order approximation of (9b), by neglecting second and higher orders in the series. It will be shown in subsequent sections, that equation (9) is more convenient for deriving predictions.

If we conjecture that instead of varying G, the spinning mass M varies, then it would result in the same effect as explained by Sidharth [21], because for Keplerian dynamics we could assert k=GM, where k represents the stiffness coefficient of the system. Accordingly, Gibson [22] has derived similar conjecture of exponential mass flux from Navier-Stokes gravitational equation, which can be rewritten in the form:

$$M = G_{\otimes}.e^{t/t_{\otimes}} = M_{\otimes}.(1 + t / t_{\otimes} + (t / t_{\otimes})^2 / 2! + (t / t_{\otimes})^3 / 3! + ...) \qquad (9c)$$

provided we denote for consistency [22]:

$$t_{\otimes} = \tau_g / 2\pi \quad (9d)$$

Using the above argument of Maclaurin series, equation (9c) could be rewritten in the similar form with (9) by neglecting higher order effects:

$$M = M_{\otimes}.(1 + t / t_{\otimes}) \quad (10)$$

In a recent article Gibson & Schild [23] argue that their gravitational Navier-Stokes approach results in better explanation than what is offered by Jeans instability. Furthermore, R.M. Kiehn has also shown that the Navier-Stokes equation corresponds exactly to Schroedinger equation [27], which seems to support the idea of quantization of celestial motion [1][2][3]. A plausible extension of Euler equation and Jeans instability to describe gravitational clustering has been discussed in [22b], which corresponds to viscosity term and also turbulence phenomena [22c,22d] described by Gibson. Therefore, apparently equation (10) is more consistent with kinematical gravitational instability consideration than (9).

From equation (10) we could write for M at time difference $\Delta t = t_2 - t_1$:

$$M_2 = M_{\otimes}.(1 + t_2 / t_{\otimes}) \quad (11)$$

$$M_1 = M_{\otimes}.(1 + t_1 / t_{\otimes}) \quad (12)$$

from which we get:

$$\Delta M = (M_{\otimes} / t_{\otimes}).(t_2 - t_1) \quad (13)$$

Inserting our definition $\Delta t = t_2 - t_1$ yields:

$$\Delta M / \Delta t = (M_{\otimes} / t_{\otimes}) = k \quad (14)$$

For verification of this assertion, we could use equation (14) instead of (5a) to predict mass flux of the Earth. Inserting the present mass of the Earth from Table 1 and a known estimate of Earth epoch of $2.2 x 10^9$ years, we get $k = 0.272 x 10^{16}$ kg/year, which is approximately at the same order of magnitude (ratio=13.83) with equation (7).

Inserting equation (14) into equation (5a), we get:

$$M_{\otimes} / t_{\otimes} \approx -\dot{\omega}.MR^2\omega / (5.c^2) \quad (15)$$

which is the basic conjecture of the present article. From this viewpoint we could rewrite equation (8j) and (8k):

$$dr / dt = M / \chi.[1 - \dot{\omega}.R^2\omega / (5.c_s{}^2)] - r \quad (15a)$$

and inserting equation (15), we get:

$$dr / dt = M / \chi.[1 + M_{\otimes} / (t_{\otimes}.M)] - r \quad (15b)$$

A plausible test of this conjecture could be made by inserting this result (14) into equation (8e) and using $M_{\otimes} = 1.98951 x 10^{33} g$ and $t_{\otimes} = 2 x 10^{10}\ year$ as the epoch of the solar system [21], and specific velocity v_o=144 km/sec [1], then from equation (15b) we get a receding orbit radius for Earth at the order of:

$$\Delta r_{Earth} / \Delta t = 6.03 m / year \quad (16)$$

Interestingly, there is an article [24] hypothesizing that there is a tad effect of *receding Earth orbit from the Sun at the order of 7.5 m/year*, supposing Earth orbit radius has been expanding as large as $93 x 10^6$ miles since the beginning of the solar epoch at $t_{\otimes} = 2 x 10^{10}\ year$ ago (in the quoted article, it was assumed that the epoch is $4.5 x 10^9$ years). Of course, it shall be noted that there is large uncertainty of the estimate of solar epoch, for instance Gibson prefers $4.6 x 10^{17}$ sec (or $1.46 x 10^{10}$year, see [22]). Therefore, it is suggested here to verify this assumption of solar epoch using the same tad effect for other planets. For observation purposes, some estimate values were presented in Table 2 using the same approach with (15b).

Table 2. Prediction of planetary orbit radii (r) increment

Celestial object	Quantum number (n)	Orbit increment (m/yr)
Mercury	3	2.17
Venus	4	3.86
Earth	5	6.03
Mars	6	8.68

Quantization of anomalous celestial precession

It is known that the Newtonian gravitation potential equation (8d) is only weak-field approximation, and that GTR makes a basic assertion that this equation is *exact*. And if the gravitation could be related to boson condensation phenomena [9][10][11], then it seems worth to quote a remark by Consoli [9b; p.2]: "*for weak gravitational fields, the classical tests of general relativity would be fulfilled in any theory that incorporates the Equivalence Principle*." And also [9b; p.18]: "Einstein had to start from the peculiar properties of Newtonian gravity to get the basic idea of transforming the classical effects of this type of interaction into a metric structure. For this reason, classical general relativity cannot be considered a *dynamical* explanation of the origin of gravitational forces." Furthermore, Consoli also argued that the classical GTR effects other than anomalous precession could be explained without introducing non-flat metric, as described by Schiff [9b; p.19], therefore it seems that the only remarkable observational 'proof' of GTR is anomalous precession of the first planet [37]. Therefore, it seems reasonable to expect that the anomalous precession effect could be predicted without invoking non-flat metric, which suggestion is particularly attributed to R. Feynman, who 'believed that the geometric interpretation of gravity beyond what is necessary for special relativity is not essential in physics.' [9d] It will be shown that a consistent approach with equation (10) will yield not only the anomalous celestial precession, but also a conjecture that such an anomalous precession is quantized.

By using the same method as described by Sidharth [21], except that we assert varying mass M instead of varying G – in accordance with Gibson's solution [22]--, and denoting the average angular velocity of the planet by

$$\dot{\Omega} \equiv 2\pi / T \qquad (17)$$

and period T, according to Kepler's Third Law:

$$T = 2\pi . a^{3/2} / \sqrt{GM} \qquad (18)$$

Then from equation (10), (17), (18) we get:

$$\dot{\Omega} - \dot{\Omega}_o = -\dot{\Omega}_0 . t / t_{\otimes} \qquad (19)$$

Integrating equation (19) yields:

$$\varpi(t) = \Omega - \Omega_o = -(\pi / T) . t^2 / t_{\otimes} \qquad (20)$$

which is average precession at time 't'. Therefore the anomalous precession corresponds to the epoch of the corresponding system. For Mercury, with T=0.25 year, equation (20) yields the average precession per year at time 't':

$$\varpi(t)_{Mercury} = \Omega - \Omega_0 = -4\pi . t^2 / t_{\otimes} \qquad (21)$$

Using again $t_{\otimes} = 2x10^{10}\ year$ as the epoch of the solar system and integrating for years n=1 … 100, equation (21) will result in total anomalous precession in a century:

$$\varpi(n) = \sum_{n=1}^{n=100} \varpi(n) = 43.86''\ percentury \qquad (22)$$

It would be more interesting in this regard if we also get prediction of this effect for other planets using the same method (20), and then compare the results with GTR-Lense-Thirring prediction. Table 3 presents the result, in contrast with observation by Hall and also prediction by Newcomb, which are supposed to be the same [25].

Table 3. Comparison of prediction and observed anomalous precession

Celestial Object	Period, T	$\omega_{prediction}$	Hall/ Newcomb	Diff.	GTR/ Thirring	Diff.
	(year)	(arcsec/cy)	(arcsec/cy)	(%)	(arcsec/cy)	(%)
Mercury	0.25	43.86	43.00	2.03	42.99	-0.05
Venus	0.57	19.24	16.80	14.54	0.8	-95.2
Earth	1.00	10.96	10.40	5.46	3.84	-63.1
Mars	1.88	5.83	5.50	6.02	1.36	-76.0
Jupiter	4346.5	$2.52x10^{-3}$				
Saturn	10774.9	$1.02x10^{-3}$				
Uranus	30681.0	$3.57x10^{-4}$				
Neptune	60193.2	$1.82x10^{-4}$				
Pluto	90472.4	$1.21x10^{-4}$				

It is obvious from Table 3 above that the result of equation (20) appears near to GTR and observation by Hall for the first planet, but there is substantial difference between GTR and observation for other planets particularly Venus. In the mean time, average percentage of error from prediction using equation (20) and observation (Hall) is 7.01%. The numerical prediction for Jovian planets is negligible; though perhaps they could be observed provided there will be more sensitive observation methods in the near future.

It is perhaps also worth noting here, that if we use the expression of quantization of period [3]:

$$T = 2\pi.GM.n^3 / v_0^3 \quad (23)$$

where $v_0 = \alpha_g.c = 144 km/s$ in accordance with Nottale [1]. Inserting this equation (23) into (20), yields:

$$\varpi(t)_{precess} = \Omega - \Omega_0 = -(v_0^3 / 2GMn^3).t^2 / t_{\otimes} \quad (24)$$

or

$$T_{precess} = 2\pi / \varpi(t)_{precess} = -4\pi.t_{\otimes} GMn^3 / v_o^3 t^2 \quad (24a)$$

This equation (24) and (24a) imply that the anomalous precession of Lense-Thirring type is also *quantized*. Apparently no such an assertion has been made before in the literature. It would be interesting therefore, to verify this assertion for giant planets and exoplanets, but this is beyond the scope of the present article.

A plausible test using LAGEOS-type satellites

In this regard, one of the most obvious methods to observe those tad effects as described in this article is using LAGEOS-type satellites, which have already been used to verify Lense-Thirring effect of Earth. What is presented here is merely an approximation, neglecting higher order effects [12][16][31].

Using equation (8c) we could find the rotational effect to satellite orbiting the Earth. Supposed we want to measure the precessional period of the inclined orbit period. Then the best way to measure quadrupole moment (J_2) effect would be to measure the ϑ component of the gravity force (8c):

$$g = 1/r.\partial V / \partial\vartheta = -3GM.a^2 J_2.\sin\vartheta.\cos\vartheta / r^4 \quad (25)$$

This component of force will apply a torque to the orbital angular momentum and it should be averaged over the orbit. This yields a known equation, which is often used in satellite observation:

$$\omega_p / \omega_s = -3a^2 J_2.\cos i / 2r^2 \quad (26)$$

where i is the inclination of the satellite orbit with respect to the equatorial plane, a is Earth radius, r is orbit radius of the satellite, ω_s is the orbit frequency of the satellite, and ω_p is the precession frequency of the orbit plane in inertial space. Now using LAGEOS satellite data [31] as presented in Table 4:

Table 4. LAGEOS satellite parameters

Parameter	Value	Unit
R_{LAGEOS}	12.265×10^6	M
i_{LAGEOS}	109.8	o
T_{LAGEOS}	13673.4	sec
ω_s	4.595×10^{-4}	rad/s
J_2	1.08×10^{-3}	

Inserting this data into equation (26) yields a known value:

$$\omega_p = 0.337561^\circ / day \quad (27)$$

which is near enough to the observed LAGEOS precession = 0.343°/day.

Now let suppose we want to get an estimate of the effect of Earth kinetic expansion to LAGEOS precession. Assuming a solid sphere, we start with a known equation [34]:

$$M = 4\pi.\rho_{sphere}.r^3 / 3 \quad (28)$$

where ρ_{sphere} is the average density of the 'equivalent' solid sphere. For Earth data (Table 1), we get ρ_{sphere} $=5.50 \times 10^6$ gr/m^3. Using the same method with equation (8f), equation (28) could be rewritten as:

$$M + \Delta M / \Delta t = 4\pi.\rho_{sphere}.(r + \Delta r / \Delta t)^3 / 3 \quad (29)$$

or

$$\Delta r / \Delta t = \sqrt[3]{(M + \Delta M / \Delta t).3/(4\pi.\rho_{sphere})} - r \quad (30)$$

From equation (30) we get dr/dt=13.36 mm/year for Earth. Inserting this value (r+dr/dt) to compute back equation (26) yields:

$$\Delta\omega_p = \omega_{p,n+1} - \omega_{p,n} = 1.41x10^{-9\circ} / day = 2.558 arc\sec/ year \quad (31)$$

Therefore, provided the aforementioned propositions correspond to the facts, it could be expected to find a tad extra precession of LAGEOS-satellite around 2.558 arcsecond/year. To this author's knowledge this tad effect has not been presented before elsewhere. And also thus far there is no coherent explanation of those aforementioned phenomena altogether, except perhaps in [21] and [30].

As an alternative to this method, it could be expected to observe Earth gravitational acceleration change due to its radius increment. By using equation (28):

$$\ddot{r}(t) = GM / r^2 = 4\pi.G.\rho_{sphere}.r / 3 \qquad (32)$$

From this equation, supposing there is linear radius increment, then we get an expression of the rate of change of the gravitational acceleration:

$$\dddot{r}(t) = \Delta\ddot{r} / \Delta t = 4\pi.G.\rho_{sphere}.(r + \Delta r / \Delta t) / 3 - \ddot{r}(t) \qquad (33)$$

It would be interesting to find observation data to verify or refute this equation.

Constraint of varying α

In recent years there is suggestion that unification of the fundamental interactions requires cosmological solutions in which low-energy limits of fundamental physical constants vary with time, including α [40][41][42]. This assertion began with Dirac's remark: "*the constancy of the fundamental physical constants should be checked in an experiment*" [42, p.439]. While this has not been widely accepted yet, a plausible way to verify this proposition is using celestial quantization method: "offers a possibility to check the variability of the constants by studying, for example, lunar and Earth's secular accelerations, which has been done using satellite data, tidal records, and ancient eclipses" [42, p. 441].

In this regard, instead of using Nottale's celestial quantization method [1], alternatively we use Rubcic & Rubcic's assertion [2] that the celestial quantization equation could be related to Planck constant and Planck mass, by introducing:

$$H'/M = fA \qquad (34)$$

$$r_n = (fA)^2.Mn^2 / G \qquad (35)$$

where

$$A = \hbar /(\alpha.m_p^2) \qquad (36)$$

therefore

$$r_n = (f\hbar / \alpha m_p{}^2)^2.Mn^2 / G \qquad (37)$$

where f, $\hbar$, α, m_p=2.177x10^{-8} kg represents a specific ratio for given system [2], Planck constant, fine structure constant (~1/137), and Planck mass, respectively. This alternative expression is quite interesting, particularly if compared to Winterberg's argument of superfluid Planckian phonon-roton as the basic entity of Nature [8].

From equation (34) and (36) we get:

$$\alpha = f\hbar M /(H'.m_p{}^2) \qquad (38)$$

Using the same method with equation (8f) we get:

$$\alpha + \dot{\alpha} = (M + \dot{M}).f\hbar /(H'.m_p{}^2) \qquad (39)$$

Now dividing both sides of equation (39) with M and α, we get:

$$1 + \dot{\alpha}/\alpha = (1 + \dot{M}/M).[f\hbar M /(H'.m_p{}^2.\alpha)] \qquad (40)$$

From equation (34) and (36) we know that components in the square bracket of the right side of equation (40) equals to unity, therefore we conclude by using equation (14):

$$\dot{\alpha}/\alpha \approx \dot{M}/M = (M_\otimes / t_\otimes)/M_\otimes = 1/t_\otimes \qquad (41)$$

From this viewpoint, we argue that α varies corresponding to inverse of the epoch of the system in question. Supposing the epoch of the Universe is 1.09 Tyr (larger than epoch of the solar system in the previous section, 2x10^{10}year), and then from equation (41) we get an estimate of varying α:

$$\dot{\alpha}/\alpha \approx 9.2x10^{-13} year^{-1} \qquad (42)$$

For comparison, other values for varying α as proposed in the literature are presented in Table 5. Alternatively, we could use Sidharth's original assertion (9) and (14), and by using an equation described in [43]:

$$\dot{G}/G = t_\otimes^{-1} = 78.2x\dot{\alpha}/\alpha \qquad (43)$$

and supposing epoch of the Universe =13.9 Gyr [40d], then we get estimate of $\dot{\alpha}/\alpha = 9.2x10^{-13}$ year^{-1}, which is near to Bahcall *et al*'s prediction [40b]. Of course, this subject of varying α is not conclusive yet, partly because of large uncertainty in determining the epoch of the Universe, but at least equation (42) could be viewed as an alternative constraint based on the celestial quantization method. However, it seems that this proposition of varying α from Rubcic & Rubcic's celestial quantization approach [2] is quite conceivable, particularly from the viewpoint of recent suggestion of the *invariance* and possible time variation of the Planck mass [2b][2c].

Table 5. Range of values of varying α

Ref.	$\dot{\alpha}/\alpha$	Unit
Prestage *et al*. [40, p.31]	$3.7\text{x}10^{-14}$	year^{-1}
Moffat [40d, p.5]	$3.8\text{x}10^{-16}$	year^{-1}
Ivanchik *et al*. [42, p.439]	$1.9\text{x}10^{-14}$	year^{-1}
Slyakhter [42a, p.2]	10^{-19}	year^{-1}
Bahcall *et al*. [40b,p.520]	$2\text{x}10^{-13}$	year^{-1}
Bahcall *et al*. [40b,p.530]	$6\text{x}10^{-12}$	year^{-1}
Nguyen [40e,p.1]	$1.2\text{x}10^{-18}$	year^{-1}

Discussion

Allow us to make some more remarks: one of the most relevant being the inconstancy of the "constants". Following Dirac's suggestion, the various constants should be validated at period intervals, with no assumption that the values will remain exactly the same as they were at the last measurement.

The fine structure "constant" ***a*** , is the most vulnerable to changes in other physical parameters, because it is relational. Instrumented observations of the *fine structure constant have recorded changes* in the value starting during the 1980s, and with divergences becoming larger than the original value at the time of its inception by Sommerfeld, as time passes.

The fine structure "constant" is a variable, G is a variable, c is a variable, and if *e* is variable, the normal understandings of the standard physics will be soon be demolished.

Variations in ***a*** are directly related to quantized red-shift, as first pointed to by astrophysicist *Halton Arp*. He also points at quantized changes in gravitation and mass, as related to quasars and active galaxies. It has been verified by astrophysical observations, that all galaxies and quasars exhibit quantized red shift.

But what causes quantized red shift?

At the core of every galaxy and quasar, there lives an enormous and very complex **plasmoid**, which exhibits periodic episodes of powerful radiations spanning the entire of the E/M spectrum. (There are no black holes, anywhere. Those figments are cartoon fantasies produced by Hollywood science to support ongoing systematic frauds.)

E/M sources are also aether sources, and act superluminally. The explosive events of galactic core plasmoids produce expanding shells of aether, with abnormal aether density. The various constants, and the laws of physics which rely on those "constants" are changed as each aether-density shell expands from the center of the galaxy, to the outer edges, changing the local "constants" along the way.

Where we live, the laws of physics **are changing** in a gradient manner, along with many of the "constants". This gradient of changing values will continue until the entire of the aether shell has passed through our solar system. At that point, the constants will remain stable in value, and the physics will change in a reliable manner, until the next episode of galactic core-plasma aether ejection occurs and passes through where we live.

The the entire process of changing "constants" will start again, and continue until the shell has passed through our location, when the values will once more stabilize and the local physics will again be reliable. Until the next galactic core-plasmoid event.

This is based on current observations of variations in the constants and on quantized red shift, seen in all galaxies, as correlated with the SQ originations of all things physical. We are reaching a crescendo of change, including changes of Consciousness and the appearance, ab initio, of new life forms, specially constructed to take full advantage of the new conditions which will comprise their environment. (The "*morphogenic field*" of Sheldrake is relevant here.)

Concluding note

If physical theories could be regarded as a *continuing search* to find systematic methods to reduce the entropy required to do calculations to minimum; then the fewer free parameters, the better is the method. Accordingly, it is shown in this article that some twelve phenomena can be explained using only few free parameters, including:

- The Moon is receding from the Earth [20];
- Earth's angular velocity decrease (K. Thorne) [19];
- Planets are receding from the Sun [24];
- Lense-Thirring effect for inner planets, corresponding to Hall/Newcomb's observation;
- Celestial orbit prediction in solar system [1][2][3];
- Exoplanets orbit prediction [1][3];
- Pioneer-type anomalous acceleration [21];
- A plausible origin of volcanoes eruption;
- A plausible origin of continental drift effect [29];
- A plausible origin of spiral motion in spiral nebulae [22];
- Prediction of extra precession of LAGEOS satellite [31];
- Prediction of angular velocity decrease of other planets.
-

As a plausible observation test of the propositions described here, it is recommended to measure the following phenomena:

- Lense-Thirring effect of inner planets, compared to spherical kinetic dynamics prediction derived herein;
- Annual extra precession of Earth-orbiting LAGEOS-type satellites;
- Receding planets from the Sun;
- Receding satellites from their planets, similar to receding Moon from the Earth;
- Angular velocity decrease of the planets;
- Angular velocity decrease of the Sun.

It appears that some existing spacecrafts are already available to do this kind of observation, for instance LAGEOS-type satellites [31]. Further refinement of the method as described here could be expected, including using ellipsoidal kinetic dynamics [12] or using analogy with neutron star dynamics [32]. Further extensions to cosmological scale could also be expected, for instance using some versions of Cartan-Newton theory [38]; or to find refinement in predictions related to varying constants.

All in all, the present article is not intended to rule out the existing methods in the literature to predict Lense-Thirring effect, but instead to argue that perhaps the notion of '*frame dragging'* in GTR [14][16] could be explained in terms of dynamical interpretation, through invoking the spherical kinetic dynamics. In this context, the dragging effect is induced by the spinning spherical mass to its nearby celestial objects.

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