GRAVITATION. THE EXPERIMENTAL FACTS AND PREDICTIONS

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Abstract. The empirical law connecting values of planetary masses in the Solar system is demonstrated and is analyzed. A characteristic property of this law is the existence of groups consisting from four planets. The law allows to predict existence and properties of three unknown planets inside the Solar system. This law can serve the useful tool for a research of extra-solar planetary systems. In this work the completeness of the modern set of the fundamental laws of a nature in the area of a gravitation is put under a doupt.

1. Empirical gravitational regularities of a symmetry in the Solar System

1.1. Principles of ratio selection

As we examine Table I, we might wonder why these specific ratios were selected, among the many combinations that are mathematically possible.

Here are the principles that guided the choice of ratios. All these principles should be fulfilled simultaneously.

From a mathematical point of view, the problem gravitational interaction between planets of the Solar System is the nonlinear n-body problem. **Principles 1,2,3,4 and 4 are the physical restrictions superimposed on the mathematical formalism of ratioes of linear combinations of planetary masses.** The given method has analogs in radiophysical, atomic and molecular spectral researches. The considered method is not statistical, it leans on properties nonlinear stationary systems.

Principle 1. The ratios having the least difference in value from integers are chosen.

Principle 2. The ratios containing only three bodies are chosen (there is one elemination stipulated by a Principle 4).

Principle 2 leans on existence of the closed solution of the three-body problem. The three-body problem was solved by Karl Fritiof Sundman [3]. This solution has a very complicated structure and that one does not give direct tie between coordinates and time, i.e. there is a full analogy to the solution for the two-body problem.

Principle 3. The ratios containing the planets, closest on masses are chosen.

These ratios are the most essential and reliable from the physical point of view. The Principle 3 integrates in a ratio those planets which have the greatest potential energies of gravitational interaction. The Principle 3 take into account also that the absolute errors in masses of large planets can exceed masses of small planets.

Principle 4. The ratios ensuring existence of a symmetry of a high level are chosen.

For the first time in the world the French mathematician and physicist Henry Poincare has paid attention to a symmetry of the physical laws [4]. The fundamental physical laws have properties tightly connected with a symmetry [5]. In the given work the properties of a symmetry of the Solar System are studied.

Principle 5. Only main terms of the ratios are chosen.

When the significant ratioes satisfying to Principles 1,2,3 and 4 are sorted in ascending order, the following sequence of natural numbers are obtained:

3,5,7(*),8,10,13,24,33,39...

Only these terms (except for number 7) are main in gravitational interaction between planets of the Solar System. These terms represent the main nonlinear process of the Solar System. The remaining ratioes are the causal corollary of the main terms, therefore they are excluded from the analysis in the given paper.

1.2. Magic ratios of linear combinations of planetary masses

Here are the most reliable values of the Solar System [1] planetary masses that can be experimentally obtained by celestial mechanics:

Table I

Planetary masses and Ratios of linear combinations of masses

Planet	Symbol used for each planet	Mass value Earth=1	Ratio considered	Exact value of the ratio	Rounded ratio
Jupiter	MJU or 1	317.735	(MJU+MSA)/(MUR+MNE)	= 12.9959	~ 13
Saturn	MSA or 2	95.147	MJU/(MUR+MNE)	= 10.0010	~ 10
Neptune	MNE or 3	17.23	MSA/(MUR+MNE)	= 2.9948	~ 3
Uranus	MUR or 4	14.54	(MJU+MSA)/MNE	= 23.9630	~ 24
Earth	MTE or 5	1.000	MUR/(MTE+MVE)	= 8.0110	~ 8
Venus	MVE or 6	0.815	(MNE+MUR)/MVE	= 38.9816	~ 39
Mars	MMA or 7	0.108	(MTE+MVE)/MME	= 33.0000	~ 33
Mercury	MME or 8	0.055	MVE/(MMA+MME)	= 5.0000	~ 5

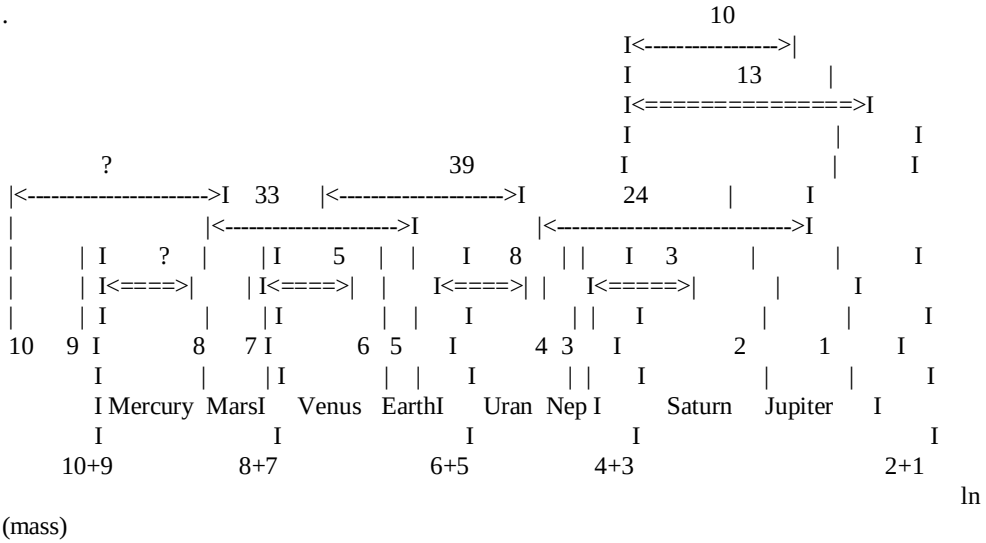
The difference between computed values of ratios and the closest integer can possibly be explained by an effect similar (Francis Aston 1920) to mass modification caused by dense packing in atom nucleii. The planetary masses are measured with some errors also.

1.3. Chiral symmetry ratios of linear combinations of the planetary masses

When organised graphically, the ratios [2] of linear combinations of the planetary masses considered, reveal a chain of gravitational correlations between triples of planets possessing chiral symmetry:

Table II

Chiral symmetry ratios of linear combinations of the planetary masses



The following symbols here are used in this graphic:

MSA + MJU <-> 2 + 1; MUR + MNE <-> 4 + 3;
MVE + MTE <-> 6 + 5; MME + MMA <-> 8 + 7;
MJU <-> 1; MSA <-> 2; MNE <-> 3; MUR <-> 4;
MTE <-> 5; MVE <-> 6; MMA <-> 7; MME <-> 8;

Direct gravitational correlation - <====>;
33
Reverse gravitational correlation - <---------->

1.4. Formula for pairs of conjugate gravitational correlations

We shall name "pairs of conjugate gravitational correlations" the following pairs of values that can be identified on the previous graph:

33,5 39,8 24,3 10,13

We shall now consider relating of sums of those pairs of conjugate gravitational correlations with squares of natural numbers:

33+5=6^2+2 39+8=7^2-2 24+3=5^2+2 10+13=5^2-2

+2 -2 +2 -2

From these relations, a common formula for the sums of the pairs of conjugate direct and reverse gravitational correlations can be established:

(value of reverse correlation)+(value of direct correlation)=n^2 +/- 2

To some extent, this formula is analog to Balmer's formula for spectral series of the Hydrogen atom. The analysis of the chained series of conjugate gravitational correlations clearly reveals here a periodic alternance of the sign before number 2.

1.5. Gravitational correlations for groups of four planets.

For a long time astronomers have been aware of dynamic relations in celestial bodies in groups of four, in the stable gravitational system which the Solar System presents us with. On this specific criterion and on some other dynamic criterions stemming from celestial mechanics, we can select two groups of four planets in the Solar System.

The planets of the Terrestrial group are: Earth, Venus, Mars and Mercury.

The planets of the Jovian group are: Jupiter, Saturn, Neptune and Uranus.

The empirical facts discovered here indirectly confirm the existence of further relations.

For the group of planets Earth, Venus, Mars and Mercury ((n^2 + 2);(n ^ 2 - 2)) the relationship is established in the following manner:

(33 + 5) + (39 + 8) = 6 ^ 2 + 7 ^ 2 = 9 ^ 2 + 2 ^ 2 = 85

For the group of planets Jupiter, Saturn, Neptune and Uranus ((n ^ 2 + 2); (n ^ 2 - 2)) the relationship is established in the following manner:

(10 + 13) + (24 + 3) = 5 ^ 2 + 5 ^ 2 = 7 ^ 2 + 1 ^ 2 = 50

In each of the groups considered, there is a higher pair (n ^ 2-2) and lower pair of planets (m ^ 2 + 2). Therefore, a possibility seems to exist to derivate various combinations of these pairs to obtain mixed combinations from these two groups of four planets. In our particular case, only the combination of the two lower pairs ((n ^ 2 + 2); (m ^ 2 + 2)) Neptune, Uranus, Mars and Mercury, forming a mixed group, allows a correlation to be determined:

(33 + 5) + (24 + 3) = 7 ^ 2 + 4 ^ 2 = 8 ^ 2 + 1 ^ 2 = 65

Some conclusions:

ž The considered relations can be expressed as the following formula:

(sum values of all correlations of the given group) = k^2+l^2=m^2+n^2

ž What is remarkable in these correlations by groups of four planets, is that the sum of the pairs of conjugate gravitationnal correlations are equal in each case to natural numbers (50, 65, 85) which are the first terms of a sequence of natural numbers, which are the sum of two pairs of squares of natural numbers. Please look Diophantus's theorem of a number theory (III, 19). Here is the beginning of this series:

		!		!	!													
number	1	25	50	65	85	100	125	130	145	169	170	185	200	205	221	225	250	260
1	1	5	7	8	9	10	11	11	12	13	13	13	14	14	14	15	15	16
pair	0	0	1	1	2	0	2	3	1	0	1	4	2	3	5	0	5	2
2	0	4	5	7	7	8	10	9	9	12	11	11	10	13	11	12	13	14
pair	1	3	5	4	6	6	5	7	8	5	7	8	10	6	10	9	9	8

1.6. Conclusions

It can be infered from the observed regularities that such regularities should also occur for stable gravitational systems:

- In extra-solar planetary systems, by analogy with the Kepler's Laws (from simple inductive assumption);
- In multiple star systems, which each can have planetary systems;
- In hierarchies of galaxies, gas and dust clouds and so on.

From the authors' point of view, the physical properties considered in this paper, represent a totally empirical development, which is incomplete at best at the present time, but which strongly suggests that quantization mechanisms may be at play in gravitational systems. The authors readily recognize that this interpretation of the phenomenon can be disputed, but they nevertheless consider it a valid working hypothesis.

The empirical regularities described in this paper clearly emphasise the incomplete state of the modern set of fundamental physical laws in the field of gravitation, and therefore the incomplete state of the modern theories of gravitation. The historical analysis of the role played by Kepler's Laws, which were also empirically developped, in the subsequent development of celestial mechanics and laws of gravitation demonstrate the fundamental value of empirical laws for the fruitful analytical development of physical theories.

2. Predictions on trans-pluto planets

" The Voyagers 1 and 2 trajectories give negative evidence about possible planets beyond Pluto. " [8]

" The mystery of the tiny unexplained acceleration towards the sun in the motion of the Pioneer 10, Pioneer 11 and Ulysses spacecraft remains unexplained. " [7]

" The positional measurements do not bode too well for the existence of Planet X. They do not entirely rule out the existence of a Planet X, but they do indicate that it will not be a large body. " [6]

Here will be used the new analytical method, considered in chapter 1, for the prediction of the unknown new planets. This method is not based on classical positional measurements. This method concerns to qualitative methods of a classical celestial mechanics. It can predict common dynamic properties of unknown planets, but it can not predict exact coordinates (like QM) of these unknown planets.

Prediction 1. The total number of planets in the solar system should be equal 12. There are three groups and in each group there are 4 planets.

If to lean on empirical theory described above in chapter 1 item 1.5, in each group of planets there should be four planets. Now group of Pluto consists of one known planet, which has the title Pluto. For this reason there should be three unknown planets which together with Pluto will make full group of four planets. These planets are not members of the

Kuiper Belt, they are far behind Pluto. These planets have distinguishing masses close on value to the mass of Pluto.

Closely consider the symmetry of the mass distribution of planets inside group of the Jove. In the pair the Jove - Saturn the heavier planet the Jove is closer to the Sun. On the contrary in the pair Uranus - Neptune the heavier planet Neptune is further from the Sun.

Closely consider the symmetry of the mass distribution of planets inside group of the Earth. In the pair the Earth - Venus the heavier planet the Earth is further from the Sun. In a pair the Mars - Mercury the heavier planet the Mars also is further from the Sun. Here has the difference of group of the Earth from group of the Jove.

For compensating the mass distribution in group the Earth, by analogy to group of the Jove is necessary that in pairs of planets of Pluto group the heavier planets in pairs were closer to the Sun!:

Table 3

The analysis of the symmetry of the mass distribution in pairs of planets

planet mass
---------->

__
Mercury

_____
Venus

_____
Earth

____
Mars

...
Asteroid Belt

_____
Jupiter

_____
Saturn

the line of the symmetry inside the Solar planetary system
==========
Mirror

_____
Uran «the mirror reflection of Saturn»

_____
Neptun «the mirror reflection of Jupiter»

.....
Kuiper Belt «the mirror reflection of Asteroid Belt»

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Pluto «the mirror reflection of Mars»

_____
Planet X (pseudo Earth) «the mirror reflection of Earth»

_____
Planet X1 (pseudo Venus) «the mirror reflection of Venus»

_
Planet X2 (pseudo Mercury) «the mirror reflection of Mercury»

Prediction 2. The mass of unknown planet pseudo Earth («the mirror reflection of Earth») is more than the mass of Pluto. The planet pseudo Earth has a satellite or more. The

planet pseudo Earth rotates about the axis faster than planet Pluto. It is very weak object, it has very small sizes.

Prediction 3,4. There are two unknown planets pseudo Venus and pseudo Mercury. The mass of unknown planet pseudo Venus is more than the mass of Pluto but its mass is less than the mass of pseudo Earth. The mass of unknown planet pseudo Mercury is less than the mass of Pluto. Similarly to the Mercury and the Venus these planets have not satellites, i.e. these two unknown planets are "bald". These unknown planets have rather slow axial rotation.

Prediction 5. Similarly to the Mercury, Venus and Earth these three planets have resonances.

Note. The additional foundation for these Predictions is served with the following prerequisites:

1. There is the law which links periods of axial rotation of planets.
2. There is the law which links potential energies of planets.

These laws make essentially reduce number of theoretically possible solutions for dynamic parameters of hypothetical planets.

These unknown planets can be detected in an infra-red telescope.

If to consider the mass distribution of planets of the Solar System with acceptance in attention of the predicted masses of unknown planets then the mass distribution of planets becomes surprising symmetrical concerning pairs of planets.

3. References

1. William B. Hubbard - PLANETARY INTERIORS, (Professor of Planetary Sciences University of Arisona), Van Nostrand Reinhold Company 198?;
2. A.N. Timofeev, V.A. Timofeev, L.G. Timofeeva - Gravitational mass - some properties, Russia, Podolsk, 1996 http://www.friends-partners.org/~russeds/unknown/astrochem/
3. Sundman, Karl Fritiof Nouvelles recherches surle probleme des trois corps, Acta Societatis scientiarum fennicae, T 35, N 9, Helsingfors, 1909 and other papers 1910-1912
4. Henri Poincaré:
   1. La Science et l'hypothèse (1903; Science and Hypothesis),
   2. 2. La Valeur de la science (1905; The Value of Science),
   3. Science et méthode (1908; Science and Method), Paris, Flammarion, 13 mille 1914, 14 mille 1918
      These three writings can be found in:
      The Foundations of Science,
      containing Science and Hypothesis, The Value of Science,
      and Science and Method, trans. by George Bruce Halsted,
      Lancaster(Pa), Science press, cop. 1946
   4. Dernières pensées (1913); This writing can be found in:
      Mathematics and Science: Last Essays, trans. by John W. Bolduc, New York, Dover, cop. 1963
5. Richard Feynman "THE CHARACTER OF PHISICAL LAW"; A series of lectures recorded by the BBC at Cornell University USA; Cox and Wynman LTD, London, 1965
6. http://www.deja.com/threadmsg_ct.xp?AN=606966502 [sci.astro] Solar System (Astronomy Frequently Asked Questions) Subject: E.11.1 What about a planet (Planet X) outside Pluto's orbit?
7. http://spaceprojects.arc.nasa.gov/Space_Projects/pioneer/PNStat.html
8. http://www.seds.org/billa/tnp/spacecraft.html#pioneer10