The Characteristic Planet

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Abstract: I have calculated a relation significant for planets from a logical starting point that a whole and its parts are immanently depandant on each other.

Keywords: planets, hypothetical mass quantum, pi, pi factor, the Earth, mass of the Universe, characteristic planetary mass

Introduction

My objective here is to show that the same reasoning can be used for both micro and macro physical quantities. Applying that approach, in the text below I will propose hypotheses significant for the origin of life on planets.

I will use the following values and the formula (1) from [1]:

Hypothetical mass quantum	$\mathbf{m_q}$**=2.7233883E-69 kg**
Number of Planck oscillations	**N=6.3871E+121**
Mass of the Universe	$\mathbf{M_u}$**=** $\mathbf{m_q}$***N=**1.739449E+53 kg

$$m_i = m_q * N^{1/i} \qquad \textbf{(1)}$$

where $\mathbf{m_i}$ is a significant mass in the function of **i.**

For the values of **i** (2, 3, 4) we get the Planck mass, fundamental mass and background mass, respectively [1]. In this article, I will expand the formula to refer to planets.

Characteristic planetary mass

My claim is that by using the above-mentioned constants we can calculate significant values of masses, both in particle physics and in cosmology. Here I will show only the simplest case for planets, although the same formula can be applied to other significant cosmological structures. For cosmological structures, I have defined the following formula (2):

$$m_k = k * m_q * N^{1-1/k} \qquad \textbf{(2)}$$

Apparently, the formula (2) we can also express in the following form (3):

$$m_k = k * M_u * N^{-1/k} \qquad \textbf{(3)}$$

Therefore, $\mathbf{m_i}$ in (1) is the product of hypothetical mass quantum, while in (3) $\mathbf{m_k}$ is a part of the whole (the mass of the Universe). Here $\mathbf{k}$ determines which form of a structure we will have in cosmological proportions. Therefore, for:

$$k = 4\pi/3 = 4.1887902 \quad \textbf{(4)}$$

we get the sphere and the related mass:

$$m_k = k * M_u * N^{-1/k} = (4\pi/3) * \mathrm{M_u} * \mathrm{N}^{-3/4\pi} = 6.076121\mathrm{E}+24\,\mathrm{kg} \quad \textbf{(5)}$$

Let’s call this mass the **characteristic planetary mass** and a hypothetical planet with that mass **the characteristic planet**.

The $\mathbf{m_k}$ mass is obtained from simple conditions: that it is true for (2) or for (3) and that an ideal sphere structure is expected (4). The key difference compared to (1) is that in (3) we have the appearance of **π**, which is understandable since form is a property of the matter, while that is not true for elementary particles.

Let's proceed with phrasing the hypotheses.

Hypothesis I**: **The $\mathbf{m_k}$ mass has special significance in cosmology.

This is yet to be researched and physically described. The planets in the solar system can be compared in different ways in relation to the above formulas and especially in relation to the $\mathbf{m_k}$ mass. Therefore, it is possible to determine relations for every single planet regarding:

- its particular shape;
- the comparison of the planet’s development stages;
- the known density of the planet and its state of matter;
- its gravitational acceleration.

I should emphasize here that in formula (5) **k** in the product and **k** in the exponent are identical for an ideal sphere (4). For real planets with mass **m**, we should use **k1** in the product and **k2** in the exponent.

Assuming that we are describing a planet which did no go through accretion, we can determine idealized **kp** value which meets the condition that:

$$m = kp * M_u * N^{-1/kp} \quad \textbf{(6)}$$

The above can also be expressed in this way: Every real planet can be presented by formula (6), which represents its shape under the assumption that there was no accretion.

I suppose that the key property of the **characteristic planet** is that it resides in the zero value of force on the Boscovitch force curve [1], [3], meaning that the equilibrium has been achieved between accretion and excretion.

The Pi Factor

Let's define the relative difference (7) for the planet mass **m** in relation to the reference **characteristic planetary mass** $\mathbf{m_k}$.

$$\mathrm{x} = |m - m_k| / m_k \quad \textbf{(7)}$$

In order to more simply present the deviation of the planet mass from $\mathbf{m_k}$, let's define the value of **Pf:**

$$\text{Pf} = 1/x = m_k / |m - m_k| \qquad \textbf{(8)}$$

Let's call **Pf "the pi factor"**. The reason for that name is that the constant **k** features mathematical constant **π**, which constitutes the crucial difference between formulas (1) and (3) for micro, i.e. macro world.

Consequently, the second hypothesis is:

Hypothesis II: The pi factor is the measure of possibility of appearance of life on planets.

Table 1 below applies (8) to the Solar System planets.

Table 1. Mass of the Solar System planets and their pi factor
a) Solar System planets b) planets with their satellites

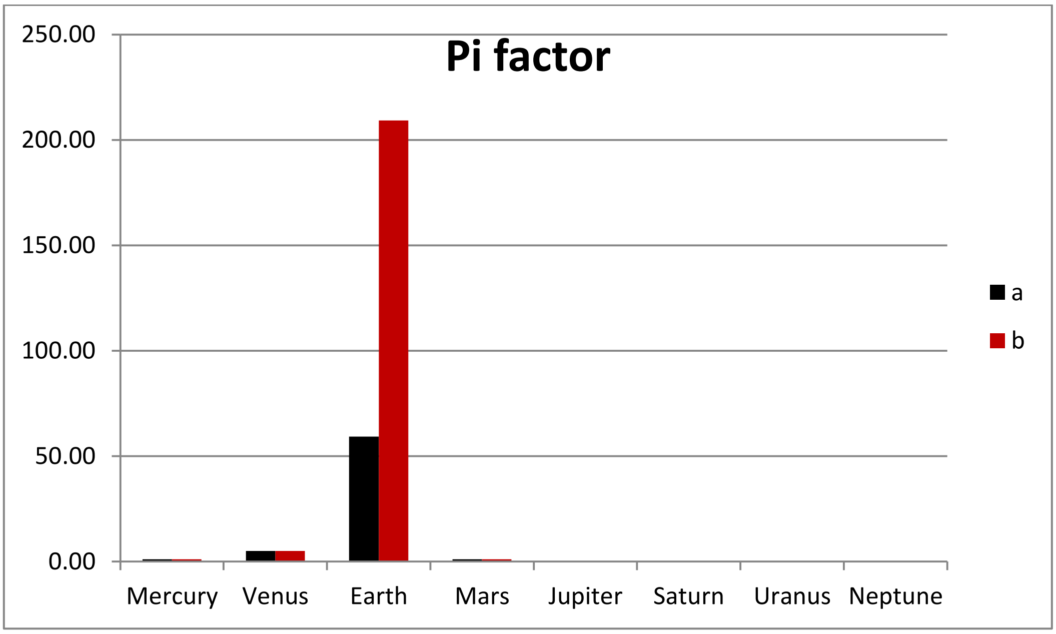
Characteristic planet	**6.07612E+24**	$\text{Pf} = m_k / \|ms - m_k\|$	$\text{Pf} = m_k / \|ms - m_k\|$
Planets	**Mass (kg)**	**a**	**b**
Mercury	**3.3022E+23**	**1.06**	**1.06**
Venus	**4.8685E+24**	**5.03**	**5.03**
Earth	**5.9736E+24**	**59.27**	**209.20**
Mars	**6.4185E+23**	**1.12**	**1.12**
Jupiter	**1.8986E+27**	**0.00**	**0.00**
Saturn	**5.6846E+26**	**0.01**	**0.01**
Uranus	**8.6810E+25**	**0.08**	**0.08**
Neptune	**1.0243E+26**	**0.06**	**0.06**
Moon (Earth)	**7.3477E+22**	**1.01**	
Ganymede (Jupiter)	**1.4819E+23**	**1.02**	
Europa (Jupiter)	**4.8000E+22**	**1.01**	
Titan (Saturn)	**1.3452E+23**	**1.02**	

As you can see in the table, the **pi factor** is much greater for the Earth than for the other planets. The next biggest **pi factor** is Venus' and it is as much as 12 times smaller than the pi factor of the Earth.

If we compare planetary systems instead of planets, i.e. mass of planets together with their satellites **ms**, then the **pi factor** for Venus, which has no satellites, would stay the same, while that of the Earth/Moon system would be:

$$\text{Pf} = m_k / |ms - m_k| = m_k / |m_{earth} + m_{moon} - m_k| = 209.2 \qquad \textbf{(9)}$$

Hence, as much as 42 times greater than Venus'. Compared to other planetary systems with satellites, it would still be significantly greater than compared to Venus' system, see **Graph 1**. Note that only certain, most massive planet satellites have been included.



Graph 1. Pi factor graph a) Solar System planets
b) Planets with their satellites

The question that arises here is whether this exceptional feature of the Earth, evident in the **pi factor**, is what makes the Earth unique and enables the existence of life and human civilization?

It is expected that the star around which a planet orbits, and to a lesser extent the galactic system to which it belongs, are also important, therefore, for them we should determine similar factors on the basis of available data. Anyway, it is expected that high **pi factor** is a necessary condition for the appearance of life and civilization, although possibly not the only one.

If the **pi factor** is dominantly significant for the development of civilization, then all the planets with $\mathbf{Pf_{planet}>Pf_{Earth}}$ would have better conditions for the development of life than the Earth, which leads us to the third hypothesis:

Hypothesis III**: **It does not necessarily have to be a planet, even a planet's satellite with high pi factor can have conditions for the appearance of life and development of civilization.

All the satellites in the Solar System have the **pi factor** lower than 0.1, so that fact can be used to check the hypothesis.

Assumption about the importance of the **pi factor** can be verified if it turns out that Venus really is the next planet with the highest probability of life, as the **Table 1** suggests.

Formulas (8) and (7) clearly single out planet Earth from other planets in our Solar System. They require only one paramenter of a planet, its mass. The assumption is that all other physical parameters of a planet (radius, density, temperature, atmosphere, etc.) follow the main parameter, planetary mass. This means that it is not necessary to define the complex indexes for life on a planet, with weighting factors for the applied physical parameters of a planet, which leads us to:

Hypothesis IV: Planetary mass preserves in the best way physical characteristics necessary for life.

Conclusion

The assumption here is that, just like in micro proportions there is the Planck mass, that in comsmological proportions there are also significant masses. I am proposing one such mass here, the **characteristic planetary mass**, and discussing the possibility of this mass giving an answer to the possibility of life on planets. I am also presenting the **pi factor** in tables and graphs, which is derived from the characteristic planetary mass on the example of the Solar System.

This article does not contain physical explanations, as I believe that relations between the whole and its parts are more general than physical laws and phenomena. Everything in the Universe is a result of immanent relations which govern it. Therefore, for example, the answer to the question of origin of the **characteristic planetary mass** is the same as in the case of the Planck mass:

It simply exists.

Actually, the masses are the result of the unity of a whole and its parts and they are reflected and can be explained through relations in which they appear and physical laws which arise from there.

Astrophysicists could give answers to the following questions:

- How does the pi factor of a planet change over time, especially that of the Earth?
- Is it more rational to use the formula (8) or (9)?
- What are physical characteristics of the **characteristic planet**?

Or they could estimate:

- How many planets are there with the mass $\mathbf{m_{Earth} < m < m_k + (m_k - m_{Earth})}$?
- How many planets are there with the mass $\mathbf{m_{Earth+Moon} < m < m_k + (m_k - m_{Earth+Moon})}$?
- How many planets are there with the mass $\mathbf{m_{Venus} < m < m_k + (m_k - m_{Venus})}$?

Answers to these questions can help confirm/refute the proposed hypotheses. The advantage of the suggested pi factor for determining the possibility of life on planets is that it is not restriced to a specific planet (the Earth) and that it contains just one paramenter (mass), which is relatively easily determined.

It is quite unlikely that the formula (3) and everything that arises from it is a coincidence, as well as everything presented in [2] and related to large number **N,** number of Planck oscillations. I believe that the proposed theory is in accordance with the force curve in [3], and that it can additionally be explained by Boscovich's theory.

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References:

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