Global Scaling as Heuristic Model for Search of Additional Planets in the Solar System

Hartmut Müller

E-mail: hm@interscalar.com

In this paper we apply scale-invariant models of natural oscillations in chain systems of harmonic quantum oscillators to search for additional planets in the Solar System and discuss the heuristic significance of those models in terms of our hypothesis of global scaling.

Introduction

In the last 8 years the heuristic significance of scale invariance (scaling) was demonstrated in various fields of physical research. In [1] we have shown that scale invariance is a fundamental property of natural oscillations in chain systems of similar harmonic oscillators. In [2] we applied this model on chain systems of harmonic quantum oscillators and could show that particle rest masses coincide with the eigenstates of the system. This is valid not only for hadrons, but for mesons and leptons as well. Andreas Ries [3] demonstrated that this model allows for the prediction of the most abundant isotope of a given chemical element. The interpretation of the Planck mass as eigenstate in a chain system of oscillating protons has allowed us to derive the proton rest mass from fundamental physical constants [4]. There we have proposed a new interpretation of the cosmic microwave background as a stable eigenstate of a chain system of oscillating protons.

Scale-invariant models of natural oscillations in chain systems of protons also give a good description of the mass distribution of large celestial bodies in the Solar System [5]. Physical properties of celestial bodies such as mass, size, rotation and orbital period can be understood as macroscopic quantized eigenstates of chain systems of oscillating protons and electrons [4]. This understanding can be applied to an evolutionary trend prognosis of the Solar System but may be of cosmological significance as well.

In this paper we apply our hypothesis of global scaling [4] to the search for additional planets in the Solar System.

Methods

In [1] we have shown that the set of natural frequencies of a chain system of harmonic oscillators coincides with a set of finite continued fractions $\mathcal{F}$, which are natural logarithms:

$$\ln(\omega_{jk}/\omega_{00}) = n_{j0} + \cfrac{z}{n_{j1} + \cfrac{z}{n_{j2} + \ddots + \cfrac{z}{n_{jk}}}} = \tag{1}$$

$$= [z, n_{j0}; n_{j1}, n_{j2}, \ldots, n_{jk}] = \mathcal{F},$$

where ω_{jk} is the set of angular frequencies and ω_{00} is the fundamental frequency of the set. The denominators are integer numbers: $n_{j0}, n_{j1}, n_{j2}, \ldots, n_{jk} \in \mathrm{Z}$, the cardinality $j \in \mathrm{N}$ of the set and the number $k \in \mathrm{N}$ of layers are finite. In the canonical form, the numerator z is equal 1.

Any finite continued fraction represents a rational number [6]. Therefore, all frequencies ω_{jk} in (1) are irrational, because for rational exponents the natural exponential function is transcendental [7]. This circumstance presumably provides for the high stability of the oscillating chain system because it avoids resonance interaction between the elements of the system [8].

In the case of harmonic quantum oscillators, the continued fraction (1) defines not only a fractal set of natural angular frequencies ω_{jk} and oscillation periods $\tau_{jk} = 1/\omega_{jk}$ of the chain system, but also fractal sets of natural energies $E_{jk} = \hbar \cdot \omega_{jk}$ and masses $m_{jk} = E_{jk}/c^2$ which correspond with the eigenstates of the system. For this reason, we have called the continued fraction (1) the "fundamental fractal" of eigenstates in chain systems of harmonic quantum oscillators [4].

The electron and the proton are exceptionally stable quantum oscillators and therefore the proton-to-electron rest mass ratio can be understood as a fundamental physical constant.

We hypothesize the cosmological significance of scale invariance based on the fundamental fractal $\mathcal{F}$ (1) that is calibrated by the physical characteristics of the electron and the proton. This hypothesis we have called 'global scaling' [9].

Results

In [4] we have shown that the masses of the largest bodies in the Solar System correlate with main attractor nodes of the $\mathcal{F}$ (1), supporting our hypothesis of global scaling as forming factor of the Solar System.

For example, the natural logarithm of the Sun-to-electron mass ratio is close to an integer number:

$$\ln(M_{\text{Sun}}/m_{\text{electron}}) =$$

$$= \ln(1.9884 \cdot 10^{30}\text{kg}/9.10938356 \cdot 10^{-31}\text{kg}) = 138.936$$

This is also valid for Jupiter's body mass:

$$\ln\left(M_{\text{Jupiter}}/m_{\text{electron}}\right) =$$

$$= \ln(1.8986 \cdot 10^{27}\text{kg}/9.10938356 \cdot 10^{-31}\text{kg}) = 131.981$$

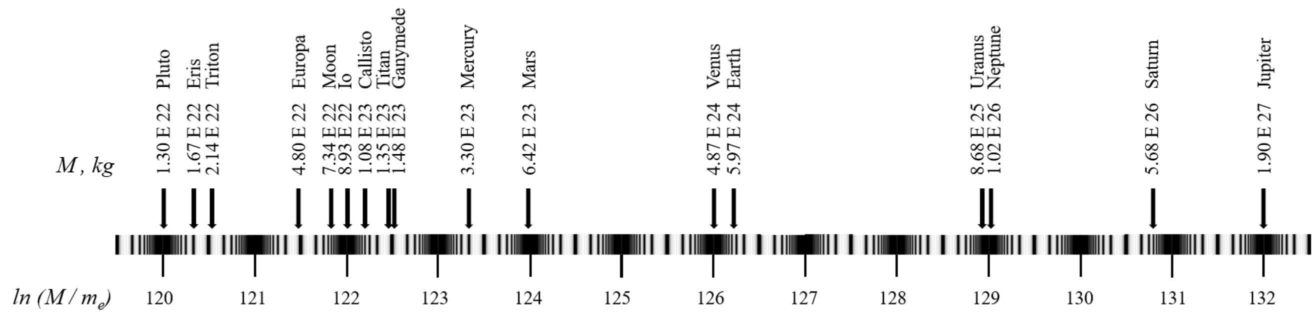

Fig. 1: The mass distribution of planets, heaviest planetoids and moons along the electron-calibrated fundamental fractal $\mathcal{F}$ (1). The nodes [130], [128], [127], [125], [123] and [121] are vacant.

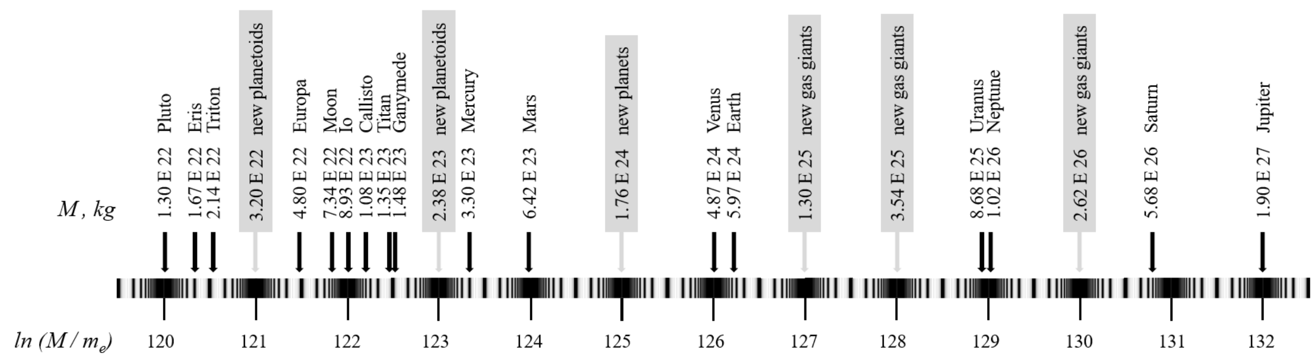

Fig. 2: This copy of fig. 1 shows the mass ranges of hypothetical planetoids, planets and gas giants which could occupy the vacant nodes [130], [128], [127], [125], [123] and [121] of the electron-calibrated fundamental fractal $\mathcal{F}$ (1).

And for Venus as well:

$$\ln\left(M_{\text{Venus}}/m_{\text{electron}}\right) =$$

$$= \ln(4.8675) \cdot 10^{24}\text{kg}/9.10938356 \cdot 10^{-31}\text{kg}) = 126.015$$

Table 1 gives an overview of the body masses of the planets and heaviest planetoids and their positions in the fundamental fractal $\mathcal{F}$ (1).
The electron rest mass $m_e = 9.10938356 \cdot 10^{-31}$ kg [10].

Table 1 shows that the body masses of Jupiter, Neptune, Uranus, Venus, Mars, Pluto, Charon and Haumea coincide with main attractor nodes (integer logarithms) of the electron-calibrated $\mathcal{F}$ (1). This also applies to the Sun. Figure 1 shows the mass distribution of planets, heaviest planetoids and moons along the electron-calibrated fundamental fractal $\mathcal{F}$ (1). The nodes [130], [128], [127], [125], [123], [121] are vacant.

The vacant nodes [121] and [123] indicate that in the mass ranges of 2 to $4 \cdot 10^{22}$ kg and in the range of 2 to $3 \cdot 10^{23}$ kg there should be planetoids still to be discovered. Furthermore, we may expect new planets in the range of 1 to $2 \cdot 10^{24}$ kg. The probability of new gas giants in the Solar System is also very high, because of the wide vacant mass ranges of 1 to $5 \cdot 10^{25}$ kg and of 2 to $3 \cdot 10^{26}$ kg. Figure 2 shows the distribution of these hypothetical bodies on the fundamental fractal $\mathcal{F}$ (1).

Conclusion

The discovery of new gas giants, planets and planetoids with the properties predicted above would be an important confirmation of our hypothesis of global scaling as a forming factor of the Solar System. Already in 2010 [5] we calculated the masses of some of these hypothetical bodies and in 2015 [11, 12] we estimated their orbital elements.

Our calculations correspond well with the hypothesis of Batygin and Brown [13] about a new gas giant called "planet 9" and with the hypothesis of Volk and Malhotra [14] about an unknown Mars-to-Earth mass "planet 10" beyond Pluto.

Based on the vacancies in the fundamental fractal $\mathcal{F}$ (1), we hypothesize the existence of at least two unknown giant planets (see fig. 2). It is likely that they are gas giants. However, this conclusion cannot be made based on the estimation of their masses only, but requires an additional estimation of their radii, which should correspond with vacant positions in the fundamental fractal $\mathcal{F}$ (1) that is calibrated by the proton

Table 1: The logarithms of the body-to-electron mass ratio for the Sun, the planets, the heaviest planetoids (P) and the corresponding positions in the fundamental fractal $\mathcal{F}$ (1).

celestial body	**body mass m, kg**	**ln (m/m$_e$)**	$\mathcal{F}$
Sun	$1.9884 \cdot 10^{30}$	138.936	[139; ∞]
Jupiter	$1.8986 \cdot 10^{27}$	131.981	[132; ∞]
Saturn	$5.6836 \cdot 10^{26}$	130.776	[131; -4]
Neptune	$1.0243 \cdot 10^{26}$	129.062	[129; ∞]
Uranus	$8.681 \cdot 10^{25}$	128.897	[129; ∞]
Earth	$5.97237 \cdot 10^{24}$	126.220	[126; 4]
Venus	$4.8675 \cdot 10^{24}$	126.015	[126; ∞]
Mars	$6.4171 \cdot 10^{23}$	123.989	[124; ∞]
Mercury	$3.3011 \cdot 10^{23}$	123.324	[123; 3]
Eris (P)	$1.67 \cdot 10^{22}$	120.341	[120; 3]
Pluto (P)	$1.305 \cdot 10^{22}$	120.094	[120; ∞]
Haumea (P)	$4.006 \cdot 10^{21}$	118.913	[119; ∞]
Charon (P)	$1.587 \cdot 10^{21}$	117.944	[118; ∞]

and electron wavelengths.

Acknowledgements

The author is grateful to Viktor Panchelyuga for valuable discussions.

Received on September 9, 2017

References

1. Müller H. Fractal Scaling Models of Resonant Oscillations in Chain Systems of Harmonic Oscillators. *Progress in Physics*, 2009, vol. 2, 72–76.
2. Müller H. Fractal Scaling Models of Natural Oscillations in Chain Systems and the Mass Distribution of Particles. *Progress in Physics*, 2010, vol. 3, 61–66.
3. Ries A. Qualitative Prediction of Isotope Abundances with the Bipolar Model of Oscillations in a Chain System. *Progress in Physics*, 2015, vol. 11, 183–186.
4. Müller H. Scale-Invariant Models of Natural Oscillations in Chain Systems and their Cosmological Significance. *Progress in Physics*, 2017, vol. 4, 187–197.
5. Müller H. Fractal scaling models of natural oscillations in chain systems and the mass distribution of the celestial bodies in the Solar System. *Progress in Physics*, 2010, vol. 3, 61–66.
6. Khintchine A. Ya. Continued fractions. University of Chicago Press, Chicago 1964.
7. Hilbert D. Über die Transcendenz der Zahlen e und π. *Mathematische Annalen*, 1893, 43, 216–219.
8. Panchelyuga V. A., Panchelyuga M. S. Resonance and Fractals on the Real Numbers Set. *Progress in Physics*, October 2012, vol. 4, 48–53.
9. Müller H. Scaling as Fundamental Property of Natural Oscillations and the Fractal Structure of Space-Time. Foundations of Physics and Geometry. Peoples Friendship University of Russia, 2008 (in Russian).
10. Olive K. A. et al. (Particle Data Group), *Chin. Phys. C.* 38, 090001, 2016.
11. Müller H. Scaling of body masses and orbital periods in the Solar System. *Progress in Physics*, 2015, vol. 11, 133–135.
12. Müller H. Scaling of body masses and orbital periods in the Solar system as consequence of gravity interaction elasticity. Abstracts of the XII. International Conference on Gravitation, Astrophysics and Cosmology, dedicated to the centenary of Einstein's General Relativity theory. Moscow, PFUR, 2015.
13. Batygin K., Brown M.E. Evidence for a distant giant planet in the Solar System. *The Astronomical Journal*, 151/22, February 2016.
14. Volk K., Malhotra R. The curiously warped mean plane of the Kuiper belt. arXiv:1704.02444v2 [astro-ph.EP], 19 June 2017.