No second chance? Can Earth explode as a result of Global Warming?

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Abstract: The existence of the Earth's solid inner core in the center of our planet is verified by six decades of seismic measurements. This article presents a proof that the very existence of the solid inner core implies the existence of a lower bound for its size and density. The fundamental equilibrium conditions prove that Earth's solid inner core could not have "grown" to its present size over time, simply because a core any smaller would not remain concentric. The solid core that we detect today could have only decayed from a core of larger size.

The existence of the lower bound for the size and density of the inner core constitutes a proof that virtually all heat generated inside our planet is of radionic origin. Hence, Earth in its entirety can be considered a nuclear reactor with an "inner core" providing a major contribution to the total energy output. Since radionic heat is generated in the entire volume and cooling can only occur at the surface, it is obvious that the highest temperature inside Earth occurs at the center of the inner core. Overheating the center of the inner core reactor due to the so-called greenhouse effect on the surface of Earth may cause a meltdown condition, an enrichment of nuclear fuel and a gigantic atomic explosion.

Summary: Consequences of global warming are far more serious than previously imagined. The **REAL** danger for our entire civilization comes not from slow climate changes, but from **overheating of the planetary interior.**

It is a well-established fact, verified by decades of seismic measurements, that the Earth's inner core is a nearly spherical solid of about 1220 km radius that occupies the central position of our planet. The generally accepted view today is that this solid grew slowly to its current size as a result of the "crystallization" of the surrounding liquid. The "latent heat" of this "crystallization" allegedly explains how the inner core generates heat.

This article considers global hydro-gravitational equilibrium conditions for the Earth's inner core and presents a rigorous and compelling scientific proof that the solid core of our planet could never be smaller or lighter than a certain minimum, otherwise the core would not be able to remain concentric. Since the inner core could have only been larger and heavier in the past than it is today, it cannot be the result of any "crystallization". This simple conclusion has astonishing consequences.

Imagine a gigantic object of 1220 km radius that slowly becomes smaller, lighter and gives off heat for millions of years. What could it be? It can only be an object that generates heat by nuclear decay. The main consequence of the above is that all heat generated inside Earth is of radionic origin. In other words, Earth in its entirety can be considered a nuclear reactor fuelled by spontaneous fission of various isotopes in the super-heavy inner core, as well as their daughter products of decay in the mantle and in the crust.

Life on Earth is possible only because of the efficient cooling of this reactor - a process that is controlled primarily by the atmosphere. Currently this cooling is responsible for a fine thermal balance between the heat from the core reactor, the heat from the Sun and the radiation of heat into space, so that the average temperature on Earth is about 13 degrees Celsius.

This article examines the possibility of the "meltdown" of the inner core assisted by the reduced cooling capacity of the atmosphere, which is known to trap progressively more solar heat due to the so-called greenhouse effect. Factors that can accelerate the meltdown process, such as an increased solar activity coinciding with increased emissions of greenhouse gasses, are discussed.

The most serious consequence of such a "meltdown" could be gravity-buoyancy based segregation of unstable isotopes in the molten part of the inner core. Such segregation can "enrich" the nuclear fuel in the core to the point of creating conditions for a chain reaction and a gigantic atomic explosion. Can Earth become another "asteroid belt" in the Solar system?

It is common knowledge (experiencing seasons) that solar heat is the dominant factor that determines temperatures on the surface of Earth. In the polar regions however, the contribution of solar heat is minimal and this is where the contribution of the heat from the inside of our planet can be seen best. Rising polar ocean temperatures and melting of polar caps should therefore be the first symptoms of overheating of the inner core reactor.

While politicians and businessmen still debate the need for reducing greenhouse emissions and take pride to evade accepting any responsibility, the process of overheating the inner core reactor has already begun - polar oceans have become warmer and polar caps have begun to melt. Do we have enough imagination, intelligence and integrity to comprehend the danger before the situation becomes irreversible? There will be NO SECOND CHANCE...

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[2]   This article was written to be understood by the greatest number of people possible, not only by experts and scientists. However, a rigorous scientific proof presented here is very difficult to formulate without using mathematics. Avoiding mathematics would severely degrade if not totally sabotage the presentation. To assist those who do not have sufficient background in the integral calculus and the theory of stability, I have illustrated mathematical derivations with vivid examples, like in any good lecture. For readers who are not familiar with geophysics I have also provided brief explanations when appropriate. That way reading is longer, but concepts are easier to understand when the reader's initial understanding of considered disciplines is limited.

The concept of equilibrium position and its stability

What force makes a balloon rise up and **stay up** in the atmosphere? The origin of the "lift" force of the balloon is the atmospheric pressure gradient. The atmospheric pressure diminishes with altitude. Hence, the upper part of the balloon encounters a lower pressure from the surrounding atmospheric gases than the bottom part.

When the balloon is light enough, the net force difference due to the pressure gradient overcomes the force of gravity and the balloon rises - it moves from a zone of high pressure to a zone of lower pressure until it reaches an altitude at which there is a perfect balance between forces due to the pressure gradient and forces of gravity.

In essence, a very similar analysis applies to the planet's solid inner core that is surrounded by a fluid under pressure. The pressure of this fluid inside Earth increases with depth towards the center of the planet, so there is a pressure gradient. Unless a solid core is large and/or dense enough, its central position at the location of maximum pressure in the center of the planet is unstable and the solid core seeks an eccentric equilibrium position at some "altitude" away from the central position of maximum pressure.

It is very important to note, that it is not sufficient for the equilibrium position of any system to just "exist" theoretically. In order for us to **observe** an equilibrium position - it should be **STABLE**. Consider for example a pencil standing upright on its tip. Although theoretically there exists a perfectly vertical equilibrium position - this equilibrium position is **not stable**. The consequence of this lack of stability is that **in Nature pencils do not stand upright.** In other words, an unstable equilibrium can only "exist" in theory, not in Reality.

The essence of this article is to analytically quantify non-linear parameters of the hydro-gravitational suspension of the solid nucleus of the planet and present a universal criterion that defines its positional stability. Since the Earth's inner core exists and its concentric position seems stable, the theoretical criterion for the stability of this equilibrium can and should be used to validate each and every hypothesis about the inner core. Disregarding this criterion is equivalent to disregarding fundamental laws of mechanics.

Overestimating the stability of planetary nuclei appears to be a "major scientific mistake of the 20th century" with quite profound consequences. For this reason, all derivations in this article are presented in explicit analytical form and in considerable detail, so that they can be examined without a need for numerical computations. The importance of understanding the stability conditions for the inner core shouldn't be underestimated - the intellectual and material future of our entire civilization may depend on it [14].

What is inside our planet?

On the outside, Earth is known to be a nearly spherical object with radius of about 6371 km.

Our knowledge of the inner structure of Earth comes principally from seismology. Naturally occurring local earthquakes generate seismic waves that travel **through** the entire planet. Hundreds of seismic measurement stations distributed around the globe monitor and keep track of a multitude of waves from each and every earthquake, their reflections, refractions, interference and timing. For several decades now the accuracy and sensitivity of such measurements is high enough to extract a significant amount of information from them. For example, an underground nuclear test can be distinguished from a natural earthquake. From refractions, reflections and travel times of various kinds of seismic waves around the globe, natural oscillations of the entire globe - selected properties of Earth's interior can be indirectly estimated.

The existence of a solid inner core in the center of Earth was first suggested in 1936 by a Danish seismologist Miss I. Lehmann [1] who tried to explain the observed "shadow zone" - a range of locations on Earth where direct waves from earthquakes were consistently absent. The actual presence of the solid inner core inside Earth was proven after the great Alaska earthquake of 28 March 1964 and is no longer questioned today. Estimating properties of this inner core, however, remains a major challenge.

Today, the main tool for reconstruction of properties of the inner Earth from seismic measurements is the technique called seismic tomography. In essence, seismic tomography aims to solve an inverse problem - it aims to determine the best parameters of the pre-determined mathematical model by matching results of measurements and behavior of the model using a least-square fit criterion. One of the first comprehensive models of Earth's interior obtained by solving such an inverse problem was the Preliminary Reference Earth Model (PREM) published by Dziewonski and Anderson [2] in 1981.

Although seismic tomography is a very useful tool that produces spectacular computer images of the Earth's interior, its results **must** be considered with great caution. The reasons for caution are as follows:

1. The inverse problem that is implemented in tomography **does not have a unique solution**. In particular, obtained results strongly depend on the initial values assigned to parameters of the model and hence are **strongly biased by assumptions and expectations** of the person who defines such initial values. For example, if a person who sets initial values for parameters isn't aware that the lower bound for the average density of the inner core of a 1220 km radius is $28.6 \ g/cm^3$ (which is one of the key results presented further on in this article), he/she will never find the real value for this density by assuming an initial value of $13 \ g/cm^3$ (the currently adopted value). Tomography is an iterative multi-parameter estimation method that typically produces a multitude of "local" minima for any chosen least square error function. There is no guarantee and no proof that it finds the "global" minimum

or even a correct solution. To complicate things even more, there exist almost an infinite number of ways to define the "error" function that is minimized by a least-square fit criterion. Of course, each such function produces a different result.

2. The Earth's interior model, parameters of which are determined by a least square fit, is determined and limited by the imagination and expectations of its designer. For example, if a designer of such a model failed to include a solid inner core (or any other feature) - it would never be found using tomography. On the other hand, if a model had a feature that didn't exist in Reality - some parameters of such a feature would be found as if the feature actually existed.

From the above it becomes obvious that tomography is useful only for a person who knows exactly what to look for. Simply speaking, finding a sensible answer using seismic tomography requires a good guess for the final result to begin with. In summary, seismic tomography can be considered an excellent tool to refine values for parameters of the Earth's interior that are already reasonably well known.

For this reason, tomographic models, such as PREM [2] and their later refinements, represent the global mechanical features of Earth's interior satisfactorily only up to the depth of about 2800 km (the crust and the mantle), simply because for this range of depths reasonable initial values for the associated parameters can be established from geology - by examining minerals found on the surface of the Earth. In general - the deeper a feature - the less accurate is the tomographic reconstruction of its parameters. Specifically, parameters of the "core" (the part of Earth's interior inside the 3470 km radius) reconstructed from seismic tomography are the least accurate.

Several facts about the core, however, can be established directly from the seismic data with quite considerable certainty:

1. The "inner core" (the part inside the 1220 km radius) **is a solid** (because it transmits shear waves and only a solid can do this).
2. The "outer core" that surrounds the solid inner core appears to be a fluid - due to the absence of shear waves.
3. The solid inner core is practically a **sphere**. Deviations from its spherical shape are small.
4. The solid inner core remains **concentric** near the geometrical center of the planet and this concentric position is **stable**.

Since the inner core is indeed a solid and does indeed remain stable in the center of the planet - its equilibrium should be theoretically stable too.

Let's examine the theoretical conditions for this positional stability. These conditions are determined by the balance of the two dominant kinds of forces: forces due to pressure gradients in the fluid around the inner core and forces of gravity.

Pressure distribution inside Earth

It is generally agreed that the compression inside our planet can be considered hydrostatic. Much like in the ocean - the pressure inside Earth increases with depth h from the surface, according to the relationship: $p(h) = \int_0^h \rho(z)g(z)dz$ where $\rho(z)$ is density and $g(z)$ is the gravity acceleration at depth z. Gravity acceleration g is a known function of the radial distance r measured from the center of the planet : $g(r) = \frac{4\pi G}{r^2} \int_0^r \rho(x)x^2 dx$.(Please see Appendix 1 for a proof). When we combine these relationships (noting that depth $h = R_E - r$ and $R_E = 6371$ km is the radius of Earth) we can express the pressure p inside Earth's interior as a function of the radial distance r from the center of the planet as follows:

$$p(r) = 4\pi G \int_0^{R_E - r} \rho(R_E - z) \frac{1}{z^2} \int_0^z \rho(x)x^2 dx dz \tag{1}$$

Hence, the pressure distribution inside the planet at the distance r from the center of the planet is defined by the radial density distribution $\rho(r)$ inside Earth, the radius of Earth R_E and the gravity constant $G = 6.67 \times 10^{-11} m^3 kg^{-1} s^{-2}$. Even if we assume that the density distribution $\rho(r)$ of the Earth's interior is completely unknown, we can conclude with considerable certainty that

1. the pressure increases with depth h from the surface of Earth
2. at any depth, there will be a **gradient** of pressure
3. at a sufficiently small range of depths this gradient can be considered constant (i.e pressure $p(r)$ can be satisfactorily approximated by a linear function of the radial distance r.)

Spherical object in a spherically symmetric pressure gradient

Consider a fluid with spherically symmetric pressure distribution p about point O - the center of an inertial frame of reference. Since the pressure distribution is radially symmetric, without a loss of generality we can orient our coordinate system so that the position of the spherical object away from the maximum pressure point O is measured along the Z axis as in Fig. 1. It is important to note, that the Archimedes principle cannot be used to determine the buoyancy of such an object for reasons explained in Appendix 5.
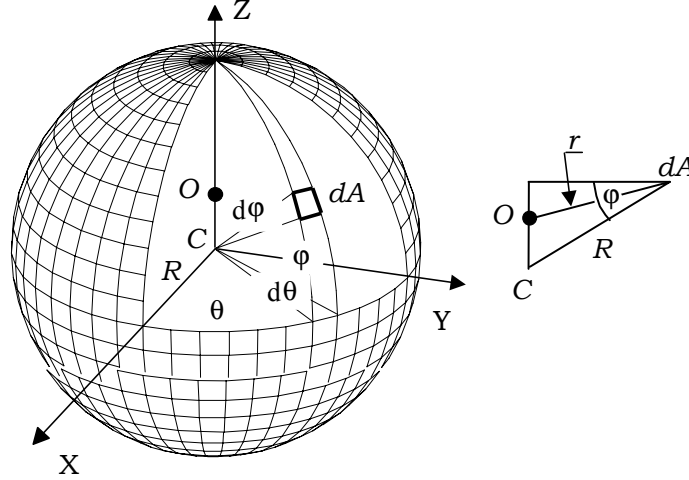
Fig 1. Spherical system of coordinates. $dA = R^2 \cos\varphi\, d\varphi\, d\theta$, $r = \sqrt{R^2 + D^2 - 2RD\sin\varphi}$ and $D = \overline{OC}$

The resultant force on a solid spherical object of radius R located in such a fluid is an integral (sum) of all pressure forces that act on all elements dA on its surface

$$\mathbf{F}_P = -\mathbf{k}\int_0^{2\pi}\int_{-\pi/2}^{\pi/2} R^2\, p(r)\sin\varphi\cos\varphi\, d\varphi\, d\theta \ . \tag{2}$$

where $\mathbf{k}$ is the unit vector along the Z axis. To calculate the above integral we need to estimate the pressure $p(r)$ in the vicinity of the surface of the sphere. In a radially symmetric pressure distribution the pressure is a function of the distance r from the point of maximum pressure O. Considering a linear pressure distribution of the form $p(r) = p_0 + \frac{\partial p}{\partial r}|r|$ is quite general, because any radially symmetric pressure distribution can be linearized in the vicinity of the surface of the sphere, especially when the center of the sphere is near point O. We have $p(r) = p_0 + a\sqrt{R^2 + D^2 - 2RD\sin\varphi}$. where $a = \left.\frac{\partial p}{\partial r}\right|_{r=R}$. Introducing the notation $z = D/R$ we have:

$$\mathbf{F}_P = -\mathbf{k}\int_0^{2\pi}\int_{-\pi/2}^{\pi/2} R^2\left(p_0 + aR\sqrt{1 + z^2 - 2z\sin\varphi}\right)\sin\varphi\cos\varphi\, d\varphi\, d\theta \tag{3}$$

$$\mathbf{F}_P = \mathbf{k}\frac{4\pi R^3}{15}a \times \begin{cases} 5z - z^3 & \text{for } |z| \leqslant 1 \\ 5 - z^{-2} & \text{for } |z| > 1 \end{cases} = -\mathbf{k}\frac{4\pi R^3}{15}\left|\frac{\partial p}{\partial r}\right|_{r=R} \times \begin{cases} 5z - z^3 & \text{for } |z| \leqslant 1 \\ 5 - z^{-2} & \text{for } |z| > 1 \end{cases} \tag{4}$$

The magnitude of the resulting force $\mathbf{F}_P$ is **proportional to the pressure gradient** $\frac{\partial p}{\partial r}$ in the vicinity of the surface of the sphere ($r = R$) and actually does not depend at all on the magnitude of the pressure p. We have already concluded that the pressure inside Earth must increase with depth h. Since $h = R_E - r$, the pressure must decrease with the distance r away from point O and hence the gradient $\frac{\partial p}{\partial r}$ inside Earth must always be negative. Mathematically we can express it as $\frac{\partial p}{\partial r} = -\left|\frac{\partial p}{\partial r}\right|$. It means that force $\mathbf{F}_P$ always pushes the sphere **away** from the maximum pressure point O for any $z > 0$. Although for $z = 0$ the resultant force $\mathbf{F}_P = 0$, the slightest perturbation of z is enough to cause the sphere to escape from its central position at $z = 0$ if no forces other than pressure are involved.

This situation is similar to a pencil standing upright on its tip. Theoretically such a pencil should stand upright in a perfect balance. In practice we do not observe pencils standing upright, because the slightest perturbation in their vertical position causes them to fall.

Fortunately, in the case of the solid inner core of Earth there exists another force that acts to return it toward the center of the Earth O. Such a force exists due to gravity.

Gravity force on the inner core

Consider a solid spherical core of radius R and mass m_c inside a spherically symmetric vessel filled with fluid with a density ρ_F. Denote by D the displacement of the core from the centre of the vessel O - an origin of an inertial frame of reference. The gravitational interaction between the solid core and the liquid in the vessel is determined solely by the gravitational attraction of the liquid contained inside the sphere of radius $R + D$, indicated in Fig 2 as a shaded area. The proof of this is provided in Appendix 1. Again, without a loss of generality, we can orient our system of coordinates so that the displacement of the solid core is measured along the Z axis.

Consider an infinitesimally small part dm of the liquid, in the form of a fragment $d\varphi\, d\theta$ of the spherical shell of radius r and thickness
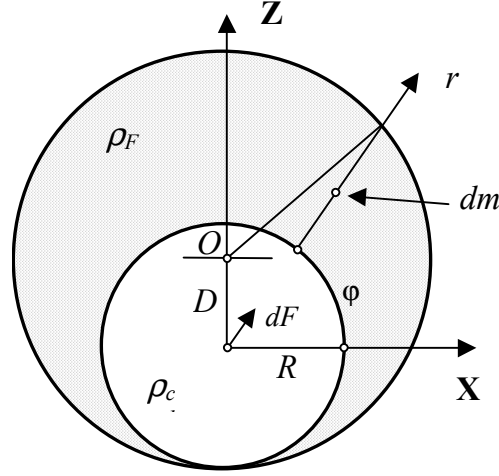
Fig 2. Solid sphere R displaced by D from the centre O of a spherically symmetric liquid. $dm = \rho_F r^2 \cos\varphi d\varphi d\theta dr$

dr. The gravity force that will attract the core toward dm is

$$dF_G = \frac{G}{r^2} m_c dm = G m_c \rho_F dr \cos\varphi d\varphi d\theta, \tag{5}$$

where G is the gravity constant. In order to find the total gravity force that attracts the solid core to the centre of the vessel we need to integrate the gravitational forces dF_G over the entire volume indicated in Fig 2 by the shaded area. Due to the axial symmetry about the Z axis, only the Z components $dF_G \sin\varphi$ will contribute to the total force $\mathbf{F}_G$. Details of the integration are presented below, considering that the mass of the solid core is $m_c = \frac{4}{3}\pi R^3 \rho_c$ and ρ_c is its average density.

$$
\begin{aligned}
\mathbf{F}_G &= \mathbf{k} G m_c \rho_F \int_0^{2\pi} \int_{-\pi/2}^{\pi/2} \int_R^{D\sin\varphi + \sqrt{D^2 \sin^2\varphi + R^2 + 2RD}} dr \sin\varphi \cos\varphi d\varphi d\theta = \\
&= \mathbf{k} G m_c \rho_F \int_0^{2\pi} \int_{-\pi/2}^{\pi/2} \left(\sqrt{D^2 \sin^2\varphi + R^2 + 2RD} + D\sin\varphi - R \right) \sin\varphi \cos\varphi d\varphi d\theta \\
&= \mathbf{k} \frac{4}{3}\pi G m_c \rho_F D = \mathbf{k} \frac{16}{9}\pi^2 R^3 G \rho_c \rho_F D \tag{6}
\end{aligned}
$$

The above result indicates that the magnitude of the gravity force is proportional to the displacement D. Displacement D doesn't need to be "small" in comparison to R, so long as the density ρ_F of the fluid is constant in the integrated volume and the density distribution of the fluid in the remaining part of the vessel remains spherically symmetric.

When the core R occupies the central position ($D = 0$) the gravitational force $\mathbf{F}_G = 0$ exactly as it was in the case of the pressure force $\mathbf{F}_P$. However, unlike the pressure force $\mathbf{F}_P$, for any non-zero value of D the resultant gravity force $\mathbf{F}_G$ is always oriented toward the center of the vessel O. It means that gravity is the force that helps to stabilize the central equilibrium position of the inner core.

From our analysis so far it is obvious that the gravity force $\mathbf{F}_G$ should be larger than the pressure force $\mathbf{F}_P$, at least for small values of D, otherwise the pressure force $\mathbf{F}_P$ would dominate and the core would not be able to remain in the center of the planet.

Condition for the positional stability of the inner core

The central position of the inner core is stable if the effective stiffness of its suspension at the centre is positive. Mathematically this condition can be expressed as

$$\left. \frac{\partial F}{\partial D} \right|_{D=0} > 0 \tag{7}$$

where D is the displacement of the core from its central position and

$$F = F_G + F_P = \frac{16}{9}\pi^2 R^3 G \rho_c \rho_F D - \frac{4\pi R^3}{15} \left. \left| \frac{\partial p}{\partial r} \right| \right|_{r=R} \left(5\frac{D}{R} - \frac{D^3}{R^3} \right) \tag{8}$$

is the sum of forces due to the gravitational attraction and the pressure gradient in the fluid surrounding the core, and R is the radius of the inner core. The gravity component F_G depends on the product $\rho_c \rho_F$ of the average density of the inner core ρ_c and the density

ρ_F of the fluid that surrounds it. The pressure component F_P depends on the radial pressure gradient $\left|\frac{\partial p}{\partial r}\right|_{r=R}$ around the solid core.

Performing the differentiation we have

$$\left.\frac{\partial F}{\partial D}\right|_{D=0} = \frac{16}{9}\pi^2 R^3 G \rho_c \rho_F - \frac{4}{3}\pi R^2 \left|\frac{\partial p}{\partial r}\right|_{r=R} > 0 \tag{9}$$

which is equivalent to the condition

$$R > \frac{3}{4\pi G \rho_c \rho_F}\left|\frac{\partial p}{\partial r}\right|_{r=R}. \tag{10}$$

This result indicates that the radius of the inner core should be greater than the minimum radius $R_{\min}$:

$$R_{\min} = \frac{3}{4\pi G \rho_c \rho_F}\left|\frac{\partial p}{\partial r}\right|_{r=R_{\min}} \tag{11}$$

otherwise the solid core would escape from its central position.

Minimum radius of the Inner Core

If compression inside Earth is hydrostatic, the pressure gradient $\left|\frac{\partial p}{\partial r}\right|$ at the radius of the core $(r = R)$ is a function of the radial density distribution $\rho(r)$ that we defined by (1) as follows:

$$\left|\frac{\partial p}{\partial r}\right|_{r=R} = 4\pi G \frac{\partial}{\partial r}\left(\int_0^{R_E-r} \rho\left(R_E - z\right)\frac{1}{z^2}\int_0^z \rho(x)x^2 dx dz\right)\Bigg|_{r=R} \tag{12}$$

where R_E is the radius of the Earth. Hence, the radius of the inner core R that can remain concentric in the surrounding fluid should satisfy the following condition:

$$R > \frac{3}{\rho_c \rho_F}\frac{\partial}{\partial r}\left(\int_0^{R_E-r} \rho\left(R_E - z\right)\frac{1}{z^2}\int_0^z \rho(x)x^2 dx dz\right)\Bigg|_{r=R_{\min}} = R_{\min} \tag{13}$$

It is important to note, that under the assumption of hydrostatic compression, the minimum radius for a concentric solid core of any solid-fluid system is determined **exclusively** by the density distribution and the size of the entire system and does not even depend on the gravity constant G.

For **any** given density distribution the radius of the concentric solid core should be greater than the minimum radius $R_{\min}$ as defined by (13) , otherwise the solid core would simply escape from its central position. Much like a balloon in the atmosphere, it would move in the fluid from a high-pressure zone to a low-pressure zone to seek a stable equilibrium position. This simple conclusion has fundamental consequences to our understanding of the inner structure as well as the **origin** not only of Earth, but also of other objects, including stars and moons.

Isn't it obvious that the Earth's inner core couldn't just gradually "grow" to its present size?

Any solid object that has a radius smaller than $R_{\min}$ as defined by (13) would rise toward the crust. It seems that the inner core had to be large enough from the very beginning, as well as at every stage of Earth's geological history. Note that this conclusion is true regardless how much or how little we know about the actual density distribution $\rho(r)$ of the Earth's interior.

The Lower Bound for the Average Density of the Inner Core

From our analysis so far it becomes obvious that the very presence of a concentric solid inner core of radius R constitutes a **fundamental constraint for the density distribution** $\rho(r)$ of any planetary or stellar interior. This constraint is expressed by the equation (13).

We have already established that global planetary models obtained by using the technique of seismic tomography (such as PREM of Dziewonski and Anderson [2]) provide quite reasonable and realistic estimates for the density distribution of Earth's interior up to the depth of 2800 km. In fact, estimates obtained by Dziewonski and Anderson in 1981 [2] are considered so reasonable that they haven't been modified much in the last two decades.

We have also established that the least certain parameters of the PREM model of Dziewonski and Anderson are density parameters of the core (the part of Earth's interior inside the 3470 km radius). Let's try to improve these estimates using the criterion (13).

Density $\rho(r)$ [kgm^{-3}] of the PREM model [2] can be expressed analytically as a piecewise function (see Fig 4):

$$\rho(r) \approx \begin{cases} \rho_1 \left(13031. - 1.8182 \times 10^{-4} r\right)/13031. & \text{inner core} & 0 < r < R \\ 8.1967 \times 10^{-5} \rho_2 \begin{pmatrix} 12514 + 2.225 \times 10^{-6} r \\ -2.0338 \times 10^{-10} r^2 \end{pmatrix} & \text{outer core} & R < r < R_2 \\ 7056.1 - 4.4843 \times 10^{-4} r & \text{lower mantle} & R_2 < r < R_3 \\ 8253.7 - 7.4627 \times 10^{-4} r & \text{upper mantle} & R_3 < r < R_E \end{cases} \tag{14}$$

where $R = 1220000$ m; $R_2 = 3470000$ m; $R_3 = 5700000$ m; $R_E = 6371000$ m, and ρ_1, ρ_2 are parameters. The density distribution of the outer core has been approximated by a parabola fitted to the PREM density data in order to express it in terms of a single parameter ρ_2. This way $R_{\min}$ can be expressed in terms of two parameters ρ_1 and ρ_2 as follows

$$R_{\min} = \frac{3}{0.987 \rho_1 \Delta} \int_{R_E - R - \Delta}^{R_E - R} \frac{8.1967 \times 10^{-5}}{z^2} \begin{pmatrix} 12514 - 2.2249 \times 10^{-6} z \\ -2.0338 \times 10^{-10} (R_E - z)^2 \end{pmatrix} \int_0^z \rho(x, \rho_1, \rho_2) x^2 dx dz$$

$$\tag{15}$$

where the derivative of the integral in (13) has been averaged over the 1 km zone ($\Delta = 1000$) around the inner core, $\rho_F = \rho_2$ and the average density $\rho_c = \frac{3}{R^3} \int_0^R r^2 \rho(r, \rho_1) dr = 0.987 \rho_1$ for the assumed density distribution of the inner core. For the PREM model we have $\rho_2 \approx 12000$ kgm^{-3} and $\rho_1 \approx 13000$ kgm^{-3}, which gives the minimum radius $R_{\min}^{PREM} \approx 2724$ [km]. The radius of the **existing** inner core of Earth is known to be 1220 km. According to the density distribution proposed by Dziewonski and Anderson [2] that is generally accepted today - the present inner core is 2.2 times too small to stay in the centre of the planet!

In other words, the density distribution proposed by Dziewonski and Anderson [2] is **self-contradicting** because its acceptance is equivalent to a **direct violation of the elementary laws of mechanics** - and more specifically - **violation of the fundamental stability criterion** that needs to be satisfied for the solid inner core to remain concentric.
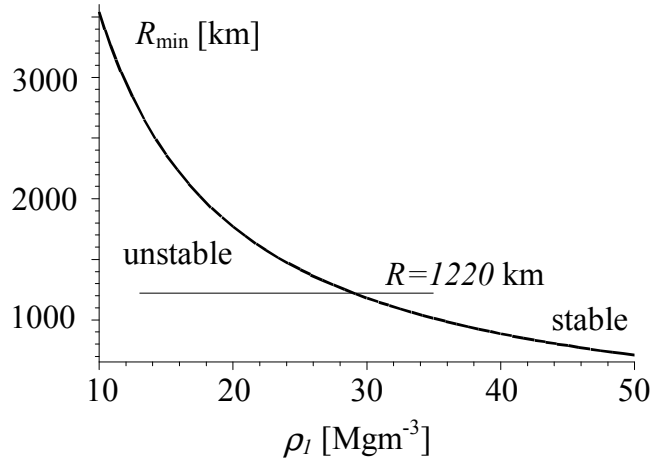

Fig 3. Minimum radius of a concentric inner core $R_{\min}$ as a function of its density parameter ρ_1

What should the radial density distribution $\rho(r)$ of the inner Earth be so that $R_{\min} < 1220$ km as we observe today? Let's explore what improvements to the established PREM model are necessary in order to satisfy the criterion (13) for the positional stability of the concentric inner core.

Since we seek to improve the values of the two least certain parameters ρ_1 and ρ_2, we need to establish at least two relationships between them. One is the stability criterion $R_{\min} < 1220$ km and the other can be formulated from the invariance of the total mass of the planet. The condition for the invariance of the total mass gives $\rho_2 = 12400.0 - 4.9847 \times 10^{-2} \rho_1$. By applying this relationship in the equation (15) we can express $R_{\min}$ using only one uncertain parameter ρ_1. The plot of $R_{\min}(\rho_1)$ is presented in Fig 3.

From Fig 3 it becomes obvious that if the density parameter ρ_1 of the inner core is considerably less than 30 Mgm^{-3} the inner core of a radius $R = 1220$ km will not be able to stay in the center of the planet. The lower bound $\rho_{1\min}$ for ρ_1 is found by solving the equation
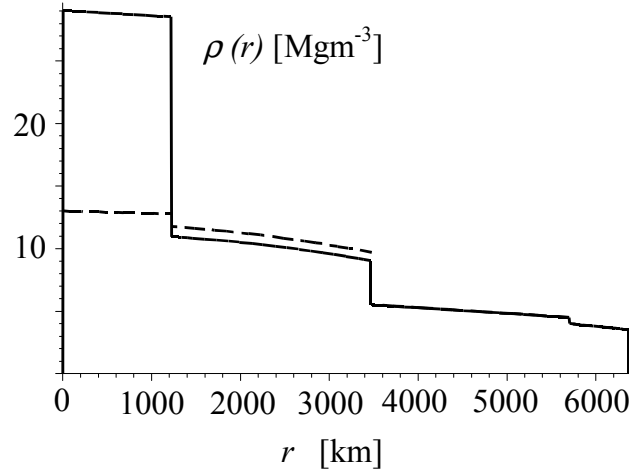
Fig 4. Density distribution of inner Earth. The generally accepted PREM model distribution [2] (dashed line) compared to a distribution that satisfies the criterion for the positional stability of the concentric inner core (solid line).

$R_{\min}(\rho_1) = 1220000$. The corresponding lower bound for the average density of the inner core $\rho_{c\min} = 0.991\rho_{1\min}$ is:

$$\rho_{c\min} = 28.6 \text{ Mgm}^{-3} \tag{16}$$

In other words, **if the solid inner core of 1220 km radius exists and is concentric, its average density has to be larger than 28.6 Mgm**$^{-3}$. The only other assumptions that we made to reach this conclusion were that

1. the density distribution of Earth's interior up to the depth of 2800 km (as determined by seismic tomography [2]) was realistic
2. the compression inside Earth up to the depth of the solid core was hydrostatic.

The graphical comparison of the original PREM density distribution and its minimal correction required to satisfy the stability of the concentric position of the solid inner core of 1220 km diameter is presented in Fig 4. Just to meet this stability criterion, the average density of the inner core needs to be about 2.2 times higher and the density of the liquid outer core needs to be proportionally 7% lower (see Fig 4) than the corresponding values of the PREM model [2].

Super-heavy nucleus ?

We have determined the lower bound for the average density of the concentric inner core of Earth to be $\rho_{c\min} = 28.6$ Mgm^{-3} with reasonable certainty. If the inner core is indeed concentric, the **real** value for its average density is actually likely to be larger. The question of how much larger remains open. Appendix 3 considers the case when $\rho_c \leqslant \rho_{c\min}$.

The lower bound for the average density of 28.6 Mgm^{-3} is quite a surprise. By comparison, the density of lead (Pb) is 11.35 Mgm^{-3}, the density of uranium (U) is 19.05 Mgm^{-3} and the heaviest metal that we know on Earth (Os) has density of only 22.5 Mgm^{-3}. We have to admit that we simply do not know of any atom or mineral that would have the density around 30 Mgm^{-3}, even if we consider such an atom squeezed by pressures of several million atmospheres known to exist around the inner core. However, the fact that at present we do not know any atoms that have a density above 30 Mgm^{-3} when under pressure - does not exclude their existence. The stability criterion of the inner core discussed in this article strongly suggests that such atoms may actually exist.

It is very important to note that the estimate (16) for the lower bound of the average density of the inner core is precisely the same for **any** spherically symmetric density distribution inside the inner core, even if this density distribution is assumed unknown. This is due to the fact proven in Appendix 1, that outside a spherically symmetric object the gravitational field generated by such an object is independent of its inner density distribution. Even if the inner core of Earth had a tiny ultra-dense neutron star in its center, a size of which couldn't be detected due to the limited range of wavelengths that we use to identify the interior, the lower bound for the **average** density of the entire solid core of $\rho_{c\min} = 28.6$ Mgm^{-3} is still valid.

There are many things that we still do not know about the structural composition of the inner core today. Before we can discuss possibilities and hypotheses let's summarize facts about the inner core that we have established with considerable certainty.

1. The existing solid inner core is spherical in shape, has a radius of 1220 km, and its position is concentric inside the planet
2. The core is super-heavy. The lower bound for its average density is 28.6 Mgm^{-3}, which is much heavier than any atom known to

man today.

3. For a given density distribution and the size of Earth, there is a lower bound for the size of the concentric core. It means that the inner core had to be large enough at every stage of Earth's geological history.

The minimum size and the minimum average density of the concentric inner core are rather massive. How could such a massive spherical object appear inside Earth? How did it get inside in the first place? It couldn't just gradually "grow" by some gradual process, simply because any object significantly smaller than the (massive) minimum would float away from the center of the planet and join the less dense mantle, much like a balloon that is too light for its volume would raise to join the less dense part of the atmosphere.

The only reasonable possibility is that the massive solid core has **always** been in the center of our planet. Can the word "always" have any sensible meaning in the context of planetary history? The only logical scenario that actually satisfies the need for the positional stability of the concentric inner core is that **our planet formed itself over time around a massive nucleus.**

Such a scenario conveniently explains the existence of a great variety of heavy atoms and radioactive isotopes found in the Earth mantle and lithosphere. They are simply daughter products of the natural and gradual atomic decay of a super-heavy nucleus.

Spherically symmetric stratification of density that we observe inside our planet today also supports the concept of the decay of a super-heavy nucleus. Lighter daughter products of decay, such as atmospheric gases for example, are bound to find their way to the outer surface.

The concept of nuclear decay of gigantic planetary nuclei also seems to explain differences between the chemical composition and size of different planets and moons that we observe in our Solar system. Simply speaking, their current composition and size is determined by the initial structure of their giant nuclei as well as their age.

A brief trip to the Moon

The scenario of planetary formation by the decay of gigantic nuclei implies that the inner core becomes smaller and lighter in time as it decays into lighter isotopes that gradually form the surface of a planet.

If indeed the inner core gradually decays, it is quite possible, if not inevitable, that at some stage of planetary evolution the core may reach the "minimum radius" (13) and/or "minimum density" while the surrounding medium is still a liquid. The solid inner core of such a planet (and its effective centre of mass) would gradually become eccentric with respect to the outer surface. Can we establish what would happen to such a planet?

On the outside, the most visible result of the inner core becoming eccentric would be that such a planet would slow down and eventually stop spinning independently around its own axis and its rotation would become "phase locked" to the star or other body that they orbited.

The reason for this is simple. The presence of an eccentric nucleus surrounded and suspended by a liquid medium creates conditions for significant dissipation of the kinetic energy of the spin. When a massive solid nucleus is concentric - its center of mass coincides with the center of mass of the remainder of the planet and they can spin together around the common axis of symmetry without dissipating the kinetic energy of the spin. When a massive planetary nucleus becomes eccentric - forces of gravitational attraction by the nearest star, moon, or other major body cause it to "wobble" inside its own planet, like a gigantic pendulum submerged in a fluid, and hence dissipate the kinetic energy of the spin.

Apparently, our own moon seems to be in such a situation. Detailed topography of the moon that was obtained from the lunar satellite Clementine lidar data in 1997 [8] indicates that the center of mass of the moon is indeed eccentric with respect to the moon's outer surface by 1.9 km. Not surprisingly, this eccentricity is pointed toward Earth - the closest celestial object to the moon. Since the mass of the inner core may be only a small portion of the entire mass of the moon, the eccentricity of the solid inner core is likely to be much larger than 1.9 km. For example, if the mass of the lunar inner core is 2% of the mass of the moon, its eccentricity could be as large as 90 km.

Now imagine a moon equipped with an inner "pendulum" composed of its super-heavy eccentric solid inner core suspended by a non-linear, anisotropic and highly viscous hydro-gravitational suspension in the fluid part of the lunar core. Isn't it obvious that such an arrangement would facilitate an efficient dissipation of the kinetic energy of the spin? Not only that - after such an old moon stopped spinning independently around its own axis, the existence of the inner "pendulum" would elastically "lock" the rotation of the moon so that one side of the moon would face Earth, even in the presence of significant disturbances. It is an observable fact [9] that the angular orientation of the moon with respect to Earth is not constant. There are small "librations" in all directions that illustrate the function and behavior of "the inner core lunar pendulum". From the natural frequencies of observed "librations" parameters of such a pendulum can, and should, be estimated.

Our moon is not the only celestial body that stopped spinning independently around its own axis. There are other moons and even planets in our solar system (Pluto) that stopped spinning independently around their own axes and their rotations became "phase locked" to their orbiting partners. For example Pluto and its moon Charon are both phase-locked to one another. This cannot be a coincidence.

It is important to note that such phase locking is **theoretically impossible** for planets and moons with concentric (spherically sym-

metric) density distributions, simply because it is impossible to apply a torque to such bodies using forces of gravitational attraction. (see Appendix 1 for a proof). The elastic "phase locking" can only occur if there exists an efficient mechanism for torque transfer and dissipation of the kinetic energy of the spin inside every moon and every planet. Such a mechanism is provided by their inner cores when they become too light to remain concentric.

The evidence of the torque exchange between Earth and Moon obtained from lunar laser ranging measurements [9] strongly suggests that **both bodies** have eccentric nuclei. If Earth inner core is slightly eccentric - its average density must be slightly lower than 28.6 Mgm^{-3}. Our estimate for the average density of the inner core just got better. Since internal positions of super-heavy eccentric nuclei **change** according to positions of Earth and Moon with respect to the Sun, centers of gravity of both Earth and Moon do not remain stationary in their local (geocentric / selenocentric) frames of reference. The evidence can be obtained from the gravitational field measurement around Earth. Any non-simultaneous gravitational field measurement around Earth (or Moon) would necessarily contain "unexplainable inconsistencies", unless variable positions of super-heavy inner nuclei are taken into account. In particular, positional variability of Earth nucleus can explain notorious irregularities in satellite trajectories observed by NASA.

Another major, long standing, and yet unsolved lunar puzzle is the fact that the "near" side of the moon is structurally very different than the "far" side of the moon [8]. Again, the eccentricity of the lunar inner core provides a plausible explanation. Since the lunar solid inner core decays by means of spontaneous nuclear fission, it is a major source of heat inside the moon. Once the inner core becomes eccentric, the "near" half of the moon receives systematically more heat than the "far" part. Over time, the temperature differences cause observable differences in the lunar surface appearance between the "near" and the "far" sides.

How many more planetary "puzzles" can be comprehensively explained by the newly discovered properties of "super-heavy planetary nuclei" that are presented in this article?

Predicting the future?

Although the existence of a super-heavy inner core inside our planet strongly suggests reconsideration of planetary origin, more urgent and productive to us today may be an attempt to predict the immediate future of our planet.

The evidence for the existence of the super-heavy, gradually decaying solid inner core inside our planet is compelling. It is very difficult to dismiss and ignore a proof that is based on elementary laws of mechanics and the fundamental condition for the stability of the equilibrium position.

Whoever understands the proof, even partially, is likely to agree that very few discoveries in the history of humanity on Earth have had more direct and more serious consequences for our individual and collective material existence.

The reason for concern is that the presence of the super-heavy, gradually decaying solid inner core inside our planet **implies** that **all heat generated inside Earth is of radionic origin**. In other words, **Earth in its entirety can be considered a nuclear reactor fuelled by spontaneous fission of various isotopes in the super-heavy inner core**, as well as their daughter products of decay in the mantle and in the crust.

Life on Earth is possible only because of the efficient cooling of this reactor - a process that is controlled primarily by the atmosphere. Currently this cooling is responsible for a fine thermal balance between the heat from the core reactor, the heat from the Sun and the radiation of heat into space, so that the average temperature on Earth is about 13 deg C.

Can we "overheat" the inner core reactor and initiate its "meltdown"?

Overheating the reactor

One of the well-established paradigms of nuclear science is that the "half-life", or "decay constant" of any given isotope is nearly independent of extra-nuclear considerations [12]. It means, that the rate of decay and hence the rate of produced heat practically does not depend on factors such as temperature, pressure, electrical potential and other environmental conditions around the decaying isotope. According to our knowledge today, the rate of decay can only be accelerated significantly by delivering enough energy **directly** to atomic nuclei. For example this can be accomplished by disturbing atomic nuclei with sufficiently fast moving neutrons.

Perhaps the best known example of such an acceleration of the nuclear decay is the so-called **"chain reaction"**. A chain reaction occurs when sufficiently many atoms that decay naturally by ejecting neutrons are brought sufficiently close together so that neutrons produced by a nucleus of one atom can stimulate disintegration of other atomic nuclei nearby. The minimum number of such atoms that can sustain such a process is defined by the so-called critical mass. As you know, a chain reaction leads to a quick release of significant amounts of energy in a process that we call an atomic explosion.

From the above it becomes obvious that the Earth's interior, as any nuclear fission reactor, will continue to release heat whether it is cooled from the outside or not. It is very important to note that in a nuclear reactor **heat is generated in the entire volume** of the nuclear fuel, but **cooling can occur only at the surface**. The temperature inside the reactor's core depends on the amount of cooling. The better the cooling - the lower temperatures inside the reactor core. When the cooling is reduced - temperatures inside the nuclear reactor rise. See Appendix 4 for details.

The cooling of the reactor called Earth is determined and controlled by the atmosphere. It is well known today that burning fossil fuels on a large scale produces large amounts of gasses that make the atmosphere "trap" progressively more solar heat. This increased capacity of the atmosphere to hold more of the solar heat is called today the "greenhouse effect". Any reduction of the cooling capacity of the atmosphere causes a corresponding increase of the interior temperatures. Appendix 4 clearly demonstrates that **the tiniest reduction in the cooling capacity of a spherical reactor, when sustained for a sufficiently long time, causes extreme temperature increases at the center of the reactor**.

How much can we possibly overheat the inner core reactor? Even if we do overheat it a little, it is likely to generate exactly the same amount of heat. The interior of our planet will just get warmer. So, perhaps there is nothing to worry about? Perhaps. There is however one particular condition of the reactor that deserves special consideration. It is the meltdown condition.

When there is a meltdown in a nuclear reactor such a Chernobyl, there is no nuclear explosion, even though the amount of nuclear fuel is significant. The reason for it is simple. The nuclear fuel that is used in a typical reactor contains only about 2% of unstable isotopes that undergo spontaneous fission. These isotopes are too far from one another in the fuel to sustain a chain reaction. When the meltdown occurs, the molten nuclear material "sinks" into the ground and becomes dispersed. Dispersion of the overheated material provides more surface area for its cooling and eventually some thermal equilibrium is reached. The area remains hot and highly radioactive, but there is no danger of a nuclear explosion.

In order to create conditions for a chain reactor and make an atomic bomb, the nuclear fuel needs to be "enriched". In essence, such an "enrichment" process utilizes the fact that different isotopes have different specific weights so that they can be separated by weight and hence concentrated.

When there is a "meltdown" in the super-heavy inner core of a planet - it is likely to occur at the hottest point - in the center of the core. From there - there is nowhere to "sink" and nowhere to "disperse". The molten nuclear fuel just remains molten.

We do not know what the exact composition of the super-heavy inner core is in its very center, but just from the fact that it has been decaying for millions of years we can establish with considerable certainty that it should be quite a complex mixture of isotopes, even if we do not yet know any of these isotopes. When a mixture of isotopes becomes and remains molten, conditions arise for stratification of individual isotopes by their weight. In essence, this process is very similar to the process that is used to "enrich" a nuclear fuel in order to make an atomic bomb.

If the molten volume of the inner core is large enough for a sufficient amount of time - the continuing stratification of isotopes will eventually lead to some of them achieving a "critical mass". When this occurs - the nuclear energy that was scheduled to be released over many millions of years may get released very quickly. A chain reaction will result in a gigantic atomic explosion.

Can a planet explode?

If a planet can indeed explode, and there was at least one such event somewhere in our Solar system in the distant past, we should be able to find the evidence of it today. This is due to the fact that the debris from the exploded planet would not vanish. Bits and pieces would not only remain, but their collective presence should still mark a trajectory (the orbit around the Sun) of the planet that exploded.

In Greek Mythology there is a story about a planet that exploded. The planet was called Phaëthon. Did our ancestors embed this event in their belief system because they actually witnessed a planetary explosion and they just couldn't explain it any other way? Can we determine **today** what is a myth and what is an actual fact?

It is a well-known fact that there exists the so-called "asteroid belt" in our Solar system. It is a "belt" of a large number of asteroids that orbit the Sun along orbits that are located between Mars and Jupiter. At least 40,000 of these asteroids are thought to have diameters larger than 0.8 km (0.5 mile). The largest asteroid in the asteroid belt, called Ceres, is about 930 kilometers across.

The existence and the origin of the entire asteroid belt are long standing scientific puzzles. Why does the asteroid belt exist only between Mars and Jupiter and there are no asteroid belts between other planets?

The present belief is that planets in the solar system formed out of randomly distributed dust and other bits and pieces. Hence, it is also believed that the growth of a full-sized planet between Mars and Jupiter was "aborted" during the early evolution of the solar system.

The very presence of a concentric super-heavy inner core inside Earth proven earlier on in this article practically eliminates the possibility of planetary formation "out of bits and pieces". The "bits and pieces" theory of planetary formation is self-contradicting, because it cannot explain the presence of the super-heavy inner core inside our own planet.

The explosion of a planet that existed between Mars and Jupiter is a much more logical and plausible explanation. Plato, one of the greatest writers and philosophers of all time, was aware that the story of Phaëthon *"destroyed by a thunderbolt"* had its origin in a real planetary event. He wrote [18] : *"Now this has the form of a myth, but really signifies decline of the bodies moving in the heavens..."*.

The meaning of the word "phaëthon" ($\varphi\alpha\varepsilon\theta\omega\nu$) in ancient Greek is "giving light, luminous, brilliant, shining" [19]. Note that words "phaëthon" and "photon" originate from the same root ($\varphi\alpha\omega\varsigma = \varphi\omega\varsigma$) [19]. In the myth, Phaëthon is known as *"the son of Helios"* (the son of the Sun) [18]. Doesn't this hint that the planet Phaëthon was one of the brightest objects in the sky at night? Isn't it obvious that a disappearance of such an object would attract attention even of a casual sky observer? The story of the destruction of Phaëthon *"by a*

thunderbolt"[18] indicates that our ancestors perceived its explosion to be **as bright as lightning**. Should we ignore a witness report of our ancestors embedded not only in their heritage but also **in their language**?

Early symptoms

Let's examine some early symptoms of overheating of the planetary interior.

It is common knowledge (we all experience seasons) that solar heat is the dominant factor that determines temperatures on the surface of Earth. In the polar regions however, the contribution of solar heat is minimal and this is where the contribution of the heat from the inside of our planet can be seen best. Rising polar ocean temperatures and melting of polar caps should therefore be the first symptoms of overheating of the inner core reactor. Significant climatic changes in polar regions will follow.

Warming of the planetary interior (regardless of its reason) will accelerate tectonic motions (slip) of plates, continents and subduction zones due to increased temperatures in their respective plastic slip zones. An example of a recently reported event of an accelerated subduction zone slip in British Columbia, Canada, has been called a "silent earthquake" [16]. Many more of these should be expected.

The next set of symptoms should be progressive activation of volcanoes around the globe. Progressive melting of certain parts of the mantle and the crust will absorb significant amount of heat from the inner reactor and will also take time. This is why activation of volcanoes will be delayed in time, perhaps by many years.

The next stage will be a systematic increase in volcanic eruptions. Crystallization of the molten lava brought to the surface will release its heat into the atmosphere. Transport of hot lava in large amounts will be the last attempt of Nature to cool the interior of the planet.

If at this stage the atmosphere is unable to radiate enough heat into space - the overheating of the inner core reactor will intensify. The meltdown zone in the core will become established and will grow. It may take many months of horrific cataclysms on the surface of Earth before conditions for a chain reaction and subsequent explosion are created.

The best case scenario ?

If we choose to ignore the early symptoms of overheating of the planetary interior, what is the best case scenario?

Imagine that the first few dozen volcanoes will actually explode rather than simply erupt. Volcanic explosions release huge amounts of volcanic dust very high into the atmosphere. Imagine that the amount of dust is such that Sun rays do not reach the surface of the Earth. Sunlight becomes reflected by dust particles into space.

The surface of Earth without sunshine will freeze and will remain frozen until the dust in the atmosphere falls down. This process may take a long time. We may experience an ice age for several decades. In the meantime, the inner core reactor will have an opportunity to cool down, because the amount of solar heat delivered to the surface of the planet will be dramatically reduced. Increased temperature difference between the hot core and the frozen surface of Earth will speed up the cooling process. Isn't this a compelling mechanism for the development of an ice age? Is an ice age a natural mechanism for cooling the reactor called Planet Earth when it overheats for one reason or another?

Surprising support for the likelihood of the above scenario comes from archaeology. Apparently, the last "mini" ice age on Earth occurred between 536 and 540 AD - only 1490 years ago (!). Following the explosive eruption of just **one** volcano in the Pacific ring of fire - trees on the entire planet stopped growing for several years. For several years there was no summer... [13] This is not a theory. The evidence is quite compelling. Disruption in tree growth is well documented and very accurately dated in the "rings of growth" of very old trees that **still grow** on all continents. The evidence of a large amount of volcanic gasses in the atmosphere around 504±40 AD has been found embedded in polar ice caps at both poles.

The ice age of 536 AD was caused by the explosion of a single volcano. Can you imagine the consequences of explosive eruptions of a hundred volcanoes?

To be or Not to be?

While politicians and businessmen still debate and dispute the need for reducing greenhouse emissions and take pride to evade accepting any responsibility, the process of overheating the inner core reactor has already begun - **polar oceans have become warmer** and **polar caps have begun to melt**.

Although the danger seems to come from the inside of our planet, the actual **reason** for the coming disaster is the pollution of the atmosphere [17], which is clearly our responsibility. At present, the atmospheric pollution increases daily...

Do we have enough imagination, intelligence and integrity to comprehend the danger before the situation becomes irreversible? There will be NO SECOND CHANCE...

Increase in solar activity is known to cause global increases in the average temperature on Earth. Do we know enough to predict the intensity of solar activity in the next decade or two? Peaks of solar activity are known to occur in 11 year intervals. What if the next peak of Solar activity is larger than usual and coincides with increased emissions of "greenhouse" gases?

We are not the first "civilization" on Earth to be wiped out due to the lack of understanding of Nature. Are we going to be the LAST one?

Save the planet?

Should we attempt to save the planet?   For **WHOM**?

For those who do not care?
For those whose ultimate dream is to win the lottery in order to do nothing, NOT EVEN THINK?
For those whose favourite activity is to intoxicate and entertain themselves in order to FORGET Reality?
For those who are ready to kill or spend their lives fighting for a piece of land or property?
For those who allow their minds to become cluttered with doctrines, misinformation and deceit?
For those who blindly follow the flock - unable and unwilling to THINK?
For those who prefer to cultivate animal instincts rather than intellect?

Wouldn't it be better if such narrow-minded people stopped existing as soon as possible? Wouldn't it be better for everyone else in the Universe if the entire "system" for propagating a narrow-minded mentality on Earth didn't exist?

Are there any people with enough intelligence, integrity and imagination for whom it is actually **worth** saving the planet? Where are they? Do you know anyone?

Everything material in the Universe is temporary anyway. The only thing in the Universe that is theoretically and actually sustainable is our consciousness [3][14]. The reason for this is simple: information can exist indefinitely, even if the storage medium that holds it is temporary. All that needs to be done to maintain the information indefinitely is to make a fresh copy of it before the storage medium that holds it becomes useless. Don't we do it to hard disks in our computers?

Incidentally, our consciousness is the only thing in the Universe that we can truly call "ours". After several decades of studying the Self I am absolutely certain that I will be able to sustain my consciousness after my physical body disintegrates. What about YOU?

The Big Picture

The Universe in its entirety is a masterpiece of Intelligent Design.

It is quite easy to demonstrate [14] that this Intelligently Designed Universe is Self-Perfecting. Aiming to design anything else just wouldn't make sense... Aiming to design anything else would actually be an insult to the Intellect of the Designer...

The existence of an extensive range of self-correcting mechanisms in the Universe virtually guarantees that it will eventually be inhabited by the Best of the Best. Thanks to Autonomy and the Freedom of Thought [3] - the Best of the Best can simply choose themselves... They can choose to develop their intellect and utilize it to advance themselves further. In contrast, those unwilling to achieve enough coherence in their thinking will not be able to sustain their consciousness and will eventually cease to exist...

Should we interfere with choices of those who choose a path of self-destruction? The sooner they eliminate themselves - the better for everyone else in the Universe... Perhaps fools and narrow minded people should be left alone so that they can cause their self destruction as quickly as possible? Should we interfere with the self-correction mechanism of the Universe?

For many decades now we have continued to abuse and pollute the entire planet. Perhaps we don't deserve it?

My goal

My long-term goal is to increase my understanding of Nature, its Design Principles, its Purpose and communicate this understanding to those who are interested to check it out. However, I cannot understand anything FOR anyone else. Everyone has to achieve the understanding entirely on his/her own. I can only communicate my findings.

Any proof can only arise in your own Intellect - nowhere else. If intellect is incapable or unwilling to understand the analysis - no explanation is actually possible.

I would love to give you some of my intelligence and imagination. I also wouldn't mind receiving some more myself. Unfortunately this is not possible. Every Individual Intellect in the Universe has to evolve entirely ON ITS OWN. Evolution of Intellect, intelligence, imagination and the ability to Understand is strictly the result of an individual effort [3]. The motivation to increase the Understanding, become more intelligent and develop imagination has to come from WITHIN.

For millennia [20] wise people have been trying to bring to our attention that *"Whoever knows everything but lacks WITHIN - lacks EVERYTHING"*. How many people today comprehend the importance of this advice?

It's your CHOICE

We have the Freedom of Choice [3]. We also have the Freedom of Thought. We can either explore or ignore the discovery presented in this article. Whatever our choice is - we shall experience its consequences, even if we cannot yet imagine any. What do YOU choose?

In 1953 Albert Einstein wrote [15]: **"The majority of the stupid is invincible and guaranteed for all time."** I am sure that you agree with this wise remark.

What do you think about a "system" in which decisions are made by the vote of the majority? How do you feel being led by leaders who are chosen be the vote of the majority? Can anything chosen by the majority be advanced? Wouldn't it be better if key decisions in a society were made by people who are the Best among the Best? Wouldn't you like your leader to be the Best of the Best? Isn't it obvious that such a leader should also be chosen by the Best among the Best?

Whom would YOU choose?

Contact

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Acknowledgments

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Appendix 1: Gravitational interaction between spherically symmetric objects

Point mass and a spherical shell

Consider a homogenous spherical shell of radius R, mass m and a point mass M at the distance D from the center of the shell. Without the loss of generality we can orient a spherical system of coordinates $r\theta\varphi$ so that the relative position of the mass M and the shell m is measured along the Z axis as in Fig 5.
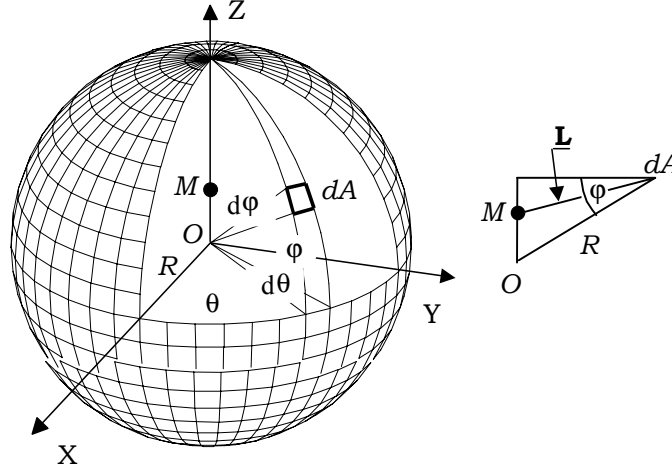

Fig 5. Spherical system of coordinates. $dA = R^2 \cos\varphi d\varphi d\theta$, $|\mathbf{L}| = \sqrt{R^2 + D^2 - 2RD\sin\varphi}$ and $D = \overline{OM}$

The mass of the infinitesimally small fragment of the shell dm, defined by $d\theta$ and $d\varphi$ on the surface of the shell, is $dm = \rho dA = \rho R^2 \cos\varphi d\theta d\varphi$ where ρ is the mass per unit area of the shell. The presence of $\cos\varphi$ in this expression is due to the variable width of the "strip" defined on the surface of the shell by $d\theta$.

Vector $\mathbf{L}$, defined by the mass M and the element dm can be expressed in terms of its components as follows

$$\mathbf{L} = \mathbf{i}R\cos\theta\cos\varphi + \mathbf{j}R\cos\varphi\sin\theta + \mathbf{k}(D - R\sin\varphi) \tag{17}$$

The length of $\mathbf{L}$ is

$$|\mathbf{L}| = \sqrt{R^2\cos^2\varphi + (D - R\sin\varphi)^2} = \sqrt{D^2 - 2DR\sin\varphi + R^2} \tag{18}$$

The gravitational force between M and dm is known to obey the inverse square law of the form:

$$d\mathbf{F} = \frac{\mathbf{L}}{|\mathbf{L}|^3}GMdm \tag{19}$$

The resultant force $\mathbf{F}$ that acts on mass M as a result of the presence of the shell, is the sum of all forces $d\mathbf{F}$ over the entire surface of the shell. $\mathbf{F}$ is best expressed in the form of the integral:

$$\mathbf{F} = GM\int_{-\pi/2}^{\pi/2}\int_0^{2\pi} d\mathbf{F} = \rho GMR^2 \int_{-\pi/2}^{\pi/2}\int_0^{2\pi} \left[\begin{array}{c} \frac{\mathbf{i}R\cos\theta\cos^2\varphi}{\left(\sqrt{D^2-2DR\sin\varphi+R^2}\right)^3} \\ +\frac{\mathbf{j}R\cos^2\varphi\sin\theta}{\left(\sqrt{D^2-2DR\sin\varphi+R^2}\right)^3} \\ +\frac{\mathbf{k}(D-R\sin\varphi)\cos\varphi}{\left(\sqrt{D^2-2DR\sin\varphi+R^2}\right)^3} \end{array} \right] d\theta d\varphi =$$

$$= \mathbf{k}2\pi\rho GMR^2 \int_{-\pi/2}^{\pi/2} \frac{(D - R\sin\varphi)\cos\varphi}{\left(\sqrt{D^2 - 2DR\sin\varphi + R^2}\right)^3} d\varphi \tag{20}$$

This result proves that the resultant force acts along the Z axis, as expected.

Let's express the distance D=OM in terms of a non-dimensional variable $z = D/R$. The total force $\mathbf{F}$ becomes a function of a single variable z as follows:

$$\mathbf{F}(z) = \mathbf{k}2\pi\rho GM \int_{-\pi/2}^{\pi/2} \frac{(z - \sin\varphi)\cos\varphi}{\left(\sqrt{z^2 - 2z\sin\varphi + 1}\right)^3} d\varphi \tag{21}$$

The integral in the above expression can be evaluated analytically:

$$\int_{-\pi/2}^{\pi/2} \frac{(z - \sin\varphi)\cos\varphi}{\left(\sqrt{z^2 - 2z\sin\varphi + 1}\right)^3}d\varphi = \begin{cases} 0 & \text{for } 0 \leqslant z < 1 \\ \int_{-\pi/2}^{\pi/2} \frac{1}{2}\frac{\cos\varphi}{\sqrt{2-2\sin\varphi}}d\varphi = 1 & \text{for } z = 1 \\ \frac{2}{z^2} & \text{for } z > 1 \end{cases} \tag{22}$$

Since the mass of the entire shell is $m = \int_{-\pi/2}^{\pi/2}\int_0^{2\pi}\rho R^2 \cos\varphi d\theta d\varphi = 4\rho R^2\pi$ we have

$$\mathbf{F}(z) = \mathbf{k} \begin{cases} 0 & \text{for } 0 \leqslant |z| < 1 \\ \frac{GMm}{2R^2} & \text{for } z = 1 \\ \frac{GMm}{R^2 z^2} & \text{for } z > 1 \end{cases} \tag{23}$$

In the case when the mass M is outside the shell $|z| > 1$ the resulting attraction is described by the inverse square law, as if the entire shell was just a point mass located at the centre of the shell.

In the case when the mass M is inside the shell, the resultant force $\mathbf{F}$ is precisely zero. It means that the point mass M does not experience ANY attraction from a homogenous outside shell.

This result is in a vivid contrast to a two-dimensional situation, when the central position of a cylinder inside a ring is unstable. Spherical symmetry provides the fundamentally unique "zero force" support for a nucleus inside a shell.

Two shells

The result above directly applies to the case of two homogenous shells.

When one shell is totally enclosed inside the other, the inner shell won't experience any net attraction from the outer shell, no matter how eccentric the relative position of the two shells is. The analysis presented above has demonstrated that to every point on the outer shell the entire inner shell will appear as a single point of mass M.

When two shells are apart or in contact, their mutual attraction is defined by the formula that describes the attraction of two point masses located at the centres of each shell.

Solid sphere and objects with spherically symmetric density distribution

Without loss of generality, a solid sphere with a spherically symmetric density distribution can be considered a superposition of concentric shells.

Hence, in the case when the mass M is outside the sphere ($|z| > 1$), the resulting attraction between the mass M and the sphere is described by the inverse square law, as if the entire sphere was just a point mass located at the centre of the sphere. The same applies to two solid spheres that are apart or in contact.

When the mass M is inside the sphere $|z| < 1$, (imagine a chamber that contains M and doesn't perturb the symmetry of the sphere m) none of the "shells" of the sphere that have a radius larger than $|z|$ will contribute to the resultant force that acts on mass M. Only "shells" of the sphere that have a radius smaller than $|z|$ will produce gravitational attraction. On the basis of the previous analysis, the attraction force will be determined only by the part of the mass of the sphere m_z that is inside the radius $|z|$. In the case of a homogenous sphere $m_z = mz^3$ and the total attraction force between the mass M and the sphere m is simply:

$$\mathbf{F}(z) = \mathbf{k}\frac{GMm}{R^2}z \qquad \text{for } |z| < 1 \tag{24}$$

which indicates that $\mathbf{F}(z)$ is zero in the centre of the sphere and increases linearly toward the surface.

For a sphere with the radial density gradient $\hat{\rho}(z)$, m_z becomes a function of z

$$m_z = m\frac{\int_0^z u^2\hat{\rho}(u)du}{\int_0^1 u^2\hat{\rho}(u)du} \tag{25}$$

and the total gravitational attraction $\mathbf{F}(z)$ becomes

$$\mathbf{F}(z) = \mathbf{k}\frac{GMm_z}{R^2 z^2} \qquad \text{for } |z| < 1 \tag{26}$$

In the case of a radially linear density distribution, changing from ρ_0 in the centre to $k\rho_0$ at the surface we have $\hat{\rho}(u) = \rho_0(1 + (k-1)u)$ and

$$m_z = \frac{3kz - 3z + 4}{1 + 3k}mz^3 \tag{27}$$

In the case of a shell that has thickness tR, $t \in (0,1)$,

$$m_z = \begin{cases} m & \text{for } z \geqslant 1 \\ mt\left(3 - 3t + t^2\right) & \text{for } 1 > |z| > 1 - t \\ 0 & \text{for } |z| \leqslant 1 - t \end{cases} \tag{28}$$
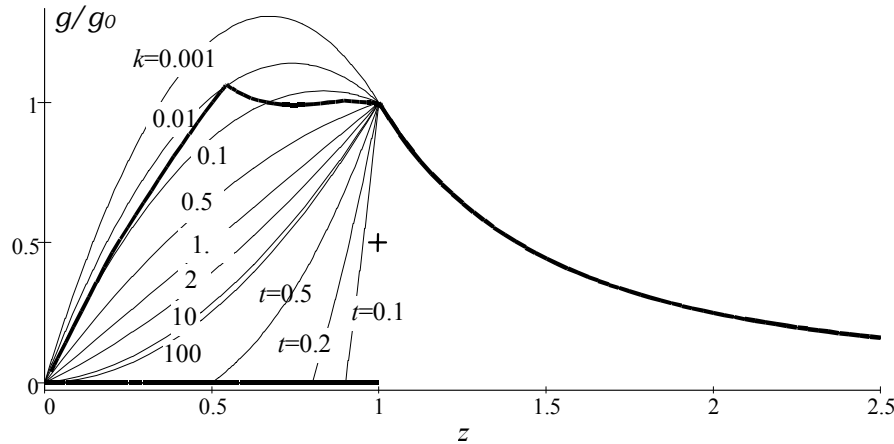
Fig 6. Gravity acceleration g relative to the gravity acceleration at the surface g_0 for a spherically symmetric object with various inner density distributions.

It is convenient to compare all results obtained so far in Fig 6 using a non-dimensional attraction ratio

$$g(z)/g_0 = |\mathbf{F}(z)| / (GMm/R^2) \tag{29}$$

which is simply the ratio of the gravity acceleration at radius z and the gravity acceleration at the outside surface of the spherical object.

The gravity acceleration ratio inside the Earth (assuming the density distribution of the preliminary model of Earth PREM of Dziewonski and Anderson [2]) has been plotted for comparison using a heavier line.

From the plot in Fig 6 it becomes obvious that from the outside - any spherically symmetric object can be accurately modelled as a point mass. An observer outside such an object will experience the total attraction force that precisely follows the inverse square law - no matter what the radial mass density distribution inside the object is. This result suggests that by gravity measurement from the outside it is impossible to determine the density distribution inside a spherically symmetric object.

Since the gravitational attraction of any spherically symmetric object can be accurately represented by the gravitational attraction of a point mass we can conclude that the sum of all moments of all external gravity forces about point O will always be zero. The practical significance of this conclusion is that it is impossible to apply a torque to a spherically symmetric object by means of gravitational interaction.

Electric charges

It is interesting to note that all the above relationships are identical for any force field that obeys the inverse square law and the rule of superposition. Mathematical expressions remain identical, only the physical meanings of parameters G, ρ and m becomes different.

For example, when considering forces between electrically charged spherical shells or spheres, masses need to be replaced by charges, ρ needs to be replaced by the charge density per unit area (or volume if appropriate) and G needs to be replaced by $(4\pi\epsilon_0)^{-1}$.

Summary

The most significant of results presented in this Appendix is the lack of any singularity. The forces between shells or any other spherically symmetric objects are finite for any distance between their centres. This is in vivid contrast to the force between two "point" masses/charges that grows to infinity when the distance between them approaches zero. Shells are perfectly happy when their centres overlap. When the radii of two shells differ, the smaller shell can enter the larger one without ever encountering an infinite resistance. It is very likely that this conclusion can be proven for shells that oscillate and/or are temporarily deformed.

Note that in Nature there may be no "point masses" nor "point charges". Everything that we know of has a finite size...

Appendix 2: Centrifugal force effects in planar rotation

If we assume that the Earth's axis of rotation is stable and limit our consideration to a steady state planar rotation with angular velocity

Ω - we can estimate the minimal stiffness K_{MIN} of elastic suspension of the inner core that is needed to keep it on the Earth axis.

$$K_{MIN} = (1 - \lambda(\rho_1))\lambda(\rho_1)M_E\Omega^2 \tag{30}$$

In the above $\lambda(\rho_1)$ is the ratio of the mass of the inner core and the mass of the planet expressed in terms of the uncertain density parameter ρ_1

$$\lambda(\rho_1) = \frac{4\pi \int_0^R \rho(x)x^2dx}{M_E} = \frac{5.9756 \times 10^{17}\rho_1}{4.7539 \times 10^{23} + 1.8795 \times 10^{12}\rho_1}, \tag{31}$$

$M_E = 4\pi \int_0^{R_E} \rho(x)x^2dx = 5.974 \times 10^{24}$ kg is the mass of the entire planet Earth and $\Omega = 2\pi/(24 \times 60 \times 60)$ s^{-1}is the angular velocity of its rotation. On the assumption of a steady state planar rotation, the criterion for the stability of the central equilibrium position of the inner core is modified by centrifugal effects as follows:

$$\left.\frac{\partial F}{\partial D}\right|_{D=0} = 0.987\frac{16}{9}\pi^2 R^3 G\rho_1\rho_2 - \frac{4}{3}\pi R^2 \left|\frac{\partial p}{\partial r}\right|_{r=R} > K_{MIN} . \tag{32}$$

The corresponding modified analytical formula for the minimum radius is not included in this article for two reasons. The first reason is that centrifugal effects due to planar rotation have very little influence on the actual value of the minimum radius and/or the corresponding lower bound for the average density of the inner core. It is best to demonstrate it by graphical comparison of the gravity-pressure suspension stiffness $\left.\frac{\partial F(\rho_1)}{\partial D}\right|_{D=0}$ and $K_{MIN}(\rho_1)$ presented in Fig 7.
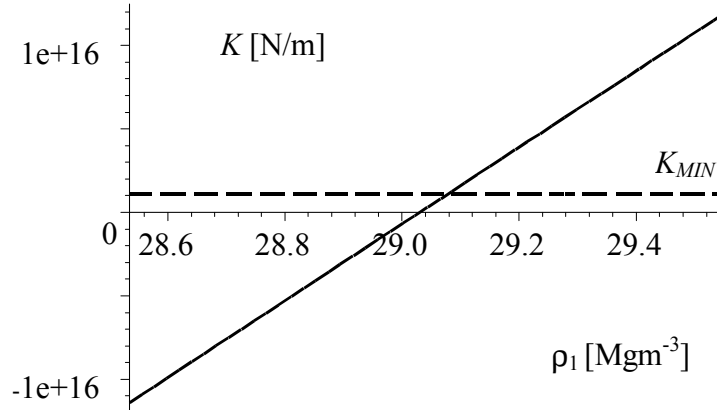

Fig 7. Stiffness of the hydro-gravitational suspension of the inner core as a function of the inner core density ρ_1. K_{MIN} - the minimum stiffness required for the centrifugal stability of the inner core in planar rotation.

The second reason is the important one. The assumption of steady state planar rotation is in general not acceptable in an attempt to describe the behavior of a nearly spherical object with an elastically suspended nucleus, simply because in such a case the stability of planar rotation cannot be taken for granted.

In order to analyze the influence of centrifugal forces at the threshold of the positional stability of the nucleus, we need to consider a 3D gyroscopic behavior of the planet which is outside the scope of this article.

Due to the near spherical symmetry of the planet, small changes in the location of the centre of mass may cause dramatic changes in the **orientation** of its principal axes of inertia. Consequences of this are nothing short of fascinating. Changes of up to 90 degrees in the direction of the Earth axis of rotation are quite imaginable due to a relatively small mass distribution change.

A number of researchers [7][6][5][4] have recognized that changes in the mass distribution of the mantle and the crust can indeed explain polar wandering. Properties of the inner core proven in this article significantly expand the context and applicability of their conclusions. The seriousness of the problem is definitely increased due to the fact that, according to results presented in this article, the inner core is actually 2.2 times heavier than it has been generally accepted in the past [2] so its position has a correspondingly stronger influence on the orientation of the principal axes of inertia of the entire planet.

The torque exchange between Earth and Moon, recently confirmed by lunar laser ranging [9], indicates that Earth inner core **is already eccentric** and therefore the hydro-gravitational suspension of the solid inner core discussed in this article is **the softest spot of our planet**. The near 90 degree "tumble" of the Earth axis of rotation seems inevitable. The good news is that the core decays very slowly and hence the problem may not be urgent. The problem of overheating of the inner core reactor however, should be addressed immediately.

Appendix 3: Pole shifts: Earth's inner core is eccentric since time immemorial.

Let's try to estimate the relationship between the diminishing average density of the Earth's inner core and the resulting eccentricity.

In the initial analysis we shall assume the free-free planar rotation of the planet with elastically suspended inner core in the intertial geocentric frame of reference and ignore the interaction with Sun and the Moon. We shall also assume that the pressure gradient (12) around the inner core is insensitive to small changes in the position of the core and hence it can be assumed constant at the sufficiently small range of depths around the inner core. This assumption seems quite reasonable, because the mass of the inner core is less than 4% of the mass of the planet and the gradient (12) at the depth of the core is practically dominated by the mass distribution of the remainder of the planet.

If the eccentricity of the inner core in the plane of rotation is D then the distance between the center of the core and the axis of the steady state rotation will be $(1 - \lambda(\rho_1))D$, where $\lambda(\rho_1)$ is the mass ratio of the core and the planet as defined in Appendix 2.

In a steady state planar rotation, the centrifugal force that acts on the spherically symmetric core should be equal to the force $F(D, \rho_1)$ in the hydro-gravitational suspension of the core defined by equation (8). This can be expressed as follows:

$$(1 - \lambda(\rho_1))\lambda(\rho_1)M_E\Omega^2 D = F(D, \rho_1) \tag{33}$$

Equation (33) defines the relationship $D(\rho_1)$. Note that the trivial solution $D = 0$ for $F(D, \rho_1) = 0$ exists regardless of the value of ρ_1. The non-dimensional eccentricity $z(\rho_1) = D(\rho_1)/R$ corresponding to the non-trivial solution of (33) is presented in Fig 8. This result indicates that for $\rho_1 \approx \rho_{1\,\min}$ the inner core eccentricity is very sensitive to the reduction of ρ_1 and hence it is very sensitive to the reduction of the average density of the core. For example, a reduction of the average density of the core of only 0.04 % causes the core to become eccentric by about 60 km. From this we can conclude that once the inner core becomes eccentric, its average density can be monitored by measuring the eccentricity.
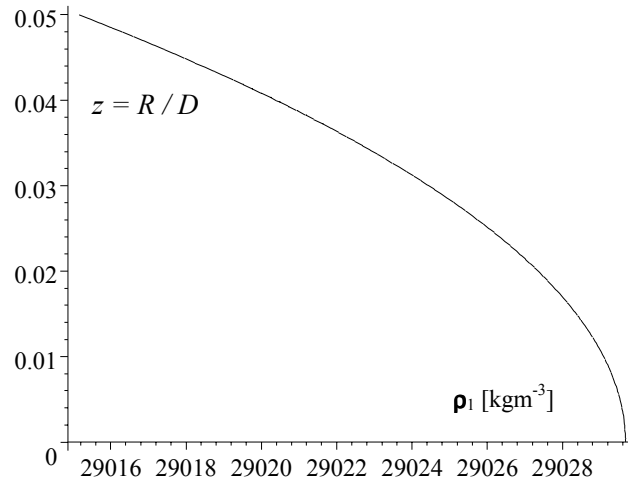

Fig 8. Relationship between the relative eccentricity of the inner core $z = D/R$ and its average density parameter ρ_1 under the assumption of planar rotation in the inertial geocentric frame of reference.

Due to quite a number of idealistic assumptions made in this Appendix, the numerical values presented in Fig 8 should be considered with considerable caution. The most adventurous assumption that we made was the assumption of a steady state planar rotation of Earth in the geocentric frame of reference. In reality, when Earth's inner core becomes eccentric, the Sun and the Moon disturb the planar rotation of Earth, even for very small values of z. This is due to the fact that the orbit of the Moon around the Earth is not coplanar with the ecliptic (the plane of the orbit of the Moon around Earth does not coincide with the plane of the orbit of the Earth around the Sun). Hence, when the Earth's inner core becomes eccentric, the variability of relative positions of the Moon, Earth and the Sun causes the inner core to "wobble" inside the Earth. This in turn causes the Earth's axis of rotation to "wobble". It should be noted that due to the non-linear nature of the hydro-gravitational suspension of the inner core, frequencies of precession may be different than frequencies of the gravitational excitation .

Hence, from the measured precession of the Earth's axis of rotation we should be able to obtain very realistic estimates for the actual eccentricity of the inner core and hence its average density. All we need to do is to develop a realistic mathematical model and study its behavior.

As it was discussed in Appendix 1, due to the near spherical geometry of Earth, very small changes in the eccentricity of the core may cause dramatic changes in the **orientation** of Earth's principal axes of inertia. Of course in such a case, our assumption of a steady state planar rotation becomes invalid, because the entire planet would "tumble" and change its axis of rotation. Since the super-heavy inner core is elastically suspended it is almost certain that such a transition will involve large angular oscillations of the entire planet before the new axis of rotation becomes established.

Continuously growing eccentricity of the inner core comprehensively explains sudden changes in the Earth's axis of rotation that occurred in the distant past and are well recorded in the magnetized mineral deposits around the globe [11]. As the eccentricity of the inner core gradually increases on the geological time scale (millions of years), it is actually **inevitable** that, from time to time, sudden and very major adjustments to the Earth's axis of rotation take place. It even becomes obvious why such events occur at irregular time intervals. In essence, the more spherical is the mass distribution (the more similar are principal mass moments of inertia) of the entire planet - the more frequent are adjustments to the axis of rotation.

The isotope and ion composition of the decaying inner core change in time. The relative motion of the electrically charged eccentric core inside Earth explains the origin of the magnetic field of our planet. Temporal changes in the electrical charge of decaying eccentric cores explain magnetic pole reversals ("pole shifts") observed in planetary and stellar objects (Sun).

Note that for all practical purposes this constitutes a proof that the inner core of our planet has been eccentric for quite some time (hundreds of millions of years) and that the next "pole shift" in the future is actually inevitable.

Although predicting the date for the next polar shift and the analysis of a "dancing planet" are both guaranteed to be entertaining, much more urgent to us today is to address the problem of overheating of the inner core reactor. Polar caps melt not because the air temperature there increased from -25 to -24 ^{o}C or so, but because they are overheated from **underneath**. This happens TODAY.

Appendix 4: Temperature distribution in a spherical reactor

Let's consider a homogenous spherical core reactor cooled from the outside. The differential equation governing the conduction and the heat storage in a solid is

$$\nabla^2 T + \frac{q}{k} = \frac{1}{\alpha}\frac{\partial T}{\partial t} \tag{34}$$

where t is time, ∇^2 is the Laplace operator in the spherical system of coordinates (r, φ, θ), $T(r, \varphi, \theta, t)$ is the temperature distribution, q is the heat generation rate per unit volume of the reactor, k is thermal conductivity and α is thermal diffusivity of the material of the reactor. In the case of spherical symmetry, the temperature distribution T becomes a function of the radial position r and time t only and the equation (34) becomes simplified as follows:

$$\frac{\partial^2 T(r,t)}{\partial r^2} + \frac{2}{r}\frac{\partial T(r,t)}{\partial r} + \frac{q}{k} = \frac{1}{\alpha}\frac{\partial T(r,t)}{\partial t} \tag{35}$$

The core is cooled by convection, i.e thermal energy is transferred between the eccentric solid core and the fluid that flows around it when the planet spins. The amount of the convection cooling determines the temperature gradient at the surface of the core $\left[\frac{\partial T(r,t)}{\partial r}\right]_{r=R} = \Delta_T(t)$. This condition, together with the obvious condition that the temperature of the outside surface of the core is $T(R,t) = T_0(t)$, defines boundary conditions required to solve the equation (35). Although the partial differential equation (35) with the above boundary conditions can be solved analytically, we focus on its steady-state solution $\left(\frac{\partial T(r,t)}{\partial t} = 0\right)$, simply because such a solution is sufficient to illustrate the key point of this article. The exact steady state solution of (35) is:

$$T(r) = -\frac{1}{6}\frac{q}{k}r^2 + C_1 + \frac{C_2}{r} \tag{36}$$

Constants C_1 and C_2 determined from the boundary conditions are: $C_1 = \frac{qR^2}{2k} + R\Delta_T + T_0$ and $C_2 = -(\frac{qR}{3k} + \Delta_T)R^2$. It is interesting to note that the constant C_2 is zero ($C_2 = 0$) only if the temperature gradient on the surface of the reactor (determined by the convection cooling) is $\Delta_T = -\frac{qR}{3k}$. The tiniest changes to the convection cooling of the reactor, and the corresponding gradient Δ_T, lead to the extreme temperature changes in the center of the spherical reactor ($r = 0$). The larger R - the stronger the effect.

Theoretically the temperature at the center of the core $T(0)$ can become infinitely large, but only when the reduction in cooling (Δ_T) is maintained indefinitely long. (We have to remember that the expression (36) is a steady-state asymptotic solution of the equation (35)). In reality, the temperature gradient Δ_T fluctuates around the value $\Delta_T = -\frac{qR}{3k}$. When cooling is reduced for whatever reason - the reactor accumulates heat, its temperatures rise and the convection cooling becomes more efficient. This in turn causes changes in the gradient Δ_T and the center of the core reactor cools down. Due to the non-linear (hyperbolic) relationship (36), the self-excited thermal oscillations are maintained. Can a similar process in the solar core can explain fluctuations in the activity of the Sun?

Back on Earth, our results clearly indicate that the slightest reduction in the convection cooling of the core (Δ_T), when maintained for a sufficiently long time, leads to the extreme thermal conditions in the center of the core. The cause-effect relationship is not linear. It is HYPERBOLIC. Hence, if we do not address the greenhouse effect problem early enough - we are highly likely to cause the meltdown of the inner core reactor and its subsequent explosion. Am I expressing myself clearly enough? Good planets are not easy to find...

Appendix 5: Limitations of the Archimedes principle

The Archimedes principle states that the weight of a body submerged in a fluid is reduced by the weight of the fluid displaced by that body.

Generations of people brought up on the Archimedes principle believe that an object denser than fluid should sink in that fluid. Strictly speaking, this belief is true only when the Archimedes principle is valid.

The Archimedes principle is valid only when the two following conditions are met:

1. the **pressure in a fluid increases linearly with depth** and
2. the **direction of the gravitational force on the submerged body coincides with the direction of the pressure gradient** in the fluid.

In order to demonstrate this in the simplest possible way, let's consider the vertical equilibrium of a prismatic object of mass m floating in a liquid of density ρ in the vertically oriented gravitational field as depicted in Fig 9. The buoyancy force (called Archimedes force) is the x component of the resultant (integral) of all pressure forces that act on the submerged surface of the object. Consider the situation when the hydrostatic pressure p in the liquid is a linear function of depth x as follows: $p = \rho g x$. The vertical equilibrium condition for the object in Fig 9 is

$$mg = Ap = A\rho g x \tag{37}$$

where A is the surface of the cross-section of the object. From the above equilibrium condition it is obvious that if the object depicted in Fig 9 is in equilibrium, its mass must be $m = A\rho x$, which is exactly the mass of the liquid displaced by the submerged part of the object, as stated by Archimedes more than 22 centuries ago. For objects other than prismatic the proof of the Archimedes principle can be conducted using vector integral calculus and the divergence theorem of Gauss. The Archimedes principle provides a convenient "shortcut" for estimating the resultant of all hydrostatic forces along the direction of the pressure gradient in the fluid.
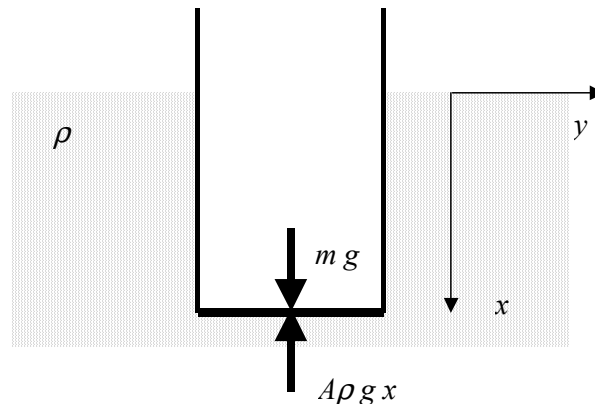

Fig 9. Prismatic object of mass m floating in a liquid of density ρ in the vertically oriented gravitational field

It is important to stress that the Archimedes "shortcut" is only valid if the pressure in a fluid increases linearly with depth and the direction of the gravitational force on the submerged body coincides with the direction of the pressure gradient in the fluid.

In any other situation the Archimedes principle is simply not valid. Specifically, when the pressure distribution is spherically symmetric, the calculation of the buoyancy force **must** include explicit integration of all pressure forces that act on the entire submerged surface of an object as demonstrated by equation (2).

Using the Archimedes principle for pressure distributions other than linear and/or in a situation when the direction of gravitational force on the submerged body does not coincide with the direction of the pressure gradient is equivalent to violating the fundamental laws of mechanics.

In the case of the near-spherical vessel called Earth, the Archimedes principle provides a reasonable approximation for the buoyancy force of a solid submerged in a fluid only when the size of the solid is much smaller than its distance away from the center of the planet. Under this condition $z >> 1$, the gradient $\left|\frac{\partial p}{\partial r}\right|_{r=D} = \rho g$ and the equation (4) expresses the Archimedes principle.

Clearly, the condition $z >> 1$ is not met for the inner core of the planet. In the case of the inner core $z << 1$ and the Archimedes "shortcut" becomes invalid. A theory of the inner core that is built on the the Archimedes principle, as any theory built on invalid assumptions, should be immediately discarded.